XIII INTERNATIONAL CONFERENCE

QUALITY SYSTEM CONDITION FOR SUCCESSFUL BUSINESS AND COMPETITIVENESS

PROCEEDINGS

ASSOCIATION FOR QUALITY AND STANDARDIZATION OF SERBIA

KURŠUMLIJSKA BANJA, 26-28.11.2025

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F O R E W O R D

The Book of Abstracts of the 27th National Conference and the 13th International Conference represent a significant contribution to the advancement of quality, standardization, and the development of quality infrastructure in Serbia and the broader region. The event is held from 26 to 28 November 2025 in Kuršumlijska Banja, bringing together numerous experts, organizations, and institutions from industry, academia, research institutes, the consulting sector, and public institutions. Such a diverse range of participants confirms that this is the largest regional event dedicated to quality infrastructure.

This year's proceedings include more than 50 papers. A total of 120 authors and co-authors contributed to their preparation, representing various fields that form the contemporary quality infrastructure. This reflects the growing interest of the professional community in topics such as standardization, conformity assessment, safety, sustainable development, and quality management.

The co-organizers of the 27th national and 13th international conference are:

- *Faculty of Veterinary Medicine, Belgrade*
- *AQP consulting agency, Kruševac*

We are organizing the scientific expert convention this year with support of

- *Ministry of Economy of the Republic of Serbia*
- *Serbian Employers' Union*
- *The Serbian Chamber of Commerce*
- *Serbian accreditation body*
- *College of Business Economics and Entrepreneurship*
- *Serbian Standardization Institute*

and in cooperation with:

- *The Academy of Vocational(professional) Studies in Šumadija*
- *Quality Center of the Faculty of Engineering Sciences from Kragujevac*
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This year we have two round tables with extremely good panelists and moderators:

1. *MANAGEMENT SYSTEMS FOR THE FUTURE: HOW TO ENSURE MANAGEMENT SYSTEMS REMAIN RELEVANT IN THE CONTEXT OF EMERGING TRENDS*
2. *CHALLENGES OF LEADERSHIP IN CRISIS CONDITIONS*

A particular value of the conference lies in the student session, where young researchers present their work and innovative solutions. The authors of the three best student papers receive monetary awards, thereby encouraging the development of young talents and their engagement in the fields of quality and standardization.

The conference traditionally features the "Training for Business Quality" award, presented to the organization that conducted the highest number of trainings in the previous year. As part of the award, the top three organizations receive a complimentary one-day workshop for their employees in the field of non-formal education.

Special recognition is also given to individuals and organizations that have made an outstanding contribution to the development and improvement of quality infrastructure in Serbia and the region. Through these awards, professionalism, innovation, and commitment to the values of quality are further affirmed.

Finally, we express our sincere gratitude to all conference participants, authors and co-authors, collaborators, institutions, sponsors and donors, media representatives, the Scientific Committee, and all those who provided professional, logistical, and organizational support. We extend special appreciation to our long-standing colleagues and veterans who, even in their ninth decade of life, continue to contribute selflessly. Is there a stronger bond than the union of theoretical knowledge and rich experience on one side, and the energy of younger generations on the other? For this reason, we offer our deep and heartfelt gratitude to everyone.

Chairman of the organizing committee

Prof. dr Zoran Punoševac

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THE "LEAN VS. CLEAN" DEBATE IN MONETARY POLICY: NEW EVIDENCE

Irena Radović [1]

Nikola Fabris [2]

Abstract: *This paper explores the ongoing debate on the role of monetary policy in preventing and addressing financial crises, known as the "lean vs. clean" dilemma. The central question is whether central banks should act preventively to avoid financial bubbles and imbalances (the lean approach), or whether it is more effective to respond only after they burst, focusing on mitigating the consequences (the clean approach). Through a review of theoretical literature and historical experiences, the paper highlights the advantages and limitations of both approaches. Special emphasis is placed on post-crisis reforms and the role of macroprudential policy as a complementary instrument to monetary policy. The paper shows that neither approach is universally applicable, but places a slight emphasis on the lean approach and suggests that the new framework for monetary policy must include a combination of preventive measures, effective responses after a crisis outbreak, international coordination of central banks, as well as improvements in forecasting models and early warning systems.*

Keywords: *Monetary Policy, Financial Stability, Lean vs. Clean, Macroprudential Policy, Central Banks*

JEL Classification*: E30 and E52*

1. INTRODUCTORY REMARKS

Over the past few decades, financial markets and institutions have undergone a radical transformation and a rapid expansion, driven by the general trends of deregulation, liberalization, globalization, as well as advances in computer technologies. International capital flows have intensified, markets have developed new and sophisticated instruments, and the speed of financial transactions has drastically increased, significantly reducing transaction costs. The degree of interdependence among financial institutions from different countries has grown dramatically. However, it is not only financial institutions that have become more interdependent, but also companies from the real sector, since today there are more and more global corporations, while even local firms are increasingly globally dependent—whether due to their suppliers, customers, or the overall economic climate. At the same

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time, these structural changes unfolded much faster than the evolution of the supervisory and regulatory framework (Fabris, 2006).

This environment proved very conducive to the development of financial and economic crises, which were less and less local in nature, with regional and global crises becoming dominant. Such developments posed serious challenges for policymakers to identify risks in time, properly assess them, and mitigate their costs.

Empirical evidence suggests that financial sector leverage is indeed procyclical (Lassen et al., 2015a). This means that there are internal cycles in which good news leads both to higher demand and greater supply of credit (White, 2009). This positively affects asset prices and consumption, fueling even greater optimism and further credit demand. Increased demand pushes up asset prices, which begin to rise above fundamental values. This implies that initially rational optimism turns into irrational exuberance, and at a certain point—when there are no new investors—the bubble bursts and a crisis emerges. It should also be noted that some authors argue that asset bubbles cannot form unless there is some form of expansionary monetary policy beforehand (Borio & White, 2004; Gali & Gambetti, 2014).

Given that crises impose extremely high costs on society, the debate over the role of central banks in relation to financial bubbles is one of the most important issues in modern macroeconomic theory and practice. The "lean vs. clean" dilemma can be viewed as a choice between preventive action—attempting to avert imbalances in financial markets—and a reactive approach, in which institutions focus on cleaning up after crises once they occur (Mishkin, 2011). As Laseen (2015) emphasizes, the key questions are whether central banks can identify emerging asset price bubbles, what the implications of their bursting are, and whether monetary policy is the appropriate response to potential bubbles.

Historically, monetary policy was primarily oriented toward price stability and inflation control. Financial stability often remained secondary, which became apparent during the period of financial market deregulation in the 1980s and 1990s. However, a series of crises—from Japan's stagnation in the 1990s, through the Asian crisis of 1997–1998, to the global financial crisis of 2008—showed that neglecting imbalances can have severe consequences for economic growth and employment (Reinhart & Rogoff, 2009).

The concrete policy question that arises is whether policy should be more restrictive than it would otherwise be if there is evidence of growing imbalances in the real economy or rising systemic risks in the financial system? Or should policymakers rely on an alternative strategy—namely, that monetary policy should be content to "clean up the mess" afterward (White, 2009)?

At first glance, it may seem logical that regulators should intervene and prevent excessive inflation of asset prices. However, experience shows that identifying bubbles is extremely difficult, that monetary intervention can produce unintended consequences, and that in many cases, solutions focused on mitigating the aftermath of a burst bubble have been more effective than preventive action. On the other hand, examples such as the global financial crisis have demonstrated how dangerous it was to ignore housing market price bubbles, suggesting that preventive action should have been taken before they burst.

Ultimately, the answer to this question should depend on the relative costs of each approach. Even if we assume that monetary intervention could be effective in halting the spread of crises and restoring the financial system, the question remains whether the costs of such interventions might outweigh their benefits. Historical experience clearly shows that, under certain circumstances, confidence in the central bank can deteriorate rapidly. For instance, if aggressive purchases of government bonds (or worse, private securities) are interpreted as debt monetization, it could lead to a sudden rise in inflation expectations and, in extreme cases, to exchange rate destabilization (White, 2009).

History has clearly shown us that crises have occurred in the past and will occur in the future. What we also know is that when crises do occur, they carry significant costs. What we do not know is when they will emerge, but through preventive action, we can make them less frequent and less destructive.

This paper examines the theoretical foundations of both approaches, their practical reach and limitations, as well as the possibilities for integrating them into a modern monetary policy framework.

The paper is structured into five parts. Following the introductory remarks, the second part provides a review of the literature addressing this issue. The third part discusses the advantages and disadvantages of the lean and clean concepts. The fourth part proposes a new framework for monetary policy, and the fifth part presents concluding remarks.

2. LITERATURE REVIEW

For a long time, traditional macroeconomic models (e.g., IS-LM) paid little attention to the financial sector, treating it as irrelevant to systemic instability. Crises were explained by external shocks or rigidities in labor and product markets. This approach dominated during the postwar period until the 1980s, when models began to emerge that incorporated financial frictions and credit cycles. Kiyotaki and Moore (1997) developed a model of credit cycles in which changes in collateral values amplify economic fluctuations. Bernanke, Gertler, and Gilchrist (1999) introduced the concept of the financial accelerator, whereby shocks to the balance sheets of banks and firms can lead to reduced lending, thereby deepening recessions. These works demonstrated that the financial sector is not neutral but rather an active generator of cycles.

Borio (2014) and Claessens, Kose, and Terrones (2013) developed the concept of the financial cycle, which lasts longer than the business cycle and has stronger implications for systemic stability. These theoretical findings provided the foundation for advocating preventive measures (lean), but also raised questions about the limitations of monetary policy as an instrument. On the other hand, theoretical arguments for the clean approach rest on the claim that it is almost impossible to identify bubbles in real time. As Greenspan (2002) emphasized, central banks should not target asset prices because doing so could lead to errors and hinder growth.

Laseen et al. (2015) argue that while there are theoretical reasons for leaning against the wind, much work remains before this becomes a viable option in practice. They stress that an unexpected increase in policy interest rates—for example, to prick an emerging asset price bubble—does not reduce risk to the financial system. Such a policy lowers output, inflation, and asset prices without fundamentally mitigating financial risks. They conclude that using monetary policy systematically to react to financial risks, such as excessive risk-taking as it builds up over time, could nonetheless be worthwhile.

Bernanke and Gertler (1999, 2001) contend that monetary policy should not target asset prices because bubbles are difficult to identify in real time. Greenspan (2002) highlights that attempts at bubble prevention are risky and that central banks have limited instruments for such interventions. Svensson (2010, 2011, 2012) adds that targeting asset prices could undermine the credibility of inflation targeting. These authors believe that it is more effective to react after bubbles burst, by lowering interest rates and stabilizing the financial system.

Laseen et al. (2015a) emphasize that leaning against the wind requires financial sector leverage to be procyclical, but empirical evidence is mixed and suggests that procyclicality varies across sectors and over time. They add that leaning against leverage without clearly distinguishing why leverage is increasing could lead to policy mistakes that worsen emerging financial stress, possibly inducing a full-blown crisis.

After the global financial crisis of 2008, more and more authors pointed to the necessity of preventive action. Cecchetti et al. (2000, 2003) stress that including asset prices in the reaction functions of central banks can dampen economic fluctuations. Borio and White (2004) argue that financial imbalances cannot arise without excessive monetary expansion and that central banks must raise

interest rates during bubble periods. Trichet (2005, 2009) maintains that it is the responsibility of central banks to react symmetrically—raising rates during asset price booms and lowering them after busts. Taylor (2008) argues that excessively loose policy prior to the crisis explains its severity. Mishkin (2011) and Woodford (2012) highlight that inflation stability is not a sufficient guarantee of financial stability, since crises can also occur under stable inflation. Leroi (2015), using the case of South Africa, concluded that monetary policy should lean against the wind.

laessens et al. (2013) argue that no single approach is universally applicable. In countries with developed and flexible financial systems, the clean approach may be sustainable. By contrast, small and vulnerable economies are often forced into a lean approach to prevent destabilization. In their view, the best outcomes are achieved by combining both approaches—preventive measures alongside rapid responses when crises erupt.

From this brief literature review, we can conclude that the theoretical framework provides arguments for both approaches: lean as a mechanism for reducing systemic risk, and clean as a pragmatic response to the limited ability to identify and control bubbles.

3. CLEAN VERSUS LEAN

3.1.Basic Assumptions of the "Clean" Strategy

The *clean* approach implies that central banks should not actively attempt to prevent financial bubbles, but rather focus on mitigating their consequences once they burst. Proponents of this approach argue that it is very difficult to identify financial bubbles in advance and that monetary policy, if applied too aggressively, can trigger unintended consequences. This approach is summarized by the premise: *the central bank can't lean, but can clean.* The rationale behind this view rests on three key elements: the difficulty of identifying bubbles, the risks of mistiming monetary policy, and the belief in the effectiveness of instruments aimed at cleaning up after the bust (Bernanke & Gertler, 2001).

1. ***The difficulty of identifying bubbles*** – Financial bubbles are rarely obvious in real time. They are usually clearly recognized only after they burst, when prices collapse and shock the economy. The problem lies in the absence of a single, universally accepted criterion for measuring "overheating" in the markets. Different indicators, such as the price-to-earnings (P/E) ratio, property price trends, or the pace of credit expansion, may signal potential imbalances, but never with absolute certainty. Hence, monetary policy—by definition broad-based and affecting the entire economy—is an uncertain instrument for targeting bubbles. If a central bank raises interest rates to curb a presumed bubble, there is always the risk that no bubble actually exists and that price increases are fundamentally justified. Such a move could unnecessarily slow down the economy.
2. ***Potential adverse effects of monetary measures*** – Using restrictive monetary policy preventively may have severe negative effects on the real economy. For example, raising interest rates to contain speculative movements in housing or stock markets also increases borrowing costs for firms and households, reducing investment and consumption. Consequently, economic growth slows down and unemployment may rise. In this way, an attempt to prevent a potential bubble could itself trigger the very recession central banks aim to avoid. Precisely because of such risks, many economists argue it is preferable to allow a bubble—if it exists—to develop, while central banks prepare to react swiftly and decisively once it bursts.
3. ***More effective tools for cleaning up after the bust*** – Experience shows that central banks are often more effective when using their traditional instruments to mitigate the aftermath of a bubble. Once a financial crisis materializes, policy rates can be aggressively lowered to stimulate liquidity and lending activity. Central banks can also provide direct liquidity support to banks to prevent panic and systemic collapse. In extreme cases, quantitative easing (QE)—the purchase of government and corporate bonds—can be deployed to further secure stability

and support economic growth. In addition to monetary measures, fiscal policy plays a key role. Through public investment, subsidies, or tax incentives, governments can cushion the shock and stimulate aggregate demand. A coordinated mix of monetary and fiscal policy therefore represents the most effective response mechanism to crises triggered by bursting bubbles.

The application of the so-called *clean* approach—focusing on damage control rather than the preventive "pricking" of bubbles—has numerous historical precedents. The Federal Reserve has predominantly pursued this type of policy over the past two decades, repeatedly emphasizing that monetary tightening was applied only in response to potential inflationary implications of rising asset prices, rather than as a reaction to accumulated credit imbalances or increasing systemic exposures (White, 2009). For instance, in the late 1990s, the Fed allowed the dot-com bubble to develop. When it eventually burst, the U.S. central bank responded quickly by cutting interest rates, enabling a relatively rapid economic recovery and averting a deeper recession.

By contrast, Japan's experience in the 1990s illustrates the risks of an excessively restrictive stance. The Bank of Japan chose to aggressively raise interest rates in order to contain rising property and stock prices. The result was prolonged economic stagnation, known as the "lost decade," during which growth was minimal and deflation became a chronic problem.

3.2.Basic Assumptions of the "Lean" Strategy

In contrast to the *clean* strategy, the *lean* approach advocates preventive action by central banks. Unlike the *clean* strategy, which assumes it is better to respond after a bubble bursts and focus on mitigating its consequences, the *lean* approach emphasizes the need for central banks to act proactively. The main idea is that the costs of prevention are lower than the costs of remediation, given that financial crises often result in deep and long-lasting disruptions in the real economy.

This approach gained prominence after the global financial crisis of 2008. At that time, it became evident that although massive fiscal and monetary stimulus packages succeeded in stabilizing economies and preventing an even deeper collapse, the price of such a strategy was the creation of new imbalances, including a dramatic rise in public debt, long-term pressures on budgets, and an increased reliance of markets on central bank support (Borio & Lowe, 2002).

Advocates of the *lean* approach argue that proactive central bank action reduces systemic risk and prevents domino effects in the financial sector. The idea is that it is better to prevent the formation of imbalances that could destabilize the entire economy, rather than allow them to expand unchecked and then attempt to repair consequences that may prove dramatic and enduring. The key arguments for the *lean* approach are:

1. ***Prevention is better than remediation*** **–** The resolution of financial crises often requires massive interventions by central banks and governments, carrying significant fiscal and social costs. Crises usually result in higher unemployment, declining investment, loss of confidence, and weakened productive capacity of the economy. If crises can be addressed preventively, the overall costs of remediation can be multiple times lower.
2. ***Systemic risk and the domino effect*** – Financial crises rarely remain confined to a single sector. The collapse of one major financial institution can trigger a chain reaction and destabilize the entire system. Preventive measures by central banks—through controlling credit expansion, strengthening oversight, and curbing risky behavior—can significantly reduce the probability of systemic collapse and thereby safeguard the broader economy.
3. ***The role of macroprudential measures*** – One of the key strengths of the *lean* approach lies in its emphasis on macroprudential policy. Central banks do not necessarily have to rely solely on interest rates, which often exert broad and unspecific effects. Instead, regulatory and supervisory tools—such as raising capital requirements for banks, restricting riskier forms of lending, introducing countercyclical buffers, or conducting stress tests—enable more targeted

and less intrusive interventions (BIS, 2014). In this way, the growth of financial imbalances can be curbed more precisely without jeopardizing broader economic growth.

There are several examples that support the validity of this approach. Canada and Australia are cases of countries that, through stricter banking supervision and macroprudential policies, managed to avoid severe disruptions during the global financial crisis. The European Union, learning from the 2008 experience, developed an institutional framework for coordinating macroprudential policies by establishing the European Systemic Risk Board (ESRB), which centralizes oversight and ensures information-sharing among national regulators (ECB, 2016).

At the global level, the Bank for International Settlements (BIS) has consistently advocated the strategy of *leaning against the wind*, arguing that preventive suppression of bubbles and risky behavior is the key to long-term stability.

4. NEW MONETARY FRAMEWORK

Although both approaches have their advantages, there are also serious criticisms. The *clean* approach is often accused of creating moral hazard, as market participants expect central banks to rescue them in case of a crisis, as well as the fact that crisis resolution can entail significant social costs. On the other hand, the *lean* approach can lead to a premature recession, since restrictive measures introduced at the wrong moment suppress growth (Woodford, 2012). The political economy of decision-making also plays an important role. Governments often prefer short-term growth, while preventive measures by central banks may be politically unpopular. This creates a conflict between long-term stability and short-term political goals (Reinhart & Rogoff, 2009). The following table presents the characteristics of both approaches.

Table 1: Comparative overview of the 'lean' and 'clean' approaches

Aspect	Lean	Clean
Basic idea	Preventive action to stop bubbles from forming.	Reaction only after a bubble bursts.
Main arguments	Prevention costs are lower than resolution costs; reduction of systemic risk.	Difficulty in identifying bubbles; avoiding premature recession.
Instruments	Raising interest rates, macroprudential measures (LTV, DTI, CCyB).	Lowering interest rates, quantitative easing, liquidity support.
Advantages	Reduces the probability of systemic crisis; long-term stability.	Flexibility; lower risk of mistimed intervention.
Disadvantages	May cause premature recession; politically unpopular.	Creates moral hazard; risk of severe and costly crises.
Examples	Canada, Australia, EU (macroprudential framework).	USA (tech bubble in the 1990s), Japan (lost decade).

We believe that monetary policy should have primacy in preventing the outbreak of crises (*lean* approach), even though during expansionary periods this may seem unpopular and unnecessary, as it slows down growth, but experience has shown that the consequences of crises can be many times greater. In other words, the loss of growth today due to monetary tightening is much smaller than the potential loss of growth tomorrow as a result of a crisis outbreak. Essentially, this is the dilemma of a *small loss of growth today versus a large loss of growth in the future*.

In our view, the elements of a new monetary framework should include the following:

1. A New Mandate for Central Banks – In addition to their traditional responsibility for maintaining price stability, central banks must also assume explicit responsibility for financial stability. Today, some central banks treat financial stability as a secondary objective, while, to the best of our knowledge, the Central Bank of Montenegro is the only central bank that has established financial stability as its primary mandate. Experience clearly shows that the collapse of the financial system poses a far greater challenge than inflation—except in cases of extremely high inflation.

To enable central banks to effectively fulfill this task, it is essential that banking supervision, where it has been transferred to independent agencies, be restored to the remit of central banks. Moreover, a Council for Financial Stability should be established as a coordinating body bringing together all financial system regulators, chaired by the central bank.

A potential challenge lies in the fact that price stability and financial stability may sometimes appear as conflicting objectives. In the short run, this requires certain trade-offs, but in the long run the two goals are compatible and mutually reinforcing. Whenever doubts arise as to whether priority should be given to controlling inflation or safeguarding financial stability, primacy should be granted to financial stability.

2. Strengthening the Macroprudential Framework – Under conditions of stable economic and financial environments, monetary policy should remain primarily focused on maintaining price stability, while macroprudential policy should serve as the first line of defense against the build-up of imbalances in the financial system. The essence of macroprudential policy lies in its countercyclical nature – during expansionary phases, banks should be required to hold higher capital buffers, stricter lending standards should be imposed when risks are rapidly accumulating, and financial institutions should maintain adequate levels of liquid assets on their balance sheets. In this way, the probability of destructive bubbles forming is reduced, and the need for abrupt and potentially painful monetary policy interventions is mitigated, thereby avoiding unnecessary slowdowns in economic activity in the case of minor disturbances.

Macroprudential policy also enables targeting of specific sectors without necessarily raising interest rates across the entire economy. This allows central banks to reconcile the goal of preserving financial stability with the objective of fostering economic growth. The European Central Bank and the ESRB play a key role in coordinating such policies among EU member states (ECB, 2016).

Nevertheless, the experience of many countries shows that macroprudential measures, although important, are often insufficient to contain growing imbalances, especially when they become systemic and affect multiple segments of the financial market. In such cases, active monetary policy responses are indispensable—through gradual but determined tightening of financing conditions, i.e., raising policy interest rates. The synchronized action of monetary and macroprudential policy makes it possible to contain risk accumulation in a timely manner, prevent the destabilization of the financial system, and preserve a stable framework for long-term sustainable economic growth.

3. International Coordination and Increased Accountability of Key Central Banks – The globalization of the financial system and economic activity has meant that economic and financial crises are increasingly less local in nature and increasingly global. The rapid transmission of shocks through international financial flows, trade, and capital movements demonstrates that no economy, not even the largest, can remain insulated from global disruptions. In this context, international coordination among central banks becomes indispensable in order to safeguard financial stability and prevent crises from spilling over from one country to another. A particular responsibility rests with the major central banks, since their decisions have the most far-reaching consequences for the global financial system. Smaller central banks, on the other hand, operate with far more limited instruments and capacities, and therefore cannot independently cope with global crises or fully mitigate their domestic effects. Cooperation, information sharing, and joint action are thus crucial for maintaining stability in a globalized financial environment.

Timely information exchange is also of critical importance. For instance, had the Federal Reserve warned other central banks in the spring of 2007 about the imbalances developing in the United States, the global financial crisis might have had less severe consequences, triggered earlier monetary policy action, and lasted for a shorter period. Whether existing international institutions such as the IMF and the BIS are sufficient for this coordination, or whether new ones are needed, remains an open question.

4. Monitoring Imbalances Beyond the Financial System – While many crises are closely linked to the financial system itself—through overly rapid credit expansion, the weakening of capital and liquidity requirements, or other channels of financial destabilization—it is important to emphasize that crises may also originate outside the financial sector. They can arise, for example, from excessive public borrowing, from geopolitical shocks and armed conflicts, from climate change, energy disruptions, or even natural disasters that seriously disturb economic flows. In such circumstances, it is evident that central banks do not possess the tools to prevent the emergence of such imbalances. However, they are obliged, through preventive measures—above all by strengthening the resilience of the financial system, improving the regulatory framework, conducting stress tests, and deploying macroprudential policies—to reduce the risk of negative spillovers from external shocks onto the domestic financial market and the real economy. In this way, central banks cannot eliminate the root causes of crises originating outside the financial system, but they can significantly mitigate their consequences and preserve stability through a proactive strengthening of financial system resilience.

5. Incorporating Climate and Geopolitical Risks into the New Monetary Framework – Contemporary global economic trends show that climate change and geopolitical shocks are becoming increasingly important sources of macroeconomic and financial imbalances. Climate change leads to a greater frequency of natural disasters, energy shocks, and supply chain disruptions, all of which directly affect inflation, production, and financial stability. For this reason, a growing number of central banks are integrating climate stress tests and scenarios into their analyses, developing indicators of the exposure of banks and the real economy to climate risks.

Geopolitical risks, on the other hand—armed conflicts, trade wars, sanctions, and the fragmentation of global markets—exert a powerful transmission effect through energy prices, capital flows, and investment expectations. Central banks must therefore strengthen their capacity to rapidly assess these shocks and adapt their policy responses, since standard macroeconomic models are often insufficiently sensitive to such extraordinary events. The new monetary framework should systematically incorporate the monitoring and integration of climate and geopolitical factors, in order to identify risks in a timely manner that could threaten monetary and financial stability.

6. Enhancing Forecasting Techniques and Early Warning Systems – The global financial crisis of 2008 clearly revealed the serious limitations of the then-dominant macroeconomic forecasting models and early warning systems. None of them succeeded in signaling the crisis in advance, underscoring their structural weaknesses. Most models focused narrowly on inflation dynamics and the output gap, while neglecting financial imbalances, asset price developments, and systemic risks. As a result, they conveyed a misleading picture of stability, even as significant risks were accumulating beneath the surface.

Improvement of existing models is therefore essential in several directions. First, the financial sector must be more strongly integrated into macroeconomic projections, particularly through the monitoring of credit cycles, real estate prices, and sectoral debt levels. Second, models must become more flexible and scenario-based, explicitly incorporating rare but high-impact events (so-called "tail risks"). Third, early warning systems should combine quantitative indicators with qualitative assessments, including data beyond traditional statistical sources—such as market expectations and geopolitical indicators.

Ultimately, crisis forecasting will never be perfectly precise, but by improving methodology, enhancing data availability, and fostering international experience-sharing, it is possible to

significantly reduce the risk of surprises and build more resilient policies capable of responding in a timely manner to the accumulation of imbalances.

This new monetary framework can be illustrated with the following diagram.

5. CONCLUSION

The "lean vs. clean" debate remains one of the central issues of modern monetary policy and economic theory. Although the *clean* approach long dominated, relying on the assumption that identifying bubbles with precision is nearly impossible and that central banks should focus exclusively on price stability, the experience of the 2008 global financial crisis clearly exposed its serious shortcomings. The costs of "cleaning up" after bubbles burst proved far greater than the benefits gained from policy flexibility.

By contrast, the *lean* approach advocates preventive action, aiming through tighter monetary policy to reduce the likelihood of sudden and destructive crises. While there is a risk of premature tightening and negative impacts on economic growth, the benefits of this approach lie in preserving the long-term stability of the financial system and reducing the accumulation of imbalances. Experience has shown that ignoring risks can lead to far greater shocks and deeper recessions.

The most realistic and effective path, however, does not lie in a rigid choice between the lean and clean approaches, but rather in their combination within a new framework of monetary and macroprudential policy. Macroprudential measures—countercyclical capital buffers, stricter lending standards, stress tests, and monitoring of imbalances—can serve as the first line of defense against bubble formation, while monetary policy remains focused on price stability but retains the readiness to respond should risks escalate.

In addition, the globalization of the financial system requires stronger international coordination among central banks. Crises are no longer local; they spread rapidly across borders, and the measures of individual smaller economies are often insufficient to prevent or mitigate them. Large central banks, such as the Federal Reserve and the European Central Bank, bear a particular responsibility, since their policies generate global effects. At the same time, smaller central banks must strengthen the resilience of their systems while also building mechanisms for cooperation and information exchange.

Finally, improving forecasting models and early warning systems is a crucial component of crisis prevention. The dominant models, focused narrowly on inflation and the output gap, failed to predict the 2008 crisis. New approaches must integrate the financial sector, credit cycles, and asset prices, as

well as scenarios incorporating rare but highly disruptive events. Combining quantitative and qualitative indicators, including geopolitical and climate risks, can significantly enhance the ability of the system to identify potential shocks in time.

All of this points to the fact that modern monetary policy can no longer be one-dimensional and exclusively oriented toward price stability. A new concept requires an integrated approach that combines prevention, timely response, international cooperation, and improved forecasting models. Only in this way is it possible to preserve stability and reduce the likelihood of repeating deep and devastating financial crises in the future.

REFRENCES

[1] Bernanke, B. (2002). Asset-Price "Bubbles" and Monetary Policy. Remarks before the New York Chapter of the National Association for Business Economics, New York, October 15.

[2] Bernanke, B. (2009). The crisis and the policy response. Lecture at the London School of Economics, January 13.

[3] Bernanke, B., & Gertler, M. (1999). Monetary policy and asset price volatility. Federal Reserve Bank of Kansas City Economic Review, 4, 17-51.

[4] Bernanke, B., & Gertler, M. (2001). Should Central Banks Respond to Movements in Asset Prices? American Economic Review, 91(2), 253–257.

[5] Bernanke, B., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. Handbook of Macroeconomics, Vol. 1C.

[6] BIS (2014). 84th Annual Report. Bank for International Settlements.

[7] Borio, C. (2007). Change and constancy in the financial system: implications for financial distress and policy. BIS Working Paper, 237.

[8] Borio, C. (2011). Rediscovering the macroeconomic roots of financial stability policy: Journey, challenges, and a way forward. Annual Review of Financial Economics, 3(1), 87-117. https://doi.org/10.1146/annurev-financial-102710-144819

[9] Borio, C. (2014). Monetary policy and financial stability: What role in prevention and recovery?. BIS Working Paper, 440.

[10] Borio, C. (2014). The financial cycle and macroeconomics: What have we learnt? Journal of Banking & Finance, 45, 182–198.

[11] Borio, C., & Lowe, P. (2002). Asset prices, financial and monetary stability: Exploring the nexus. BIS Working Papers, No. 114.

[12] Borio, C., & White, W. (2004). Whither monetary and financial stability? The implications of evolving policy regimes. BIS Working Paper, 147.

[13] Cecchetti, S. G., Genberg, H., & Wadhwani, S. (2003). Asset prices in a flexible inflation targeting framework. In W. Hunter, G. Kaufman, & M. Pomerleano (Eds.), Asset Price Bubbles: The Implications for Monetary, Regulatory, and International Policies (pp. 427–444). MIT Press.

[14] Cecchetti, S. G., Genberg, H., Lipsky, J., & Wadhwani, S. (2000). Asset prices and monetary policy. Geneva Report on the World Economy, 2.

[15] Claessens, S., Kose, M. A., & Terrones, M. E. (2013). Financial cycles: What? How? When? IMF Working Paper, WP/11/76.

[16] European Central Bank. (2016, October). *Macroprudential Bulletin* (Issue 2). Frankfurt am Main: European Central Bank. Available at: https://www.ecb.europa.eu/pub/pdf/other/ecbmpbu201610.en.pdf

[17] Fabris, N. (2006). Centralno bankarstvo u teoriji i praksa. Centralna banka Crne Gore, Podgorica.

[18] Gali, J. and Gambeti, L. (2014). The Effects on Monetary Policy on Stock Market Bubbles: Some Evidence. NBER, WP No 19981.

[19] Greenspan, A. (2002). Economic Volatility. Federal Reserve Bank of Kansas City Symposium.

[20] Greenspan, A. (2002). Economic volatility. Speech at Jackson Hole Symposium, August 30.

[21] Kiyotaki, N., & Moore, J. (1997). Credit cycles. Journal of Political Economy, 105(2), 211–248.
[22] Laseen, S., Pescatori A. and Turunen, J. (2015). "To Lean or Not to Lean?" That is the Question, IMF Blog. Abailale at: https://www.imf.org/en/Blogs/Articles/2015/07/01/to-lean-or-not-to-lean-that-is-the-question
[23] Laseen, S., Pescatori A. and Turunen, J. (2015a). Systemic Risk: A New Trade-off for Monetary Policy?. IMF Working Paper, No 15/142.
[24] Leroi, R. (2015). The lean versus clean debate and monetary policy in South Africa. Journal of Economics and Political Economy, 2(4), 467-481.
[25] Mishkin, F. S. (2009). Is monetary policy effective during financial crises? American Economic Review, 99(2), 573–577. https://doi.org/10.1257/aer.99.2.573
[26] Mishkin, F. S. (2011). Monetary Policy Strategy: Lessons from the Crisis. NBER Working Paper No. 16755.
[27] NGFS (2019). A call for action: Climate change as a source of financial risk. Network for Greening the Financial System.
[28] Reinhart, C. M., & Rogoff, K. S. (2009). This Time Is Different: Eight Centuries of Financial Folly. Princeton University Press.
[29] Svensson, L. E. O. (2010). Inflation targeting. In B. Friedman & M. Woodford (Eds.), Handbook of Monetary Economics (Vol. 3). Elsevier.
[30] Taylor, J. B. (2008). The financial crisis and the policy responses: An empirical analysis of what went wrong. NBER Working Paper, 14631.
[31] Trichet, J.-C. (2005). Asset price bubbles and monetary policy. Lecture at the Monetary Authority of Singapore, June 8.
[32] Trichet, J.-C. (2009). Credible alertness revisited. Speech at Jackson Hole Symposium, August 22.
[33] White, R. (2009). Should Monetary Policy "Lean" or "Clean". Working Paper, No 34, Federal Reserve Bank of Dallas.
[34] Woodford, M. (2012). Inflation Targeting and Financial Stability. NBER Working Paper

QUALITY MANIFESTO AND QUALITY MANAGEMENT STANDARDS FOR ENHANCING THE QUALITY OF SOCIETY

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Abstract: *The International Academy for Quality (IAQ) Quality Manifesto (2021) serves as a strategic declaration calling on quality professionals worldwide to revitalize their profession by emphasizing the role of leaders in addressing quality challenges. The global dissemination and proclamation of the quality manifesto, especially at the management level of organizations and society, aims to promote a positive attitude towards quality thinking and competence. The manifesto is comparable to the ISO 9000 quality management standards, which have been the most widely used quality management implementation model over the years. Although they differ in origin, they share the same ultimate purpose: to help organizations evolve towards leadership and sustained success by using effective and advanced professional quality management principles and practices. Both can also be applied in the context of the quality of individuals and society as a whole. The scope of the quality manifesto has been expanded to cover all of humanity, ecology, and the planet. However, in these contexts, it is important to critically examine their inherent characteristics as well as the economic, political, ideological and religious paradigms associated with them. Both the quality manifesto and the ISO 9000 standards also have connections to sustainability and social responsibility. The greatest benefit is achieved by understanding how quality management standards and a quality manifesto can complement and support each other. This article examines the quality manifesto and quality management specifically from a societal perspective and is thus part of the author's broader research on quality in society.*

Keywords: *quality, quality manifesto, quality management, ISO 9000, International Academy for Quality, IAQ, sustainability*

JEL Classification*: L15, I31*

1. INTRODUCTION

A manifesto (Britannica 2025a) is a public statement that sets out the intentions, motives or views of its publisher. Notable manifestos have been used in literature, art and politics. The International Academy for Quality (IAQ) Quality Manifesto (IAQ 2021a) aims to support all organizations and the

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global community of quality professionals to enable leadership through quality and thereby promote quality *as the essence of goodness in all dimensions of humanity's experience*.

Quality management (QM) is a standardized and widely used concept and practice for implementing quality in all types of organizations. It was launched, developed, disseminated, and established for global use by the International Organization for Standardization (ISO) committee ISO TC176 (ISO, 2024b) through the ISO 9000 standards. QM was first formally defined in ISO 8402 (ISO, 1986). QM refers to all the means by which an organization's management implements quality-related measures to promote the organization's business success. Before QM, organizations focused primarily on quality assurance (QA), i.e., requirements intended to demonstrate and assure confidence between the organization and its customers. Today, it is understood that QA is a part of QM. The ISO 9000 standards can be supplemented, as needed, with dozens of other management system standards for specific areas related to organizational management (ISO, 2025a). The term quality management has also been used in several other contexts, for example in connection with the concept of Total Quality Management (TQM) (Houston and Dockstader, 1988). However, TQM did not establish itself as an unambiguous concept, and today it can be understood as identical to the latest definition of QM in the ISO 9000 standard: *management with regard to quality* (ISO 2025b). Later in this article, quality management (QM) refers to this definition.

The ISO 9000 standard defines quality as the *degree to which a set of inherent characteristics of an object fulfils requirements*. In ISO language, *requirements* mean *needs and expectations*. Quality is only realized when parties interested in the object perceive it. Quality is a human-centered issue; only humans can have needs and expectations, and only they can perceive and be aware of them and their fulfillment. These requirements can encompass the entire range of human perception, including rational (reason or logic-based), nonrational (emotional), and irrational (spiritual) aspects. This definition of quality has achieved wide global acceptance and can also be considered a historically profound, practically versatile, and progressive definition (Anttila, 2023). When implementing QM, the human aspects of quality should always be appropriately taken into account.

The concepts, principles and practices of the ISO 9000 standard are primarily applied in the operational environment of various organizations. However, they are also useful in ensuring the quality of people's lives and society. The scope of the quality manifesto is also broader than the organization, and includes the perspectives of people, society, and even humanity (i.e. people and the human race collectively). People, individuals, and society are very different in nature compared to organizations, and therefore their specific characteristics as well as prevailing psychological, ideological, economic and political phenomena and paradigms and associated risks should be taken into account, especially when considering their quality management.

Since 1986, internationally active communities have published four quality manifestos as follows (IAQ, 2021b):

1. American Society for Quality (ASQ) – Quality Manifesto of 1986.
   - Stimulated by the ISO 9000 standards and Malcolm Baldrige National Quality Award.
   - Philosophical document with a ‘call to action’.
   - Signed by all living Presidents of ASQ.
2. American Society for Quality (ASQ) – Quality Manifesto of 1996.
   - No substantial changes from 1986 document.
   - Signed by the most recent Presidents of ASQ.
3. World Alliance for Quality – Quality Manifesto of 2001.
   - Stimulated by the ASQ Future Studies of 1995-2000
   - Approved by ASQ, EOQ, JUSE, and IAQ.
4. International Academy for Quality (IAQ) – The Global Quality Manifesto for the 21st century of 2021.
   - Revitalization of the Quality Manifesto.
   - Drafted by a group of IAQ Academicians.

- Approved and disseminated by IAQ.

There is no research on the actual practical effects of previous manifestos. In any case, they have not had a specific impact, for example, on the ISO 9000 international quality management standards, and they have not been widely reflected in QM training, teaching or research articles.

This article is part of the author's broader research on the quality of society and, in this context, examines how the quality manifesto and quality management based on the ISO 9000 standards can ensure quality on a societal scale.

2. QUALITY MANIFESTO AND QM STANDARDS AS PUBLICATIONS

This article focuses on the latest quality manifesto (IAQ, 2021a) published by IAQ in 2021. At the same time, the authors of the manifesto also presented its underlying ideas (IAQ, 2021b).

The language and expressions of the manifesto are difficult to interpret in many places, especially when trying to translate it from English into another language. The manifesto does not contain any vocabulary, so its text can be understood with the help of general references. In this article, the general quality-related concepts of the manifesto have been interpreted in accordance with the most commonly accepted and used definitions of the ISO 9000 standard. Additionally, commonly used words have been understood according to the Oxford English Dictionary. ISO 9000 QM standards are easier to understand because they include appropriate vocabulary and are written in consensus among people from different languages and backgrounds. The preparation of standards always involves many rounds of comment and approval.

The quality manifesto and the ISO 9000 standards have developed from different origins and responded to different interests. The following table compares their key features.

Quality manifesto (IAQ, 2021):	**Quality management (ISO/TC 176, 2025):**
History: A few earlier versions from quality professionals in various quality organizations from 1986; Not well known or widely used.	History: Continuous general international standardization starting from previous sector-specific standards since 1979; Growing number of different applications worldwide.
Drafting process: A small group of IAQ Academicians; No general review or consensus practice.	Drafting process: ISO community of hundreds of global quality experts; Formal review and approval process; Broad global consensus.
Target group: Quality professionals and organizational leaders; All people.	Target group: Quality professionals, organizations' leaders, certification bodies.
Published: IAQ public declaration as a single two-page document. Translations available in some countries.	Published: Many continually revised international standards by ISO and its national mirror bodies; Officially translated into many languages.
End beneficiary: Quality professionals, organizations, humanity, and the planet.	End beneficiary: Organizations, quality experts, different professionals.
Quality (concept): Fulfillment of the stated, implied, and latent requirements of all stakeholders; Goodness for humanity.	Quality (concept): The degree to which a set of inherent characteristics of an object fulfils needs and expectations; Goodness implicitly included.
Quality management (practice): Not applied; No implementation guidance.	Quality management (practice): Management with regard to quality as an implementation practice; A lot of guidance for implementation available.

In summary, there is a parallel between optimistic declaration and realistic practice, both of which, when used effectively and sensibly together, can lead to optimistically realistic results. This will be explored in more detail in the following paragraphs.

3. CHALLENGES TO THE QUALITY MANIFESTO AND QM STANDARDS

The authors of the quality manifesto have justified the revival of the manifesto with the following facts:

- Previous quality manifestos have been ineffective.
- In general, appreciation for quality and quality professionals has weakened, especially among managers.
- The need for professional quality procedures has grown in many different sectors of society and throughout humanity.
- A more consistent strategic approach with leadership commitment is necessary to solid quality implementations.
- New technologies, and digitalization in particular, bring the new challenges of quality and also opportunities for the implementation of quality.
- The current quality approaches have not been able to meet the new needs. For instance, human issues from a quality perspective are not adopted sufficiently.

This means that previous quality manifestos have not had a significant impact on the overall development of quality activities, and the overall appreciation of quality activities has weakened. However, it was believed that the renewal of the quality manifesto would improve the situation. It was not explained in more detail, which could have caused the weak effect of the previous manifestos. In this context, it is useful to compare with the ISO 9000 QM development and implementation.

The authors of the quality manifesto emphasize the responsibility of quality professionals, who should actively synchronize their efforts and become more enthusiastic about dedicating themselves to the comprehensive promotion of the new philosophy, art, and science of quality with the following goals:

- Committing to customers and society as beneficiaries of quality.
- Deepening quality arts and sciences for profound knowledge.
- Expanding their scope on the macroeconomic sphere.
- Identifying sustainability of the Earth's systems as a principal area for engaging quality thinking and methods.

However, these are still very general and vague ideas for achieving the desired goals and results, and they alone are unlikely to have much impact on the guidance of quality professionals. The key question is, then, how the current challenges can be realized in practice with the revised quality manifesto, its dissemination, and implementation. The authors of the manifesto themselves also state challengingly: 'Excellence comes from execution, not good intentions!' It is essential to monitor and observe how the implementation of the quality manifesto in practice will meet expectations and challenges. So far, at least during the first four years, there are no significant signs of its impact.

The above-mentioned perspectives still contain quite traditional views on the challenges of future quality professionalism. For example, leadership commitment, human issues, and digitalization are not new quality aspects, but already existing facts in today's QM implementations. This raises the critical question of how the quality manifesto could effectively bring anything new when, for example, the ISO 9000 QM standardization has similar challenges and seeks to implement them through the continuous development of standards in a more concrete way in all kind of organizations with greater resources and practical plans. The ISO/TC 176 standardization committee has described in detail the following concepts and principles for future ISO 9000 standards (ISO/TC 176, 2022):

- Customer experience
- People aspects
- Relationship management
- Demographic change
- Change management
- Integration
- Agility

- Knowledge management
- Innovation
- Information aspects
- Circular economy
- Emerging technologies
- Ethics & integrity
- Organizational culture

The ISO 9000 standards consist of many separate standards that cover many aspects of QM to support comprehensive quality implementation for the sustained success of organizations. In addition, many other management system standards (MSS) are compatible with the ISO 9000 standards and can therefore be used to comprehensively extend the implementation of QM to many other management-related fields and organizational sectors. An interesting example is the standard ISO/IEC 42001 (ISO/IEC, 2023a), which addresses the use and management of artificial intelligence (AI) in organizational management.

Although the ISO 9000 standards has been used worldwide in different countries and sectors of society for years, the real appreciation and benefits of quality and QM have not developed sufficiently favorably and effectively. The reasons for this has been:

- Insufficient knowledge and mechanistic implementation of standards without application-specific innovations.
- Shortage of recognizing the potential of all different management system standards (MSS).
- Building formal quality management systems (QMS) without effective business integration and implemented by quality professionals and consultants without genuine commitment from business leaders.
- Focusing primarily on quality assurance (QA) according to ISO 9001 mainly for external audits and certifications.
- QM standards do not have a solid scientific ontological and epistemological foundation.

Sustainability and the sustainable development goals (SDGs) are highlighted in the quality manifesto as issues related to global society. Sustainability is seen as a way to implement the quality manifesto, but also the other way around. Sustainability is also addressed as an essential issue in the ISO 9000 QM standards and other management systems standards (MSS).

We should learn from both positive and negative experiences with the application of ISO 9000 and other management system standards when implementing the quality manifesto. In particular, it is important to ensure that the two approaches are not in competition with each other, but rather complement each other.

4. THE CONTENTS OF THE IAQ QUALITY MANIFESTO 2021

The core statement of the IAQ 2021 quality manifesto is: ‘We, quality professionals of the world, unite to commit ourselves to revitalize quality and transform our profession to increase its relevance for the world’. Thus, the manifesto is a declaration formulated and published by IAQ and directed to all quality professionals to provide for professional guidance to organizations and people all over the world. The aim is to promote goodness, eliminate badness, and ensure betterment in the quality of life for human inhabitants of the planet. The quality manifesto is an approach to quality and QM emphasizing leadership through quality. In general, the phraseology used in the quality manifesto is strange to traditional and established quality professionals who are used to applying the standardized basic concepts of QM.

The manifesto does not formally define the concept of quality, but implicitly, it can be understood according to the ISO 9000 standard. The manifesto emphasizes the word goodness, which means part of the standardized concept of quality. Goodness is the quality of being morally good or virtuous (OED, 2025). Morality is related to the principles of right/wrong and good/bad. Hence, it refers to the

important moral aspects of quality. The same applies to the concept of badness, which in ISO 9000 terminology is related to nonconformity and defect. However, the needs and expectations in the ISO 9000 quality definition include more than just moral aspects. The statement in the quality manifesto "quality defines the essence of goodness for humanity" should also be understood in this limited sense. The quality manifesto uses the expression "betterment", which is apparently identical to the concept of "(quality) improvement" in ISO 9000 and hence a part of QM.

The quality manifesto presents ten ways in which quality professionals should commit to the purpose of the manifesto. We have simplified these rather difficult texts as follows to emphasize their practical understanding and implementation in conjunction with the ISO 9000 QM approach:

1. Deepening the knowledge and skills of the science and profession of quality, and expanding their practical application across all fields of endeavor for driving the benefit of humanity.
2. Doing no harm and doing good for society and the planet's ecology.
3. Expanding the scope of quality management to all geographies, activity sectors, and different functional areas.
4. Going beyond business area also to the management practices in education, health care, environment, and government.
5. Serving customers and emboldening leaders to commit to meeting customer needs as a principal priority.
6. Building strategy with regard to quality by equipping managers to shape vision and objectives that minimize weaknesses, leverage strengths, seize opportunities, and create value for all relevant interested parties.
7. Involving everyone by fostering broad engagement across the organization, building ownership and accountability for quality in individual work, and empowering people to continually drive improvements.
8. Creating trust and happiness by fostering a workplace where employees feel secure through shared prosperity, strengthened abilities, self-respect, and a culture of confidence and trust.
9. Bringing data into daily conversation by enabling everyone – from board members to frontline staff – to confidently generate, interpret, and apply data for control and improvement.
10. Embracing the new technologies of digital, biological, material, and other advanced technologies, and the seamless integration of quality into them.

These professional aspects presented in the quality manifesto focus on QM issues. The main emphasis is on organizational implementations, but issues related to society, humanity, ecology, and the planet are also emphasized. However, these ten core statements of the manifesto do not offer anything particularly new that is not already applied also in appropriate ISO 9000 QM implementations.

The most visible difference here compared to the ISO 9000 standards is the orientation of the manifesto towards society and humanity. However, this raises questions about the responsibilities of implementing QM, which are blurred in these contexts. This will be discussed separately and in depth later in this article, as it is so central to our topic. Nor are people, as individual members of society and humanity, brought forward as the perceivers and implementers of quality benefits, even though this is a key issue for the quality of society.

The quality manifesto brings out that quality professionals and the quality profession and discipline would possess power, with which organizations would enable to transform radically their way of operations and to direct them particularly for the lasting benefit of humanity. This is very strongly said when, at least at the moment, quality professionals often do not have a strong strategic position in organizations or impressive power in societies. Economic, political, and religious forces are more influential in organizations and society. Professional quality procedures are not generally known or recognized among organizational or societal leaders. The manifesto aims at instilling these aspirations in all types of organizations including businesses, health care, education, not-for-profit, social and humanitarian organizations, and governments. Enterprises are independent organizational systems that operate according to their own purposes and business strategies. It is not self-evident that the lasting benefit of humanity would be a genuine important goal of business organizations if their main

purpose is to generate profit for their owners. Public service organizations, on the other hand, operate in accordance with local regulations and political preferences and guidelines. In all economic sectors, general politics and business sponsors have a significant impact on the strategic choices of organizations. The quality manifesto also wants to influence on the hearts and minds of individual people. How this could happen is a broad societal issue. Also, ISO 9000 standards intend to the implementation of a professional QM in all kinds of organizations, and are also possible and applicable in the cases of individual people and societies. The application of ISO 9000 standards has also faced the same challenges over many years as the quality manifesto.

5. CHALLENGES IN IMPLEMENTING QM STANDARDS AND THE QUALITY MANIFESTO FOR SOCIETAL BENEFITS

The quality manifesto generally states that an organization should meet the stated, implicit, and latent requirements of stakeholders, which is precisely what the ISO 9000 quality standards also strive for with their approach, principles, and guiding practices towards relevant interested parties. Here, stakeholders and interested parties may include both people and organizations. In addition, the quality manifesto emphasizes the implementation of quality for the benefit of society as a whole. The practical use of QM according to ISO 9000 standards is limited to promoting the business success of organizations and assuring the satisfaction of stakeholders, but through this they also have a positive impact on society

There is no difficulty with the concept of quality. It can be understood in the same way in the context of an organization and society. However, when it comes to quality management, the situation is significantly different. When considering QM broadly in society, we should understand the principal differences between organizations and society and take into account the key aspects that characterize society. These issues are not explicitly addressed in the ISO 9000 standards, and the quality manifesto only refers to these application areas very generally, for example with the phrases "Do no harm and do good to society", "Quality defines the core of goodness in humanity" and "Quality can and must be applied for the betterment of humanity".

Organizations are entities created by people. An organization is a bounded entity with an inside and an outside, and it is owned by someone and designed for a particular purpose. This is according to the definition of an organization (ISO, 2025b): *A group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives*. Hence, organizations are systems, which may be for profit or not-for-profit. One person can be understood as a singular case of an organization. Conceptually (Ibid), management relates to organizations. Management consists of *coordinated activities to direct and control an organization*. An organization's operations are intended to be managed in a rational way. Top management (ISO, 2018) sets the visions, goals, and objectives of an organization. High quality of an organization ensures sustained success by fulfilling the needs and expectations of the relevant interested parties. Quality management is integrated with the general management and means *management with regard to quality* (ISO, 2025b). It encompasses the entire organization, and people play a central role in it. QM is covered comprehensively in the main standard of the ISO 9000 family, ISO 9004 (ISO, 2018), which can be supplemented, as needed, with other MSSs and also using general ISO directives Annex SL (ISO/IEC, 2023b). A natural and flexible way to develop an organization's QM is based on organizational learning (Anttila and Jussila, 2018).

Society is not any unambiguously defined entity. However, it is generally understood as *an aggregate of people living together in a more or less ordered community*. This community may be in a particular country or in a region, and it may have shared customs, laws, and organizations. In this context, we have two concepts, The People and The State, which should be understood as two different things, as people and as an organization. Society-members interact continuously with each other and outside parties. From the management perspective, we have identified two different options for understanding society and its essence, which often stem from different philosophical ways of thinking:

- Society: Independent individuals acting and interacting directly or via organizations. Society is a network, and it is not a system.
- Society: A community of interrelated individuals acting and interacting directly or via organizations according to a set of rules to form a united whole. Society is a system.

According to the option (a), society is not created or owned by somebody, and therefore it has no top management. Society is an emergent entity, and it does not meet the system's criteria. This means that the holistic management and QM of society are not possible. Option (b) is problematic because it does not correspond to the reality of free societies. Therefore, in this article we understand society according to option (a).

In theory, societies (option a) can be examined as *scale-free networks* (Barabási, 2003) consisting of independent and interactive actors with distinct values, identities and developmental states. Societies include citizens, visitors, private companies, and the organizations of public civil service and not-for-profit third sector. Individuals institute the society, and individuals are influenced and developed by the instituted society (Castoriadis, 1978). Society members function through complex responsive processes of relating (Stacey, 2002).

A good quality of society means a well-functioning and -developing society for all its members and other relevant interested parties, included also visitors. The quality of a societal network originates through diffusion from several win/win interactions between participating members, whereby a member (individual or organization) can fulfill its needs and expectations through all other members and their services.

The quality of society consists of many multidisciplinary aspects, which has also led to various approaches when different parties have considered, evaluated, or compared the quality of societies through fragmented and detached approaches and by focusing only on certain specific aspects, consisting of such examples as municipal activities, environment, nature, culture, family issues, feminist issues, migration, employment, education, industry, agriculture, tourism, innovation, welfare, wellbeing, happiness, aging, health, sport, communication, food, security, religion, etc. Many of these topics also overlap, at least in part, and there are vague relations between them. This confuses conceptually the examination of the quality of society and prevents us from getting a clear picture of its practical holistic development. The topic has often been considered based on certain standardized criteria. In these cases, people's real needs and expectations cannot be taken into account as required by quality. Meeting society's diversity needs and expectations requires diversity of services. In theory, the quality of the entire network is the summed-up quality perceived by all members. In practice, however, different parties experience this comprehensive quality of society in different ways. In this way, an outsider may also find the quality of the network attractive and thus be interested in joining the network as a new member. In a free societal network, a member can also leave when he is sufficiently dissatisfied with the quality of the network.

We have developed the following comprehensive systematic approach to the characteristics of tangible and intangible societal products (goods and services) offered and then also perceived by different members of society:

- Effectiveness, including serveability (service dependability, accessibility, and retainability)
- Ergonomic performance
- Security (privacy, information, belongings, and life)
- Esthetic performance
- Ethical performance
- Social performance*, incl. connectivity, interactivity and sharing, and freedom
- Ecological and environmental performance*
- Economy*, and efficiency and the cost of poor quality

The often-mentioned pillars of sustainable development (Purvis et al., 2019) (*) are included here as a subset. Sustainability is discussed in more detail in the next paragraph. In this context, also the

theory, methods and policy applications of social quality (IASQ, 2022) have been developed to examine the socio-economic and financial, socio-political and legal, socio-cultural, well-being and environmental dimensions of society. Social quality is defined as the extent to which people are able to participate in social relations under conditions that enhance their well-being, capacity and individual potential.

In addition to society, the quality manifesto also addresses humanity, which is a complex global network of people. It means all human beings collectively on Earth, and also refers to the characteristics of people that make them human. Humanity is owned by no one if we leave religious considerations out of consideration. The members of humanity are human individuals and they also have individual needs and expectations. No single party or authority has a natural or legal right to set quality requirements collectively to the humanity as a whole. With regard to the goodness for humanity as it is brought out in the quality manifesto, we all people have an innate understanding of human dignity and universal and absolute moral truths, 'written on our hearts' (Budziszewski, 2013). This has also been brought up by the UN, when the representatives of different legal and cultural backgrounds have jointly established and agreed the universal and fundamental human rights (UN, 1948) as a common standard for all people and all nations. However, this does not mean that the UN or some other institution had an authority to direct and control (i.e. implement quality management) within global human society or humanity.

To understand humanity, the global society, it is important to examine the development of humanity over thousands of years, from Homo Sapiens to modern humans, through many stages (Hariri, 2018a). We cannot understand human origin, essence, and life by scientific means alone because they also have significant connections to spiritual worldviews. If we wanted to view humanity as a whole, then we should accept religious comprehension. All people have some kind of belief in God as an innate trait from birth (Barrett, 2012). According to our religious belief, only the Creator of the world and man, God, can know what is right and good for the whole of humanity, and only He can also rule it with sovereignty and omnipotent power. Creationism and evolutionism are competing theories, which stems from different religious orientation. The secular and spiritual regimes (Melanchthon, 1531) should be looked at as existing realities but their examination must be done in very different ways, and they must not be confused with each other. The development and reflection on this topic are acute and have continued to this day, when a significant topic of discussion is transhumanism (Britannica, 2025b), i.e. to *use technology to modify and enhance human cognition and bodily function, expanding abilities and capacities beyond current biological constraints*. Some people believe that these aspects are significant for the quality of humanity in the future (Hariri, 2018b; Schwab, 2016). However, from a religious point of view they are questionable, and transhumanism can be seen as a danger to all of humanity. For this reason, the issue in question has also been subject to a strong criticism (Ebbets, 2021).

Since society is made up of people, it is natural in this context also to look at the quality of human life, which is influenced by a person's living conditions and environment and personal innate characteristics. People behave rationally, non-rationally (emotionally) and irrationally (spiritually) in a paradoxically existential freedom. They interact in many ways with other individuals and the surrounding environment. A high quality of life means a good life or well-being when subjective rational, non-rational and irrational human needs and expectations are met. People have the capacity to love, to feel compassion and to be creative. Humans are also characterized by human rights (UN, 1948), which are significant factors of human quality. Human rights belong to all people regardless of race, gender, nationality, ethnic background, language, religion or other status. Human rights include the right to life and liberty, freedom from slavery and torture, freedom of opinion and expression, the right to work and education and much more. Everyone is entitled to these rights without discrimination. For example, robots, aliens, or the problematic re-creations of transhumanism are not considered human. Human quality management is self-control (self-management) (Radha, 1991) within the prevailing secular and spiritual space.

In the context of society, the quality manifesto also raises aspects related to the planet Earth and ecology. However, it is problematic to consider the planet as the object of quality activities. The Earth or the entire cosmos does not have a humanist owner, and the usual talk about the needs and expectations of the Earth does not make sense. The Earth functions as a part of space in accordance with physical laws. However, again, the matter can be seen in very different ways depending on whether one supports a materialistic or religious worldview. Ecology can be considered in a similar way. Ecology (ESA, 2025) means the interactions between organisms and their living and non-living environment and the factors limiting the occurrence and distribution of organisms. Traditionally, in the context of QM, the planet and ecology are seen as natural resources. In this context, the quality manifesto gives a good general instruction: Do not harm the ecology of the planet.

In many societies, it has been common for the escalation of ideological confrontations and related power struggles in national and international politics to lead to turmoil and cruelty that has a destructive effect on the quality of people, organizations, society, and even the humanity. This also causes dark clouds on the quality of society, and hence, also the implementation of the quality manifesto. This has been exacerbated by global intimidation, distortion and concealment, which have led to the following consequences (Anttila and Jussila, 2021):

- Widespread misinformation and distortion, which generate fear and anxiety.
- Political measures of restricting, isolating, and violating human rights.
- Disagreements and contradictions between people.
- Economic and social problems to organizations and people.
- Physical and mental nausea.

Historically, paradigms of societal development are constantly changing through competing ideological trends with the opposite emphases, for instance:

- Top-down --- Bottom-up
- Centralized --- Decentralized
- Institutional --- Human
- Authoritative --- Liberal
- Conservative --- Radical
- Global --- National

Ideologically biased perspectives have always varied in the development of societies. Therefore, the current chaotic situation and social crises can also be understood as a time of new opportunities and point to the emergence of something new (Sorokin, 1941; Toffler, 1980), the understanding of which should be sought through complementary scientific, artistic and religious views.

Regarding the quality manifesto and QM in the context of societies and humanity, we have many interesting and relevant questions for practical consideration:

- How do we understand society and humanity and their needs and expectations and goals?
- What is the current state of society and how does it develop?
- What are and who can set the criteria for the quality of society and goodness for humanity, and who can manage them?
- How should we understand the environment (physical and living nature) and the entire cosmos in the connection of quality of society and humanity?

6. THE QUALITY OF SOCIETY AND SUSTAINABILITY INTERRELATED

The quality manifesto has a society- and people-centered approach, as the topic has been discussed in the previous paragraph. Sustainability, which also emphasizes and broadly addresses key societal issues, is currently a topic of widespread discussion everywhere. According to the authors of the quality manifesto, the manifesto aims to respond to the UN Sustainable Development Goals (SDGs) (IAQ, 2021b). The SDGs aim for *social and economic progress to ensure people's healthy and productive lives but without compromising the ability of future generations to respond to their needs*

(Brundtland, 1987). Sustainability can be understood as the result of sustainable development. The UN (UN, 1997) includes in sustainability (a) the use of the biosphere by the present generation while preserving its potential returns (benefits) for future generations and (b) sustainable economic development, which may be affected by the depletion of natural resources and the deterioration of the state of the environment. In practice and in details, however, sustainability is a vague concept (Anttila and Jussila, 2021). The UN has included sustainability in the UN Agenda 2030 (UN, 2015a), which also includes 17 Sustainable Development Goals (SDGs). The implementation of this agenda is monitored annually, and its implementation is also enhanced by later decisions (UN, 2024).

According to ISO decisions (ISO, 2021), the development of ISO 9000 standards and other MSSs should take into account sustainable development aspects in accordance with the UN Agenda 2030 in a context-appropriate manner. This also applies to the practical application of the standards. Many sustainable development aspects or related elements are also addressed in various management system standards (ISO, 2022) and can be well integrated into an organization's business systems and QM in accordance with the guidelines of ISO 9004 and ISO Directive Annex SL (ISO/IEC, 2023b).

Based on ISO definitions, sustainability is very closely linked to the concept of the quality of society:

- Sustainability (ISO, 2019): state of the society, including environmental, social and economic aspects, in which the needs of the present are met without compromising the ability of future generations to meet their own needs.
- Quality of society (ISO, 2015): degree to which a set of inherent characteristics of society fulfills the needs and expectations of relevant interesting parties.

The definition of sustainability is not well-established, while quality in a societal context is based on an established definition of the concept of quality. However, from these definitions we can conclude that:

- Sustainability is a subset of the quality of society.
- The concept of the quality of society is broader than sustainability and includes aspects of people, products, processes, organizations, society, human life, etc.

Formally, sustainability management could be defined in accordance with quality management as a management with regard to sustainability. In fact, such a management concept cannot even be applied in practice, as it would require society to have top management. However, society is not like an organization or a system, which are managed entities. Sustainability development goals can be strived for through the management and QM of different private and public service organizations in accordance with these organizations' own purposes and be realized through organizations' social responsibility (ISO, 2010), which means the *responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behavior*. In this case, the required social responsibility functions can also be seen as part of ISO 9004 QM.

The commonly stated and known goals of sustainability and sustainable development are collective top-down political decisions, on which many undemocratic non-governmental organizations (,s) have had a great influence (Anttila and Jussila, 2021). This means that they may not necessarily meet the genuine, diverse and subjectively holistic needs and expectations of individual people, as required by the quality of society. For example, in the field of healthcare, as part of the implementation of the UN Agenda 2030, the UN World Health Organization (WHO) launched IHR (International Health Regulation) violates human rights (Campbell, 2023; Thunder, 2023; MKR, 2024). Top-down definitions are based on objective considerations. However, quality is always related to people's subjective needs and expectations and their realized perceptions. Defining quality objectives requires a bottom-up approach in identifying needs and expectations and observing and evaluating their realization and fulfillment. A widely discussed example is measuring happiness in different countries. In this case, it may be that the people in the happiest country in the world are not necessarily the happiest in the world.

From several sources, we can understand that sustainable development and the 17 SDGs cover a wide range of quality-related issues affecting society. However, this article focuses only on the three pillars of sustainability mentioned in the previous paragraph, environment, economy, and society, which are part of that larger whole. We have discussed the theme of sustainability in a larger scope in our previous article (Anttila and Jussila, 2021). Societal aspects from the perspective of quality and QM were examined in the previous paragraph of this present article.

Environment, which is one of the three pillars of sustainability, has become part of the UN's political agenda very early on. Its roots are in the meetings of the UN General Assembly in 1968-1969 (UN, 1968; UN, 1969) regarding the problems of the human environment and consisted of air and water pollution, erosion, soil deterioration, waste, noise, and biocides. These problems were seen to be due to the increasing population and urbanization, and in particular, industrialization, heavy industry, mining, and transport. The focus was on the consequences of human activity in the physical and biological environment leaving out purely natural phenomena. Also, forestry and fishery were the addressed topics. Hence, the UN's sustainable development goals were originally based on problems raised by politicians in different countries. Since 1988, the environmental topic has been further developed from a climate perspective in a special body formed by representatives of the UN's member states, the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2025), and whose work has been significantly influenced by NGOs over the years, such as the Brundtland Commission (EBSCO, 2025), the Club of Rome (The Club of Rome, 2025), and the World Economic Forum (WEF) (WEF, 2025).

We cannot define global environmental quality criteria or requirements because no one can know the true environmental needs and expectations from an environmental perspective or ensure that they are met. The quality of environment and ecology is not only a humanistic issue. For these same reasons, quality management is not possible. However, we can look at environment in terms of human and organizational quality and quality management, in which case environment can have a positive or negative effect on quality. ISO 9004 considers the appropriate use of natural resources consumed by the organization in the provision of goods and services as a strategic issue affecting its sustained success. The organization should address how to determine, obtain, maintain, protect and use essential resources such as water, soil, energy. or raw materials. The organization should address both the current and future use of natural resources required by its processes, as well as the impact of the use of natural resources related to the life cycle of its products. Living nature and its properties are very important for human existence and activity, and therefore nature conservation and protection are essential. This can also be justified from a religious perspective. Nature and environmental protection have also been taken into account in management standardization, for example through the ISO 14000 standards (ISO, 2024a).

Physical nature behaves according to natural laws, and human actions cannot significantly affect it (US Department of Energy, 2025). There has been a lot of talk about climate change recently, also in connection with quality and sustainability. For example, the ISO 9001 standard states that the organization shall determine whether climate change is a relevant issue. Climate is the long-term weather pattern of a given area (Britannica, 2025c). Climate data is most commonly presented in moving 30-year periods, from which the calculated statistics describe the averages and variations of weather in the recent past. These statistics can be used to view current weather in a historical context. So, it's not really about climate change, it's about changing weather, and climate describes how this has happened. Long-term weather forecasts have been very uncertain and inaccurate because weather phenomena depend on so many different factors. Many researchers rely on computer models and forecasts that have not matched reality (Christy, 2014). The discussions have emphasized the average global temperature, even though it is a very vague concept, and its determination and measurement have proven questionable. Temperature changes regularly and has a certain periodicity over time. At the moment, the long-term trend in global temperature is towards colder times (Rohde, 2019). Weather variations are mainly caused by the sun and the oceans and based on physical phenomena. The anthropogenic impacts that are much talked about today, such as the effect of carbon dioxide on

the entire Earth's atmosphere, temperature, and weather conditions, are insignificant (US Department of Energy, 2025). However, there is a lot of conflicting information on the topic, especially due to the intertwining of politics and science, which has caused confusion, so in order to draw the right conclusions, it is necessary to thoroughly investigate the backgrounds of different views (NIPCC, 2025). Atmospheric carbon dioxide does not significantly warm the Earth and is not dangerous to humans, but it is essential for nature (Clintel, 2025). Currently, there is too little carbon dioxide in the air for nature. However, mainstream media has talked about a climate emergency, which has caused fear and concern in many due to climate anxiety. Also, political decisions have attempted to curb the growth of carbon dioxide, but without success and in vain, which has led to economic and social problems in terms of the quality of society and the vitality of nature. From a quality management perspective, climate change is not a relevant issue. However, climatic properties are an important quality issue, especially in product development, when designing and testing the functionality and durability of products for intended operating conditions (IEC, 2013).

A topic very closely related to sustainability and environmental issues is energy. Cheap, sufficient, and reliable energy is a fundamental requirement for the quality of society and its development (US Department of Energy, 2025). Currently, cheap and reliable fossil and nuclear energy have faced unjustified ideological and political opposition and bans, especially in Europe, due to carbon dioxide emissions and environmental and safety risks, which has led negative effects on the quality of society.

In the context of sustainability, economics refers to promoting sustainable economic development without depleting natural resources or harming communities. Economics covers the entire economic system of society and its functioning, i.e. production, consumption, employment, gross domestic product, and other broad economic phenomena. An important part of this is finance, which focuses on the management of money, investments and financial instruments, as well as the functioning of financial markets at the individual, corporate and public sector levels. The current financial sector deals with digital money and transactional information. The fiat currency (Chen, 2022), which is used as a means of transaction, is no longer based on gold or other real assets, but on the visions, decisions, actions, and regulations of central authorities. Today we can recognize in several countries and globally a money-based dominance strengthened through the Central Bank Digital Currency (CBDC) systems and social credit systems (Goschenko, 2023), which implies a risk of controlling people and companies and thereby increasing centralized power, when in addition to financial information, also other person-related information is being included in these systems using biometric digi-ID. Such a development towards a centralized power is a risk, for example, to compromising human rights. This can also be seen as a sign of the long-standing discussion of transforming the world towards a New World Order (Novus Ordo Seclorum), with regard to which we have a lot of different views, explanations, and also criticism (McIntosh. 2023). We also have historical evidence that financial crises cause political radicalization and there is a synergy between financial distress and social and cultural predispositions (Doerr et al., 2021).

The authoritarian and morally questionable implementation of sustainability is clearly a risk and threat to the quality of society in terms of human rights, which are a very central requirements of the quality of society. This has also been seriously realized, for example, in policies regarding the Covid-19 pandemic (Anttila, 2025) and climate change, at least in the EU. The UN's top-down approach to sustainable development as an undemocratic political institution is also influenced by NGOs. The forces behind NGOs, in turn, include large international corporations in the financial, media and pharmaceutical sectors, which are mainly owned and controlled by a small group of individuals and families and which influence decision-makers, especially through financing. Due to the selfish interests of these influential parties, the decisions and actions of the UN and its specialized agencies do not necessarily seek to promote the quality of society or the goodness of humanity.

Sustainability development and its recent manifestations regarding the UN Agenda 2030 are seen as part of a global multi-phased development that has taken place over the past hundred years, with its roots in the 1920s in the USA at Columbia University's The Technical Alliance. This is based on a technocratic, scientific way of thinking that emerged as a counterbalance to capitalism and whose

idea is centralized resource-based, and especially energy-based, management of society (Oh, 2023). These ideas were then implemented more widely as the new international economic order in the early 1970s by Z. Brzezinski, D. Rockefeller, and the Trilateral Commission they founded and led. Their activity also influenced the UN program of action in 1974 (UN, 1974; Gardner, 1974). Since then, these ideas have also been taken into account by influential statesmen in the US politics and administration. China also provided a favorable basis for their practical application in the 1980s. The UN Agenda 2030 was adopted by the UN General Assembly in 2015 as Resolution 70/1, titled Transforming our World (UN, 2015b). Its content was strongly influenced by the 4th Industrial Revolution and The Great Reset, widely promoted by the World Economic Forum (WEF), as well as the strategic partnership between the WEF and the UN. This also established the name The New World Order for the topic. These ideas have particularly influenced the activities of the EU in Europe.

7. PROFESSIONALISM FOR IMPLEMENTING QUALITY MANIFESTO

The quality manifesto aims to motivate and commit quality professionals to revitalize and radically change the quality profession by enriching management practices and revitalizing the application of quality thinking. This is a very challenging issue for the entire quality profession and would require diverse and renewed training, targeted development activities and research, which are not currently strong areas of the quality profession. Results can only come from implementation, not from good intentions, and therefore we should focus especially on examining the possibilities of success. The effectiveness of the implementation of the quality manifesto should also be examined through a reliable monitoring mechanism. In this context, we could also look at the positive and negative experiences and achieved results from ISO 9000 applications, which cannot be considered as excellent despite the resources invested in them.

The quality manifesto emphasizes professionalism. Professionalism means a foundation based on science and a motive for service. We professionals should promote our own field ourselves, because no one else will do it for us. Expectations regarding professionalism include, among others:

- Selflessness and consideration for the needs of the people we serve.
- Continuously increasing skill or knowledge and expertise, striving for excellence.
- Reliability to build trust in the profession.
- Discipline in following one's own science and working with others.

The ISO 9000 standards and the entire international standardization emphasize the same things as the quality manifesto. The main principle of international standards, including the ISO 9000 standards, is that *standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits* (ISO/IEC, 2004).

In connection with the quality manifesto, the concept Quality 4.0 has been introduced as a challenge to the implementation of the manifesto. It includes a reference to Industry 4.0, which requires conceptual, social, and methodological changes in the operations of organizations. However, there is no evidence yet that the global quality community is mature enough to accept, invest, or adapt extensively to the new way of working. Furthermore, Quality 4.0 is a very vague concept. It does not have a generally accepted definition. It is often seen as focusing only on the use of digital technology in quality implementation and QM. However, the new advanced quality management includes many other things than digitality. These have been highlighted, for example, in the previously presented future concepts of the ISO 9000 standards (ISO/TC 176, 2022). New technology is also much more than just digitalization.

The quality manifesto emphasizes scientificity, which includes the pursuit of *understanding the world and how it works based on observable physical evidence* (Railsback, 2020). Science means the socially institutionalized, systematic, and critical pursuit of new knowledge about nature, humans, and society, which involves (a) a continuously evolving and developing body of knowledge, (b) methods for discovering and justifying new knowledge, (c) objectivity, criticality, autonomy, and progressiveness, and (d) professional and social networking with academia and scientific

organizations. Quality science is a significant challenge for the entire quality sector. This term quality science is not widely used in references dealing with quality, and such a specific area of science or research does not usually exist, for example, in universities. Very often, in higher education, quality topics are subordinate to other disciplines. You can often see the phrase "scientific approach" instead of "quality science" in connection with specific quality-related topics. A comprehensive quality science seems to be lacking. For this reason, many quality management practices are based on methodologies initiated by some individuals or consultants. A modern, broad concept of quality would also require interdisciplinary research. Also, the ISO 9000 standards lack a scientific basis, as the entire quality profession. Given this situation, we have investigated the ontology and epistemology of quality to clarify the scientific basis of quality science (Anttila, 2023).

The new application area of quality, society, which the quality manifesto emphasizes, is definitely one of the greatest development challenges for quality professionalism. The importance of the issue is further emphasized by the fact that currently the key quality aspects of society are strongly influenced by large non-governmental organizations (NGOs) that do not have professional knowledge or experience in quality and are often also severely corrupt. We quality professionals should not submit to supporting their actions that clearly lead to risks to the quality of society. Instead, we should provide them with reliable expert help and guidance in the conceptual understanding of quality and the professional implementation of QM, for example in terms of risk management.

8. QUALITY MANIFESTO AND QUALITY MANAGEMENT STANDARDS FOR THE QUALITY OF SOCIETY - CONCLUSIONS

IAQ's quality manifesto of 2021 has challenging goals regarding quality professionalism and its positive impacts. However, a mere declaration is not enough; the message of the manifesto should be widely disseminated and put to effective use. However, the manifesto does not present practical means for this. The specific purpose is to get leaders of organizations to demonstrate an active commitment to quality in accordance with their leadership role. However, these people primarily value economic issues, for which the manifesto text is neither attractive nor motivating. The quality manifestos published in the past had no significant impact either. The ISO 9000 QM standards have had the same goals, but despite significant investments and guidelines, the impact of the standards on management commitment and organizational quality has remained modest, mainly in the narrowly understood area of quality assurance.

At the organizational level, the implementation of the quality manifesto should take place through QM (cf. ISO 9000 standards) in accordance with the organization's own business objectives and strategies and integrated into their business systems and processes. The manifesto also emphasizes societal and human aspects. Thus, the manifesto reminds organizations of their social responsibility and supports them in integrating ISO 9000, ISO 14000 and ISO 26000 standards.

From the point of view of society, the implementation of the quality manifesto has been seen as an effort to realize sustainability. In the context of the quality of society and its development, it is essential to understand what the prevailing ideological, economic and political paradigms of society are, and what the role, influence and risks of strong global corporations and NGOs are in the development of society. In free societies, the quality of society cannot be defined or controlled by any single entity, but rather is created through diffusion by the actions of all actors in society. It is particularly important that quality and QM are not flavored with political ideologies.

The pursuit of goodness for humanity is problematic because it cannot be addressed solely with traditional concepts, principles, or practices of quality, leadership, and QM. In this case, we also need a religious attitude and approach.

Although the practical benefits of the quality manifesto are not very promising, it cannot be considered harmful. When the thoughts of the manifesto is widely disseminated and proclaimed in the world, especially at the leadership level of organizations and society, and when it can be seen in line with the general global prevailing paradigms, it can increase a positive attitude towards quality

thinking and expertise. By referring to it, quality professionals can highlight practical QM guidelines, including the ISO 9000 standards, other MSSs, and other useful QM principles and methods that can be applied to support creative management for the sustained success of organizations. If the quality manifesto and a QM approach were understood as competing options, the manifesto would be in a weak position. The greatest benefit can be achieved by understanding how the QM standard approaches and the quality manifesto support and complement each other.

REFERENCES

[1] Anttila, J. (2025). Quality and quality management issues in the pharmaceu4cal and healthcare ecosystem during the Covid-19 pandemic, Quality conference in Złoty Potok, Poland, https://www.researchgate.net/publication/392970035_Quality_and_quality_management_issues_in_the_pharmaceutical_and_healthcare_ecosystem_during_the_Covid-19_pandemic.

[2] Anttila, J. (2023). Ontological and epistemological foundations for the effective and efficient implementation of quality. The International Symposium on Quality, Opatija Croatia, https://www.researchgate.net/publication/370251406_Ontological_and_epistemological_foundations_for_the_effective_and_efficient_implementation_of_quality.

[3] Anttila J. and Jussila K. (2021). Sustainability as an aspect of societal quality. ICSD2021 Conference. https://www.mdpi.com/2673-4931/15/1/70.

[4] Anttila, J. and Jussila, K. (2018). Organizational learning in developing the integrated quality management. Production engineering archives 18. Częstochowa Poland, https://bibliotekanauki.pl/articles/111763.

[5] Barabási, A. (2003). Linked: How everything is connected to everything else and what it means for business, science, and everyday life, 2003. Plume Books. New York USA.

[6] Barrett, J. (2012). Born believers. Free Press. New York USA.

[7] Britannica. (2025a). Manifesto. UK, https://www.britannica.com/topic/manifesto.

[8] Britannica. (2025b). Transhumanism. UK. https://www.britannica.com/topic/transhumanism.

[9] Britannica. (2025c). Köppen climate classification. UK. https://www.britannica.com/science/Koppen-climate-classification.

[10] Brundtland, G H. (1987). Report of the World Commission on Environment and Development: Our common future. https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf.

[11] Budziszewski, J. (2013). What we can't not know. Ignatius. San Francisco USA.

[12] Campbell, J. (2023). New WHO International Health Regulations concerns, Video https://www.youtube.com/watch?v=q_MhB4BWOa8.

[13] Castoriadis, C. (1978). Pouvoir, la politique, l'autonomie, (Finnish translation in Magma, Karisto Finland 1997).

[14] Chen, J. (2022). Fiat Money: What it is, how it works, Example, pros & cons, https://www.investopedia.com/terms/f/fiatmoney.asp.

[15] Christy, J. (2014). Climate models reality. https://ktwop.files.wordpress.com/2013/10/73-climate-models_reality.gif.

[16] Clintel. (2025). World climate declaration, https://clintel.org/world-climate-declaration/.

[17] Doerr, S., Gissler, S., Peydro', J-L., and Voth, H-J, (2021). Financial crises and political radicalization: How failing banks paved Hitler's path to power. BIS Working Papers No 978. https://www.bis.org/publ/work978.pdf.

[18] Ebbets, J. (2021). The debate over transhumanism. Smith College, MA USA. https://www.smith.edu/news-events/news/debate-over-transhumanism.

[19] EBSCO. (2025). Brundtland Commission and Report, https://www.ebsco.com/research-starters/environmental-sciences/brundtland-commission-and-report.

[20] ESA, (2025). What is ecology? https://esa.org/about/what-does-ecology-have-to-do-with-me/.

[21] Gardner, R. (1974). The hard road to world order, https://ia800903.us.archive.org/32/items/1974-hard-road-to-the-new-world-order-r-n-gardner_202012/1974%20-%20Hard%20Road%20to%20The%20New%20World%20Order%20-%20R%20N%20Gardner.pdf.

[22] Goschenko, S. (2023). Economist Jim Rickards warns of a CBDC-supported social credit system in the US: 'It can happen here'. https://news.bitcoin.com/economist-jim-rickards-warns-of-a-cbdc-supported-social-credit-system-in-the-us-it-can-happen-here/.
[23] Hariri, Y. N. (2018a). Sapiens: A Brief History of Humankind. Harper Perennial. London UK.
[24] Hariri, Y. N. (2018b). Yuval Harari on transhumanism and the singularity. https://www.youtube.com/watch?v=qc4v7AvqigU.
[25] Houston, A. and Dockstader, S. (1988). A Total Quality Management process improvement model. Navy personnel research and gevelopment center, San Diego, California USA. https://apps.dtic.mil/sti/tr/pdf/ADA202154.pdf.
[26] IAQ. (2021a). Quality Manifesto for the 21st century. IAQ, https://iaquality.org/resources/Documents/Position%20Paper/Revitalizing%20Quality%20-%20The%20Quality%20Manifesto%20for%20the%2021st%20Century%20-%202021.pdf.
[27] IAQ. (2021b), IAQ Position Paper: Revitalizing the Global Quality Manifesto. IAQ, https://iaquality.org/resources/Documents/Position%20Paper/IAQ%20Position%20Paper%20-%20Revitalizing%20the%20Global%20Quality%20Manifesto%20-Corrected%20May%2021.pdf.
[28] IASQ. (2022). Some basic principles of social quality, https://socialquality.org/about-iasq/basic-principles-social-quality/.
[29] IEC. (2013). IEC 60068-1, Environmental testing – Part 1: General and guidance, IEC, Geneva Switzerland, https://webstore.iec.ch/en/iec_catalog/product/preview/?id=L3B1Yi9wZGYvcHJldmlldy9pbmZvX2llYzYwMDY4LTF7ZWQ3LjB9Yi5wZGY=.
[30] IPCC. (2025). About the IPCC, https://www.ipcc.ch/about/.
[31] ISO. (2025a). Management system standards list, ISO, Geneva Switzerland, https://www.iso.org/management-system-standards-list.html.
[32] ISO. (2025b). ISO/DIS 9000, Quality management systems - Fundamentals and vocabulary, ISO, Geneva Switzerland.
[33] ISO. (2024a). ISO 14000 family. Environmental management. ISO, Geneva Switzerland. https://www.iso.org/standards/popular/iso-14000-family.
[34] ISO. (2024b). ISO/TC 176 Quality management and quality assurance. ISO, Geneva Switzerland, https://www.iso.org/committee/53882.html.
[35] ISO. (2021). ISO's climate commitment, https://www.iso.org/ClimateAction/ISO-climate-commitment.
[36] ISO. (2019). ISO Guide 82 Guidelines for addressing sustainability in standards. ISO, Geneva, Switzerland.
[37] ISO. (2018). ISO 9004 Quality management - Quality of an organization - Guidance to achieve sustained success, ISO, Geneva Switzerland.
[38] ISO. (2010). ISO 26000 Social responsibility. ISO, Geneva, Switzerland. https://iso26000.info/wp-content/uploads/2017/06/ISO-26000_2010_E_OBPpages.pdf.
[39] ISO. (1986). ISO 8402 Quality - Vocabulary, ISO, Geneva Switzerland.
[40] ISO/IEC. (2004). ISO Guide 2, Standardization and related activities - General vocabulary, ISO, Geneva, Switzerland.
[41] ISO/IEC. (2023a). ISO/IEC 42001 Information technology. Artificial intelligence management system. ISO, Geneva Switzerland.
[42] ISO/IEC. (2023b). ISO/IEC Directives, Part 1. Annex SL. Harmonized approach for management system standards. https://www.iso.org/sites/directives/current/consolidated/index.html#_Toc134090862.
[43] ISO/TC 176. (2022). Updated summary of emerging themes document. ISO, Geneva Switzerland, https://committee.iso.org/files/live/sites/tc176/files/ISO-TC176_N1382_ISOTC_176_TG4_Updated_summary_of_emerging_themes_document_.pdf.
[44] McIntosh, M. (2023). A history and critiques of the 'New World Order' conspiracy theory. https://brewminate.com/a-history-and-critiques-of-the-new-world-order-conspiracy-theory/.
[45] Melanchthon, P. (1531). The apology of the Augsburg confession, (In Finnish Augsburgin tunnustuksen puolustus, https://tunnustuskirjat.fi/puolustus/toc.html).

[46] MKR. (2024). MKR WHO seminar with James Roguski, Finnish introduction and translation, https://tube.kansanvalta.org/w/a8tdUW2EwHnPcTE4JNL9sL?start=2m28s.
[47] NIPCC. (2019). Climate change reconsidered II, https://climatechangereconsidered.org, Reference in Finnish https://www.ilmastofoorumi.fi/nipccn-ilmastoraportti/.
[48] OED. (2025). Oxford English Dictionary, Goodness. https://www.oed.com/search/dictionary/?scope=Entries&q=goodness. UK Oxford.
[49] Oh, K. (2023). A non-conforming technocratic dream: Howard Scott's technocracy movement, https://www.tandfonline.com/doi/full/10.1080/17449359.2024.2343657#d1e135.
[50] Purvis B., Mao Y. and Robinson D. (2019). Three pillars of sustainability: in search of conceptual origins. Sustainability Volume 14, https://link.springer.com/article/10.1007/s11625-018-0627-5.
[51] Radha, R. (1991). The Zen way to be an effective manager. Mercury Books, UK London.
[52] Railsback, B. (2020). What is science? http://railsback.org/railsback_1122science1.html.
[53] Schwab. K. (2016). Implanted microchip, Klaus Schwab, World Economic Forum and The Great Reset. https://www.youtube.com/watch?v=UmQNA0HL1pw.
[54] Rohde, R. (2019). Holocene temperature variations. https://commons.wikimedia.org/wiki/File:Holocene_Temperature_Variations.png.
[55] Sorokin P. (1941). The crisis of our age. One world publications, Chatam, USA NY.
[56] Stacey, R. (2002), Organizations as complex responsive processes of relating, Journal of Innovative Management, Vol. 8 No. 2.
[57] Thunder, D. (2023). Proposed amendments to International Health Regulations would set in motion a dangerous WHO-Led global health bureaucracy. The freedom blog. https://davidthunder.substack.com/p/proposed-amendments-to-international.
[58] Toffler, A. (1980). The third wave, https://ia903409.us.archive.org/14/items/AlvinTofflerTheThirdWavePdfTKRG/Alvin%20Toffler%20-%20The%20Third%20Wave%20-%20pdf%20%5BTKRG%5D.pdf.
[59] UN. (2024). Pact for the future, global digital compact and declaration on future generations, https://www.un.org/sites/un2.un.org/files/sotf-pact_for_the_future_adopted.pdf.
[60] UN. (2015a). Resolution adopted by the General Assembly on 25 September 2015, Transforming our world: The 2030 Agenda for sustainable development. https://upload.wikimedia.org/wikipedia/commons/d/d5/N1529189.pdf.
[61] UN. (2015b). Transforming our world: the 2030 agenda for sustainable development, https://sdgs.un.org/2030agenda.
[62] UN. (1997). Department for Economic and Social Information and Policy Analysis. Glossary of environment statistics. https://unstats.un.org/unsd/publication/SeriesF/SeriesF_67E.pdf.
[63] UN. (1974). Programme of action on the establishment of a new international economic order, https://digitallibrary.un.org/record/218451?v=pdf.
[64] UN. (1969). Agenda item 21: Problems of the human environment: report of the Secretary-General, https://legal.un.org/avl/pdf/ha/dunche/A-C.2-SR.1277.pdf.
[65] UN. (1968). 1346 (XLV). Question of convening an international conference on problems of human environment, https://undocs.org/en/E/RES/1346(XLV) and 2398 (XXIII), Problems of the human environment. https://undocs.org/en/A/RES/2398(XXIII).
[66] UN. (1948), The universal declaration of human rights, http://www.un.org/en/documents/udhr/index.shtml.
[67] US Department of Energy. (2025). A critical review of impacts of greenhouse Gas Emissions on the U.S. Climate, https://www.energy.gov/sites/default/files/2025-07/DOE_Critical_Review_of_Impacts_of_GHG_Emissions_on_the_US_Climate_July_2025.pdf.
[68] WEF. (2025). Climate action, https://www.weforum.org/stories/climate-action/.

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QUALITY THROUGH CREATIVE GAMES

Prof. Slavko Arsovski, PhD [1]

Abstract: *A games are imanent during civilization development. The relatation between games and quality is not enough explaired and assessed. It is purpose of the research which part is presented in the article. For different tipes of games is possible to develop different games products and services for different purposes, as for education, trade, creativity, leasure, for children and other persons, wars and ecology problems, etc.*

Purpose of the presented research is very dofficult to achieve because is not clearly what is quality and what is games, and how works their sinergy. This is goal of the paper. For it is developed a model of sinergy of Quality and Goals based on Smart and Intelligent Technologies and effects of this sinergy on positive and negative effects on Smart Society.

Keywords: *quality, games, synergy, AS - model*

JEL Classification*: L15*

1. INTRODUCTION

We are living in the new era with higher impact of digitalization, new paradigms and needs for better resolving old problems on a new approaches. In area of quality are developed new approaches, tools and standards for achieving strategic role of quality bat we are recognized that quality is not sufficient used as driver for significant changes in all areas of human life. In purpose to give new energy to quality improvement author developed new approach with sinergy quality and games.

The article has goal to present the new way to resolve dilemma of posibility to integrate quality and games, especialy creative games.

The goal of the paper is to present development results of integration quality and creative games paradigms.

The novelty is quite new model of sinergy of quality and creative games, based on now separate literature from these areas and expirience of author in area of quality and new paradigms as sinchronicity, leadership, mind fields etc. The results are in progress with including in model aspects of virtual reality based on AI, smart peoples and new concepts as Quality 4.0/5.0/6.0 and Society 4.0/5.0/6.0.

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For the research are used dominaitly existing methods and tools based on Grounded Theory, Decision Support Systems (DSS), System modeling and Performance Assessment included in BSC (Balance Score Cards) and Business Models development. The theoreticaly results are a new model of sinergy between a quality and creative games and practicaly results are viewing the quality as games and assessment of quality of games.

The article is presented in four chapters. Affter introduction in the second chapter are presented models of smart and intelligent quality and creative games.

In the third chapter is presented model of sinergy between quality and creative games and model of assesment of the new approach for the new era.

In the fourth chapter are presented discussion, limitation, and first conclusion of performances of new sinergy Model of Quality and Games (SMQG), called AS model.

2. MODELS OF SMART AND INTELLIGENT QUALITY (SIQ) AND CREATIVE GAMES (CG)

2.1.Model of Smart and Intelligent Quality (SIQ)

Smajdorova T. (2024) analized Quality 5.0 as evolutive stage from Industry 4.0/5.0 and Quality 4.0/5.0 which consits from:

1. total quality,
2. life cycle quality,
3. digital transformation,
4. sustainability,
5. innovation and cooperation, and
6. quality based on data analisis,

with using folloving technologies:

1. concious machines and autonomous quality system,
2. quantum quality analysis,
3. holographic quality visualization and
4. neuro-quality interfaces based on brain-comuter interfaces.

Chourasia S. et al. (2022) analyzed benefits and challenges of sustainability aspect of Industry 6.0. in their research last stage of industry evolution is Industry 6.0 with following content:

- product personalization,
- automatic robotic industry controled by quantum rador,
- customer driven,
- virtualization,
- anti-fragile manufacturing,
- digital twins,
- dinamic supply chain,
- dynamic inter and intra connectivity across organizations,
- system integration,
- service dominant logic and
- green sustainability.

Žižek S.Š., Muley M. and Potočnik A. (2021) analyzed social respond on Industry 6.0 according Japan concept of Society 6.0. In their research is pointed out concept of Well-Being Society as core component of sustainable socially responsible Society 6.0. The dimensions and components of the „Well-Being Society 6.0“ model are:

- organisations with human factors,
- economic system,
- political system,

- legal system,
- ecological system,
- social system,
- health system,
- technological system, and
- values, culture, norms, etics.

At the end of circle they defined upgraded sustainability Leadership Model in conection to „Well-Being Society 6.0“ with:

1. social sustainability,
2. economic sustainability,
3. environmental sustainability,
4. procedural sustainability, and
5. personal sustainability.

In *developed* model of Society 6.0 isusing System Dynamic approach. For it are identified following interconnected loops:

- Smart, Spiritual and Intelligent Leadership (SSIL),
- Smart and Intelligent Technologies (SIT),
- Smart, Intelligent and Spiritual Citizens (SISC),
- Smart Government (SG),
- Smart and Intelligent Industry (SII),
- Smart and Intelligent Quality (SIQ),
- Smart and Intelligent Society (SIS),
- Smart and Intelligent Sustainability,
- Agility and Resilience (SISAR), and
- Smart and Intelligent Prosperity (SIP).

Expected results of integration Quality 6.0 and Industry 6.0 in Society 6.0 are:

1. higher level of development of both concepts,
2. higher implementation and uprading existing SIT into Quality and Industry concepts,
3. higher sustainability of society,
4. higher resilience of society,
5. higher development and agility of SIT and social processes,
6. higher level of eco-cyber environment,
7. higher level of achieving of Milenium Goals,
8. higher level of quality of life of citizens,
9. higher interconnection and support to civilization goals, and
10. achieving a super intelligent, smart, resilient, sustainable society with higher spirituality and human-machine interaction.

The new role of Smart Quality (Quality 5.0/6.0) in Industry 5.0/6.0 has impact on Society 6.0. Presented base model of its integration is very complex and is necesary to modeling each entity in this model with intra relationships in entities and extra relationships related to other relationships. This model is very dynamic because high speed of technological development, social and eco-cyber environment and possible limitations of ours civilizations. For it is necessory to extend concert of quality to achieve peace and civilization development. It is next very broad and deep area of our research.

2.2. Model of Creative Games (GM)

Eberle S. and Brown S. (2024) explained what is Play important. Playing has positive impact on: (1) building brains, (2) enabling attanement and securing attachment, (3) development of self-awareness, (4) learning and learning to love language, (5) sharpening social skills, (6) reducing stress, (7) training physical skills and building physical strength, (8) hoosting courage and increasing health.

According Gray P. (2013) „the carracteristics of play all have to do with motivation and mental attitude, not with the behavior. Two people might be throwing a ball or tuping words on a computer, and one might be playing while the expressions and the details of their actiond other not. To tell which one is playing and which one is not, you have to infer from their actions ..... why they are doing it one their attitude towards it.

A common styles of play are: (1) the collector, (2) the competitor, (3) the creator/artist, (5) the manager, (6) the explorer, (7) the joker, (8) the mover/kinesthete, (9) the storyteller.

A people playing on different ways: (1) attunement play: two-partharmony throughent life, (2) bodily movement play: getting your groove on, (3) object play: setting thinks in motion, (4) imaginative play: inspiration, invention, and innovation, (5) social play: preparing thor the unexpected, establishing competency.

On other side creativity is possile to defined as „a gift for the gifted", benefits of high-ability students are: (1) personal connections with content areas, (2) originality and individuality, (3) greater exploration of interdisciplinary connections and sources, (4) discavery, (5) higher level thinking and depth of learning, (6) artistry and depth of feeling.

Dokler T. (2021) analyzed psychological model of the gaming expirience. He proposed gaming expirience model with two group of variables: (1) player specific variables as beliefs, personal preferences, attitudes and intention, and (2) game specific variables as identification, transportation, and Need For Cognition (NFC). For measuring the quality of gaming expirience he developed questionary for each variable and concluded that is necessory for each kind of play it is different.

A lot of games are supported by Virtual Reality (VR). Neira C., Fernandez M. and Porteles C. (2018) analyzed relationships among VR and games. VR allows to replace the real world by AI and we believe that we are in real world.

Capecchi I. et al. (2022) defined Immersive VR (IVR) with following carracteristics: (1) physical immersion and (2) mental immersion.

Somlrio G. et al. (2014) defined Cloud of Terms Concerning with creative learning process with: (1) creativity, (2) technologies, (3) education, (4) games environment, (5) creative man, (6) knowledge, (7) trust, (8) teachers/trainers/consultants, etc. They emhasized that: (1) not only creativity, but creativity and education, (2) creativity, education and technology.

Milakis E. (2025) defined STEAM education with integration of Science, Technology, Engineering, and Mathematics into cohesive, transdisciplinary learning approach. He emphasized fondings as: (1) current perceptions and pedagogical value of educational games, (2) implementing educational games in Giffed STEAM Education: Teacher Insights, (3) differentation approaches in Game-Based Learning for Giffed Students, (4) pedagogical and design considerations for game development in Giffed STEAM Context, (5) holistic benefits of educational games for gifted learners, (6) chalenges of inclusive Game-Base Learning in Mixed-Ability Classrooms, (7) assessing the educational impact of games on STEAM Skill development, (8) fostering creativity and innovation through educational games, (9) promoting Problem-Solving Skills through Game-Based Learning, and (10) integrating educational games in the design of Giffed STEAM Learning scenarios.

Stojanović Stošić M. and Stajić J. (2021) based their research of creative games with emphsizing structure of creative processes: (1) process of learning, (2) process of playing, (3) process of creation, (4) process of work, and (5) process of assessment and proved hypothese that creative games in arts education contribute to seeing in a more creative way.

Houge J.B., Duin H. and Thoben K.D. (2013) analyzed problem of evaluation of serios games with supporting creativity through student labs based on questionnaire and analysis of: (1) motivation during the game, (2) expected level of creativity and responsibility in game playing, and (3) how much the game is able to support creativity.

Epstain R. (2000) analyzed creativity games with for this research chapters: (1) the ABCs of Creativity, (2) bridges to Creativity, (3) Design Challenge, (4) The Experts Game, (5) The Keys to

Creativity, (6) Managing Resources, (7) Managing Teams, (8) Sticky Business, (9) The Team as Quality Editor, and (10) The Ultimate Challenge game. He emphasized that: (1) everyone has roughly equal creative potential, (2) „creative" people have special skills, (3) anyone can learn these skills and (4) the creative process can be accelerated and directed. On other side creativity competence development is related to: (1) capturing, (2) challenging, (3) broadening and (4) surrounding. Also, managers, teachers and suppervisors have seven competences: (1) encourages the preservation of new ideas, (2) challenges others, (3) enconrages broadening of knowledge and skills, (4) manages surroundings to stimulate creativity, (5) manages teams to stimulate creativity, (6) manages resources to stimulate creativity, and (7) provides feedback and recognition to stimulate creativity.

Based on previos literature research and using Grounded Theory, System Modeling Technoloques is proposed model of creative games *(Figure 1)*. In the model are emphasized eight entitics: (1) playing purpose ang gools, (2) smart and AI support, (3) creativity development, (4) development of Creative games, (5) impact of Creative Games, (6) spirituality, and (7) creative tools and Creative Games environment.

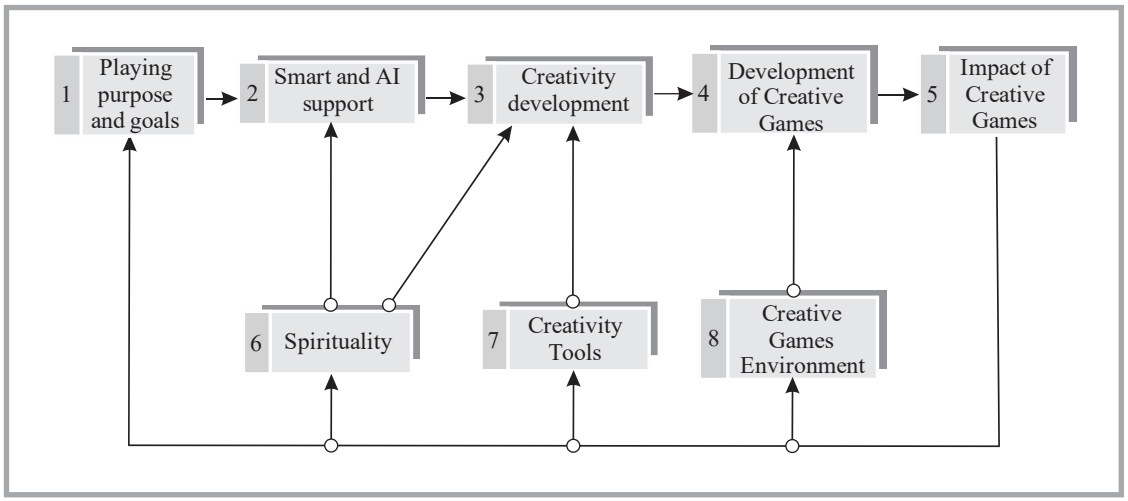

Figure 1. *Model of creative games*

2.3. Model of Smart, Intelligent, Spiritual, Sustainable and Resilient Quality (SISSRQ)

This model is based on previos work of author presented in monographs of autor titled: (1) Quality Science, (2) Squering Quality and (3) Research in Progress related to high level of. (1) smart society, (2) smart prosperity, (3) smart intelligent and sustainable leadership to achieve global goal of civilization.

In *Figure 2* is presented base model of SISSRQ.

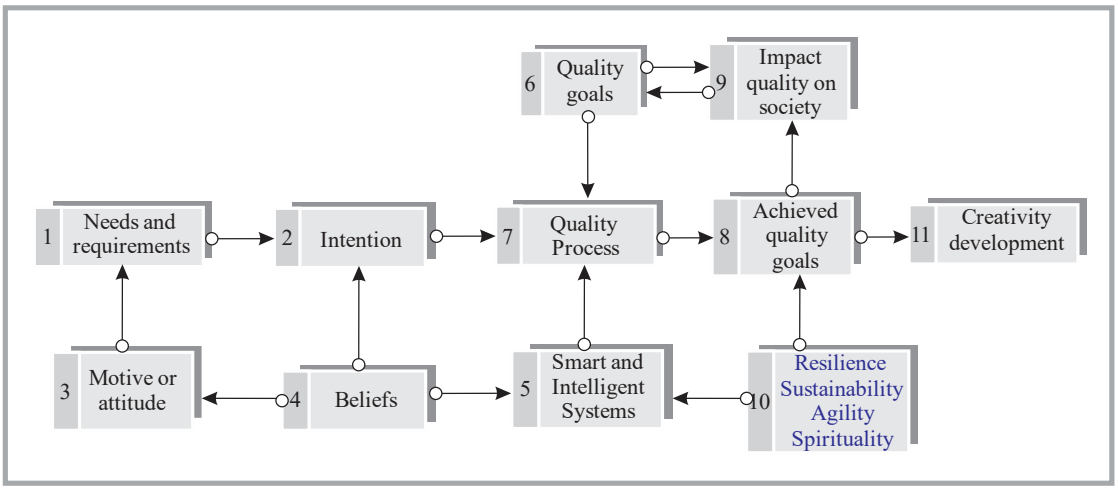

Figure 2. *Model of SISSRQ*

In this model are emphasized eleven interconected entities: (1) Needs and requirement, (2) Intention, (3) Motive or attitude, (4) Beliefs, (5) Smart and Intelligent Systems, (6) Quality goals, (7) Quality Process, (8) Achieved quality goals, (9) Impact quality on society, (10) Resilience, sustainability,agility, and spirituality, and (11) Assessment of quality.

3. MODEL OF SYNERGY BETWEEN QUALITY AND CREATIVE GAMES

3.1. Base model

The proposed model of synery between quality and creative games (AS) is developed in the case:

- stakeholders are players,
- goal is prosperity after introduction of playing (creative) results and improvements,
- key players are: (1) consultants, (2) knowledge providers, (3) organization as object and subject of the game,
- IoT and other connected smart and AI systems for communication among stakeholders, and
- market is base for assessment of quality and quality of games.

In *Figure 3* is presented this model of sinergy with three big areas: (1) model of Creative Games, (2) model of SISSRG and (3) model of collaboration of stakeholders in comminication sistems and Design Support System based and Smart and Intelligent Software.

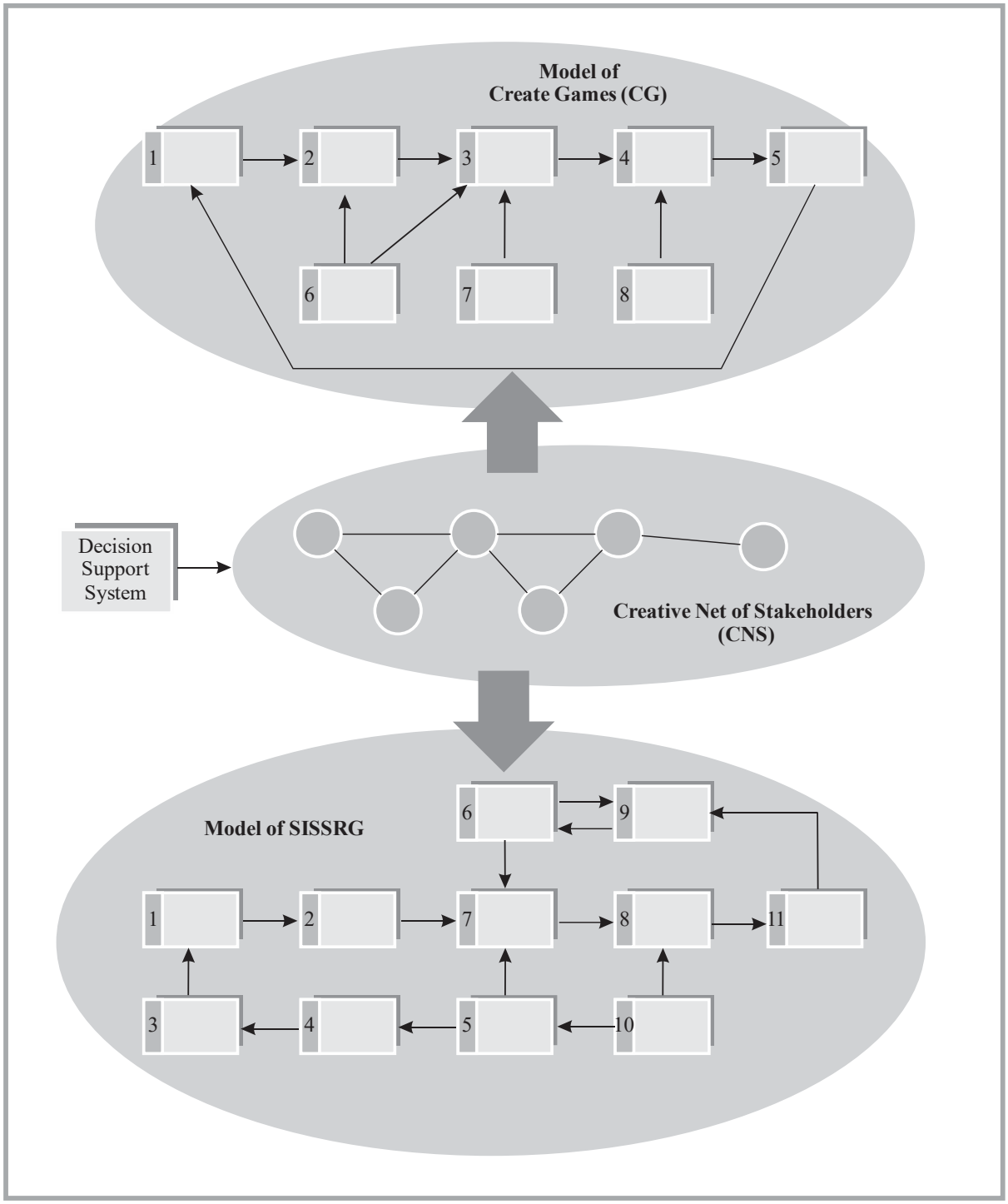

Figure 3. *Model of Synergy Between: (1) Submodel of Creative Game, (2) Submodel of SISSRG, and (3) Submodel of Creative net of stakeholders supported by Decision Support System empowered by AI.*

Presented synergy model is now in phase of testing in case where key stakeholders are: (1) management of organization, (2) consultants, (3) other organizations in supply chains, (3) smart and intelligent provider organizations, (3) knowledge and skills providers, and (4) society representatives *(Figure 4)*.

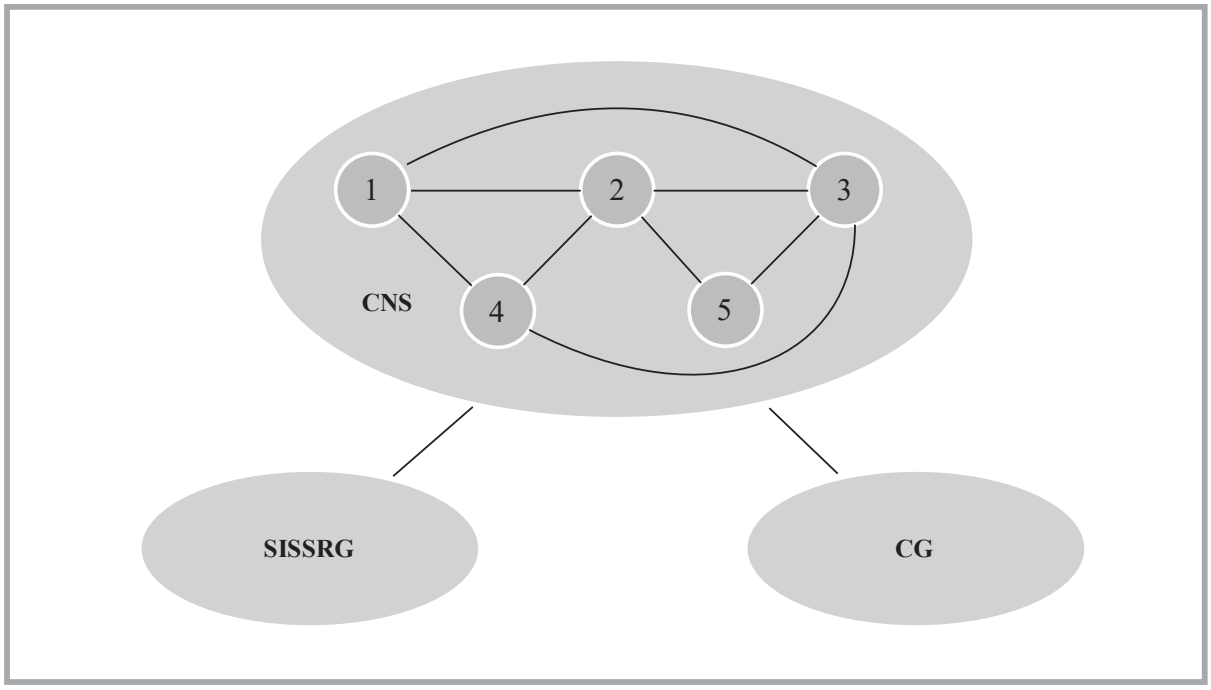

Figure 4. *Model of synergy in case game of quality*

In praxis this model functioning with different ways and different success. A game of quality can improve this process and enable greater prosperity.

3.2. Model of gamefication of organizations quality

According previos chapter proposed model of gamefication of organizations quality is presented in *Figure 5*.

A creative game colled be in two different kind, i.e.: (1) in design and (2) in implementation in area of organizations quality. In first cases a creative games started in CNS with all presented stakeholders, especialy government, suppliers, leadership, and leadership for purpose to activate all organization strenghts and elimination or reducing risks and weaknesces, as well as achieving higher sustainability, resilience, intraducing Smart and community, city or Society Level. The result of the process are decisions of regarding improvement of organizations quality and formulating the quality strategy and quality plans for management level. In this process also gamefication roles are on all organizations levels, relations to knowledge providers (consultants, training, education, sertification bodies, etc.). the next group of gamefication process consist from quality decisions for each key process, managing working teams, managing operations in each key process, quality monitoring and assessment. For each of them is other needed to design own game, as well as for quality improvements games (techigues, tools, communications and optimal quality decisions. At the end of this gamefication process are games for processes of quality sertification and/or accreditation and assessment of benefits of achieved quality level.

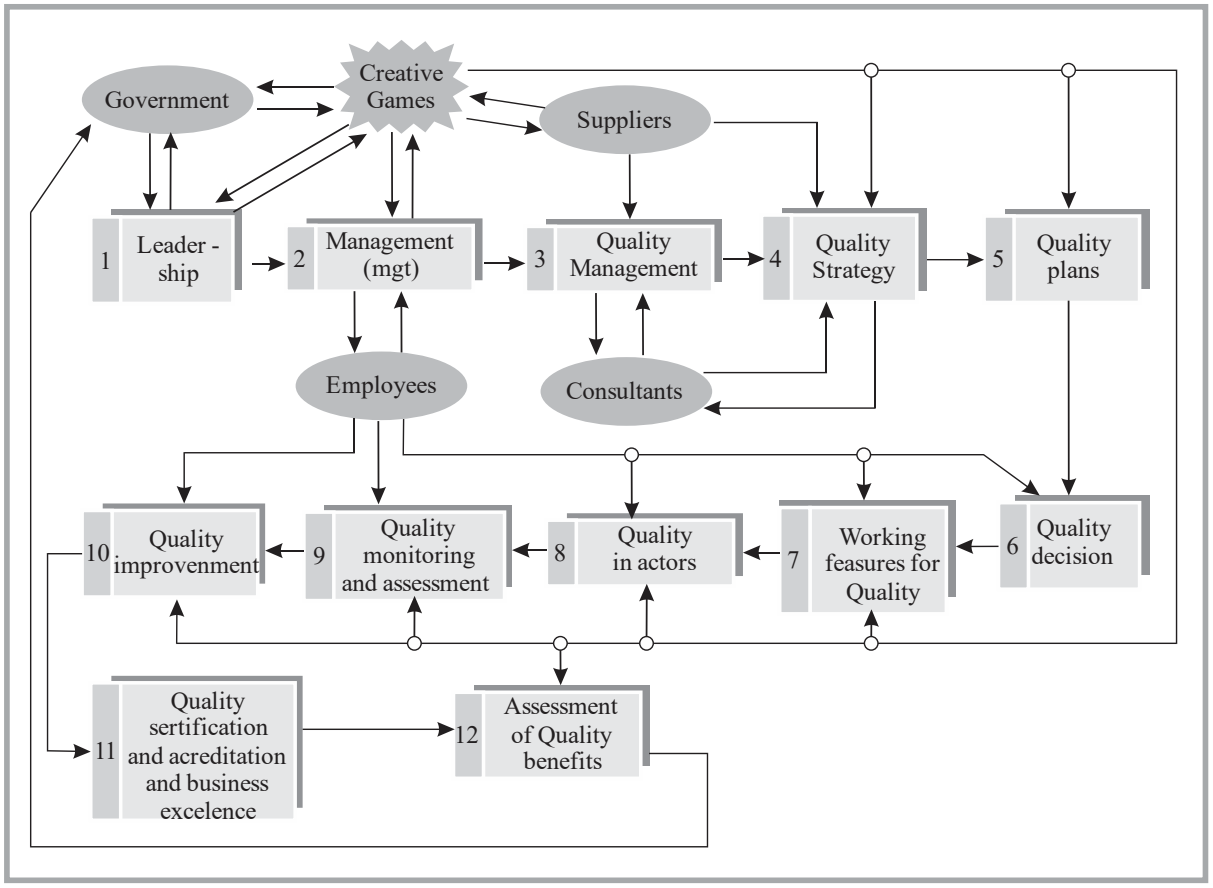

Figure 5. *Model of gamefication of organizations quality*

Relationships in this model of gamefication of organizations quality are always two-directional with communications with two or more key stakeholders. Each relation in the model need time and consumpt a lot of resources (labour, ICT, knowledge, informations, material, equirment, environment support, etc. In *Figure 6* are presented time-table for design of gamefication of organizations quality.

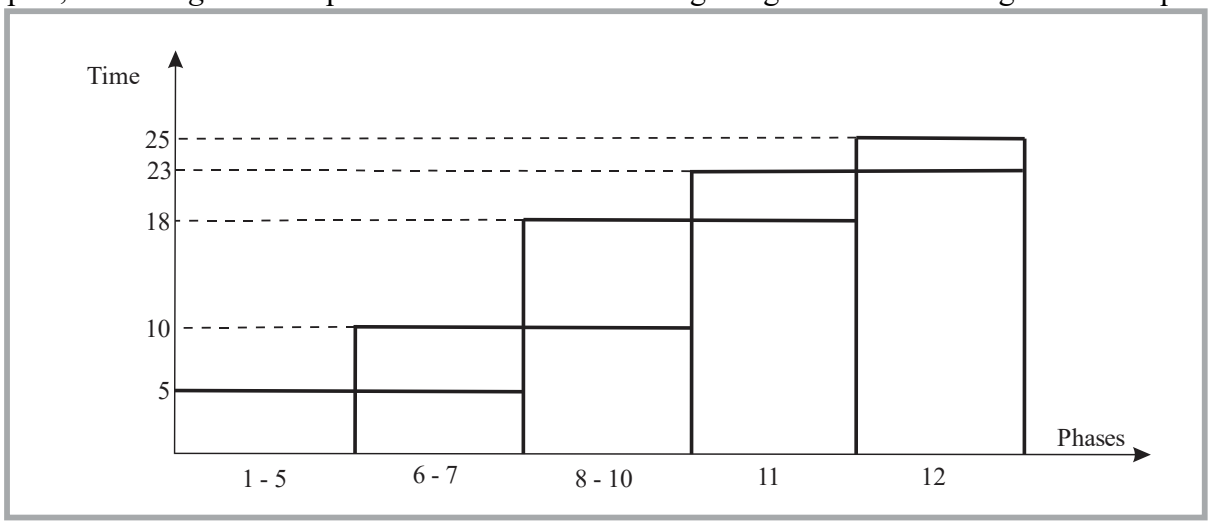

Figure 6. *Time-table for design of gamefication process of organizations quality*

The required for the gamefication process of organizations quality is rough assessed because this processdepends from a lot of stakeholders, needs and reqirements, intentions, creativity of actors, using Smart and Intelligent Systems for support, as carracteristics of Decision Support Systems.

4. DISCUSION, LIMITATION AND CONCLUSION

This area of quality games as special case of cognitive/creative games in new not seriosly analyzed, modeled, and performed in praxis. Discusion about it is now in starting phase and author as base

forexpect that because need to signiticantly improve quality to level needed for Quality 5.0/6.0 the creative had high impact for its improvement.

Limitation of the research presentes in the article is related to separatly research about games, quality, smart aid intelligent systems, spirituality, etc. It is reason for higher need to develop multydisciplinary, interdisciplinary research and create transdisciplinary new model of SISSRQ, CG and CNS, or AS as whole.

In conclusion author emphasize role of spirituality, sinhronicity, smart and inteligent systems, and also society support to improve prosperity on organizational and society level.

REFERENCES

[1] Capecchi I. et al. (2022). The Combination of Serios gaming and Immersive Virtual Reality through the Constructivist Approach: An Application to Teaching Architecture, Education Sciences, 12, 536.
[2] Chourasia S. et al. (2022). Sustainability of Industry 6.0 in Global Perspective: Benefits and Challenges, MAPAN-Journal of Metrology Society of India, Springer.
[3] Dokler T. (2021). Psychological model of the Gaming Expirience, Universitety of Groningem.
[4] Eberle S. and Brown S. (2024). The Power of Play, The National Institute for Play, Carmel Valley, CA.
[5] Epstain R. (2000). The Big Book of CREATIVITY GAMES, Mc Graw-Hill, New York.
[6] Gray P. (2013). Definition of Play, Scholarpedia 8, No.7.
[7] Houge J.B., Duin H. and Thoben K.D. (2013). The Evaluation of Serios Games Supporting Creativity through Student Labs, Seria Games Development and Application, Springer, pp. 186-195.
[8] Milakis E. (2025). The role of educational games in developing cognitive, social and creative skills in gifted STEAM education, International Journal of Communication and Information Technology, 6(1), pp. 88-97.
[9] Neira C., Fernandez M. and Porteles C. (2018). Virtual Peality and Games, Multimedial Technologies and Interact, 2, 8.
[10] Smajdorova T. (2024). Jopurney to Quality 6.0: Evolution of nquality management across industrial revolutions Computer Science and Information Technology, 9(2), pp. 63-70.
[11] Somlrio G. et al. (2014). Games and Gamification: A Proposal for a Creative Learning Process in Education, Journal of Education and Human Development, Vol. 3, No. 4, pp. 117-125.
[12] Stojanović Stošić M. and Stajić J. (2021). Creative games different materials in arts education, Facta Universitatis, Vol. 5, No. 2, pp. 123-135.
[13] Žižek S.Š., Muley M., Potočnik A. (2021). The Sustainable Socially Responsible Society: Well-Being Society 6.0, Sustainability, 13, 9186.

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INTEGRATION OF EXPERT SYSTEMS AND MACHINE LEARNING METHODS IN KNOWLEDGE MANAGEMENT

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Aleksandar Mišković, PhD[2]

Milica Tufegdžić, PhD[3]

Abstract: *Modern organizations face increasing challenges in managing knowledge effectively as information volumes grow and learning processes demand adaptability. Traditional expert systems, based on predefined rules and knowledge bases, provide valuable decision support but remain limited by their static nature.*

This paper explores the integration of expert systems with data analysis and machine learning methods to enhance knowledge management. Using the „Vivo e Classico" expert system as a conceptual model, a hybrid architecture is proposed that combines rule-based reasoning with predictive and classification techniques such as clustering, latent factor analysis, and recommendation models.

The hybrid approach enables adaptive decision-making and improved knowledge utilization within organizations. By merging the interpretability of expert systems with the flexibility of machine learning, the model advances toward intelligent, scalable, and data-driven knowledge management solutions aligned with the principles of digital transformation.

Keywords: *Expert Systems, Data Science, Machine Learning, Knowledge Management, Hybrid Intelligent Systems*

JEL Classification*: C80, D83, O33*

1. INTRODUCTION

Knowledge management represents a strategic and systematic process of identifying, creating, organizing, sharing, and applying intellectual resources within an organization. In the contemporary business environment, characterized by rapid technological development, global competition, and the

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exponential growth of digital data, effective knowledge management has become a critical factor for sustainable competitiveness, innovation, and long-term organizational success [2][8]. It facilitates the transfer of individual expertise into organizational processes and knowledge bases, promotes collaboration and continuous learning, and thereby directly contributes to improved decision-making processes [7].

One of the earliest technologies supporting the development of knowledge management is expert systems, a branch of artificial intelligence. These systems enable the formalization of expert knowledge through rule bases and inference mechanisms, allowing decision-making within a narrow domain of application. Their value lies in their ability to simulate expert logical reasoning and provide consistent support for decision-making processes [4]. However, classical expert systems exhibit limitations in terms of flexibility, as they require manual knowledge acquisition and updating, which complicates their use in dynamic business environments [6].

The advancement of machine learning and data analysis techniques has opened new possibilities for the automatic discovery and updating of knowledge [3], [5]. Machine learning algorithms enable the identification of complex patterns in large datasets and the adaptation of systems based on new information, making them suitable for application in knowledge management [1]. Nevertheless, these systems often operate as „black boxes“, lacking clear interpretability of their decision-making processes, which presents a challenge in domains where transparency is critical [10].

The primary aim of this paper is to explore the potential integration of expert systems and machine learning methods for the development of hybrid intelligent systems for knowledge management. The proposed approach seeks to combine the structured framework and interoperability of expert systems with the adaptability and predictive capabilities of machine learning [8]. In doing so, it aims to overcome the limitations of traditional approaches and create systems that are simultaneously flexible, scalable, and capable of continuous learning [5][6].

The following sections of this paper present a theoretical framework explaining the fundamental principles of knowledge management, expert systems, and machine learning, followed by a model for integrating these approaches and their practical application, illustrated through the case study of the „Vivo e Classico“ expert system.

2. THEORETICAL FOUNDATION OF THE STUDY

The theoretical foundation of this study is grounded in the interdisciplinary convergence of artificial intelligence, knowledge management, and machine learning methodologies. At its core lies the understanding of knowledge management (KM) as a systematic process of identifying, creating, organizing, sharing, and applying knowledge within organizations. Literature indicates that effective knowledge management constitutes a key factor in the competitiveness and innovativeness of contemporary enterprises [2][3].

Within the broader domain of artificial intelligence, expert systems hold a particularly significant place, historically representing the initial approach to the formalization and computational representation of expert knowledge. Expert systems operate through clearly defined rules and knowledge bases, enabling decision-making within specific domains. Their limitations—rigidity in the knowledge acquisition process (limited learning capabilities) and challenges in adapting to changing conditions—have created opportunities for integration with more advanced data analysis and machine learning techniques [4].

The development of machine learning methods has enabled the overcoming of these limitations through the ability of algorithms to automatically detect patterns in data and enhance system performance without explicit programming. In the context of knowledge management, machine learning methods contribute to more efficient identification, classification, and recommendation of relevant information, thereby significantly improving organizational learning processes and knowledge transfer [9].

Within this theoretical framework, the concept of a hybrid system is proposed, wherein an expert system is used for the formalization and validation of domain-specific knowledge, while machine learning methods support adaptation, personalization, and process optimization. In this way, expert systems provide interpretability and transparency, whereas the integration of machine learning algorithms introduces flexibility and the capacity to process large volumes of data.

Particular emphasis in this study is placed on data analysis and recommendation systems (recommender models), as they enable the creation of intelligent systems that support learning and decision-making. Such a framework allows for the achievement of dual value: on one hand, enhancing organizational learning, and on the other, developing new methodological models for integrating diverse AI approaches within the field of knowledge management [5][9].

3. INTEGRATION MODEL OF EXPERT SYSTEMS AND MACHINE LEARNING METHODS

In contemporary organizations, knowledge management requires systems capable of dynamically adapting their recommendations and decisions in response to environmental changes and new information. Classical expert systems (ES), such as the "Vivo e Classico" system for recommending classical music compositions, operate based on strictly defined rules and knowledge bases, providing systematic and consistent support for decision-making, but simultaneously limiting adaptability and the ability to learn from data [1].

To overcome these limitations, a hybrid model integrating expert systems and machine learning (ML) methods is proposed. In this model, the expert system provides the structural framework and rule-based inference mechanism, while the ML modules analyze user and organizational process data to dynamically adjust recommendations and predictions. This integration enables enhanced personalization, prediction of knowledge needs, and recognition of patterns within organizational knowledge [2][3][9].

The architecture of the hybrid system can be described through three main components: (1) the knowledge base and inference mechanism of the expert system, which formalizes rules and defines logical relationships; (2) the ML module, which employs clustering, classification, and recommendation techniques to identify relevant knowledge and expertise; and (3) the user interface, which facilitates interaction and gathers feedback to support continuous system learning [4][6].

Application of this hybrid model within organizations enables the recommendation of relevant documents, identification of internal experts, and adaptive planning of employee training. Furthermore, the integration of expert knowledge with ML approaches contributes to greater system scalability and flexibility compared to traditional expert systems, while ensuring continuous adaptation to changing operational conditions [5][7][10].

According to relevant studies, the hybrid approach combining expert systems and ML has been recognized as an effective method for enhancing knowledge management in organizations, particularly in the context of digital transformation, where a combination of formalized knowledge and autonomous system learning capabilities is essential [1][3][8]. In this regard, the proposed model represents a significant step toward developing intelligent, adaptive, and scalable solutions to support decision-making and knowledge management in modern organizations.

4. CASE STUDY EXAMPLE

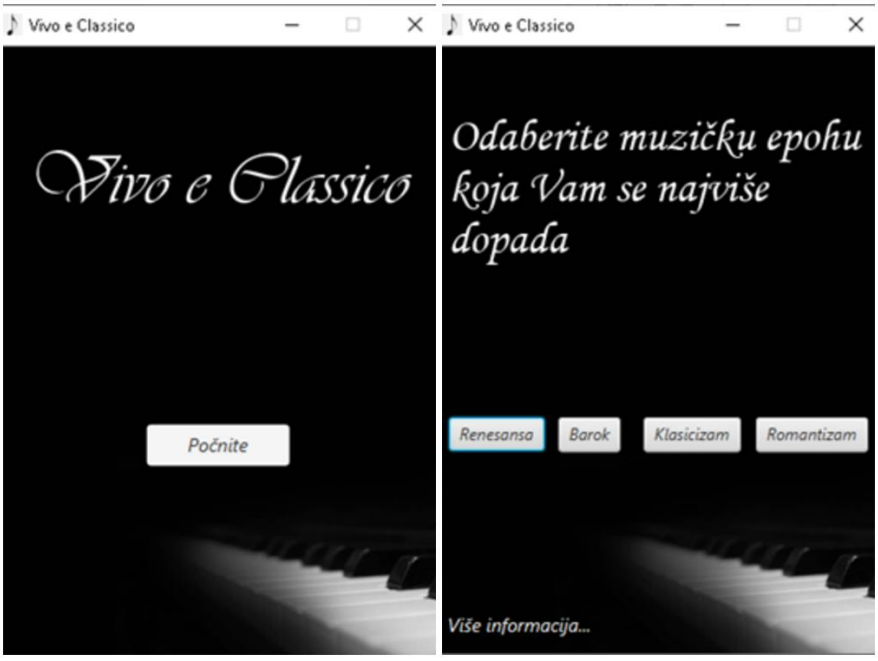
As a practical example of applying the concept of integrating expert systems with machine learning methods in the field of knowledge management, the „Vivo e Classico" system can be considered. Originally designed as an expert system for identifying classical music compositions, this system fundamentally relies on rule-based mechanisms to formalize knowledge about musical genres, composers, and historical periods. This approach enables users, through a series of questions and logical rules, to receive recommendations for compositions that best match their preferences.

However, contemporary research indicates that combining the classical expert system approach with machine learning methods can significantly enhance the efficiency and adaptability of such systems [2][3]. While the expert system provides structure, formalization, and interpretability of knowledge, machine learning—conceptually intended for later system expansion—allows the detection of patterns in user behavior data and the personalization of recommendations based on interaction history [1].

In this context, „Vivo e Classico“ can be viewed as a foundation for developing a broader organizational knowledge management system. Instead of music compositions, the recommendations would pertain to various forms of organizational knowledge, such as documents, expert notes, procedures, and databases. In this way, the system could be transformed into a platform that simultaneously utilizes expert rules to structure knowledge and machine learning to optimize it dynamically [2][4].

One of the key challenges in this transformation is aligning formally defined rules with statistical learning models. Systematic reviews in the field [1] indicate that hybrid models combining domain knowledge with machine learning algorithms can achieve better recommendation accuracy while maintaining the transparency often lacking in purely data-driven approaches.

Consequently, the proposed concept can be applied within organizations through the development of an „intelligent corporate advisor“ that provides employees with relevant resources and expert knowledge based on their tasks, using a combination of expert rules and machine learning. In this way, a system like „Vivo e Classico“ can serve as a prototype for integrating expert systems with modern data science methods to enhance knowledge management in organizations [1][2][3][4].



Picture 1. User Interface of the “Vivo e Classico” system

5. DISCUSSION

5.1. Advantages

The integration of expert systems and machine learning methods brings significant advantages in the field of knowledge management. Primarily, hybrid models provide greater flexibility by combining formal inference mechanisms with the ability to learn from data. While expert systems ensure transparency and structured knowledge, machine learning enables system adaptation in dynamic environments [1]. Additionally, such systems possess adaptability, meaning they can adjust to changing organizational needs through the analysis of new data and model updates [2]. Finally,

integration also enables scalability, which is particularly important in large organizations where the volume of knowledge and documents grows exponentially [3].

5.2. Limitations

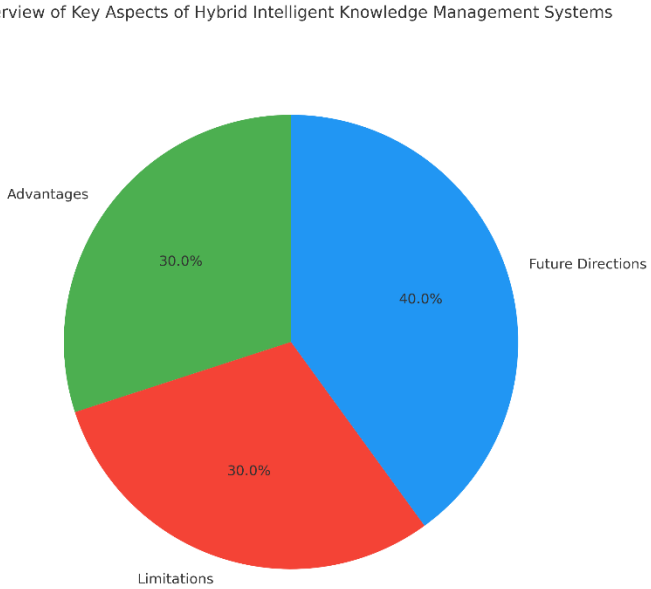
Nevertheless, hybrid systems face several limitations. One of the key challenges is the need for a large volume of data to adequately train machine learning algorithms. When data are incomplete, inconsistent, or subject to privacy constraints, the system's effectiveness can be significantly reduced [4]. Another limitation concerns the maintenance of the knowledge base. While machine learning enables dynamic adaptation, expert systems still require continuous expert intervention to update rules and verify knowledge, which can result in high maintenance costs [5]. Additionally, there is the challenge of integrating formal expert knowledge with probability-based machine learning methods, as the different approaches may generate conflicting outcomes or reduce the interpretability of the model [2].

5.3. Future directions

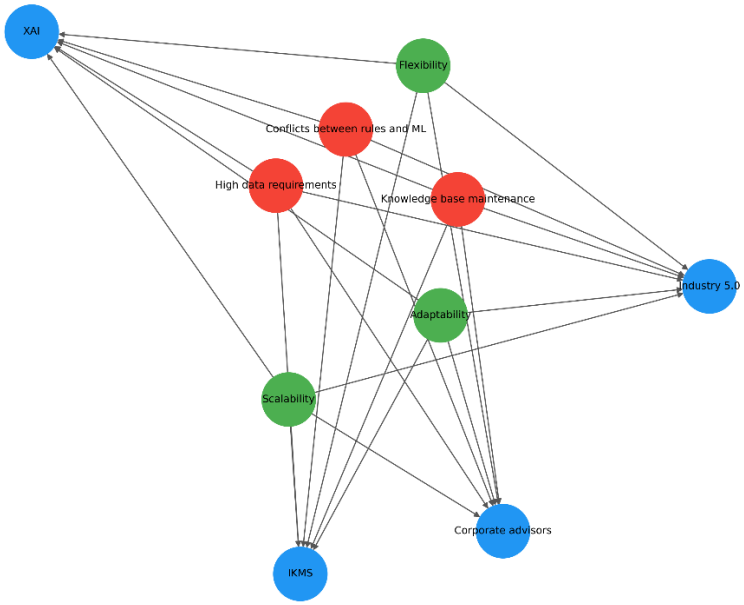
The future development of hybrid systems points to the need for integration with Industry 5.0 concepts and the creation of Intelligent Knowledge Management Systems (IKMS). Industry 5.0 emphasizes human–intelligent system collaboration, implying that future knowledge management systems should combine expert knowledge with AI/ML techniques to support collective decision-making [3]. This approach enables the development of intelligent corporate advisors capable of personalizing recommendations, accelerating training processes, and enhancing organizational learning [1][2]. Such systems will increasingly employ explainable AI models to ensure transparency and build trust in the decision-making process [1]. In this context, the integration of expert systems and ML techniques represents a key step toward developing sustainable, adaptive, and intelligent knowledge management solutions.

Table 1. Advantages, Limitations, and Future Directions of Hybrid Intelligent Systems for Knowledge Management

Advantages	Limitations	Future directions
Flexibility – combining formal rules with ML models	Large volumes of data required to train ML algorithms	Integration with Industry 5.0 concepts
Adaptability – adjusting to changes through data-driven learning	High maintenance costs of the knowledge base	Development of Intelligent Knowledge Management Systems (IKMS)
Scalability – applicable in large organizations with extensive knowledge	Potential conflicts between formal rules and ML outcomes	Use of explainable artificial intelligence (XAI)
Enhanced personalization and predictive capabilities – delivering tailored recommendations and insights	Creation of intelligent corporate advisors	Creation of intelligent corporate advisors that support decision-making and organizational learning



Picture 2. Graphical representation illustrating the distribution of advantages, limitations, and future directions of hybrid systems



Picture 3. Concept map depicting the relationships between the advantages, limitations, and future directions of hybrid systems

6. CONCLUSION

The integration of expert systems and machine learning methods represents a significant advancement in the evolution of knowledge management systems. While traditional expert systems have demonstrated value in the formalization and structuring of knowledge, their limitations—such as the static nature of rule bases and the need for manual maintenance—restrict their applicability in modern, dynamic organizational environments [5]. Conversely, machine learning and data science techniques provide the ability to analyze large volumes of data, detect patterns, and deliver personalized recommendations, thereby enabling greater adaptability and scalability [2][3].

By combining these two approaches, a hybrid model is achieved that simultaneously provides the transparency of expert systems and the dynamic learning capabilities of ML algorithms. Such systems can serve as intelligent corporate advisors, supporting organizational learning, optimizing training processes, and enabling knowledge-based decision-making [1][4]. Furthermore, developments within the Industry 5.0 framework are expected to foster even greater synergy between human experts and

intelligent systems through the creation of Intelligent Knowledge Management Systems (IKMS), which integrate interpretability and scalability [1].

In conclusion, it can be emphasized that the future of knowledge management lies in hybrid intelligent systems that integrate the strengths of expert rules and machine learning algorithms. Although challenges such as the need for high-quality data, maintenance costs, and ethical considerations remain relevant [2][4], the potential for enhancing organizational efficiency and competitiveness makes this integration one of the most promising directions in the development of information systems and knowledge management.

6.1.Recommendations for practical implementation

For the successful implementation of hybrid systems within an organizational context, several steps are recommended. First, it is essential to establish an initial expert knowledge base, which will serve as the foundation for structured reasoning. Second, organizations need to ensure a high-quality and diverse dataset to train the ML models effectively. Third, an iterative development approach should be adopted, in which expert rules and machine learning algorithms are continuously updated based on user feedback. Fourth, it is important to integrate explainable AI (XAI) models to provide transparency and build trust in the system's recommendations. Finally, the deployment of these systems should be accompanied by comprehensive education and training programs for employees to ensure proper understanding, acceptance, and effective utilization.

LITERATURE

[1] Mathias, U., et al. (2024). Knowledge-based recommender systems: Overview and research directions. Frontiers in Big Data.
[2] Rezaei, M. (2025). Artificial intelligence in knowledge management. ScienceDirect.
[3] Sauer, C. R. (2025). A systematic review of machine learning for hybrid systems.
[4] Chen, E. (2024). Empowering artificial intelligence for knowledge management. IACIS.
[5] Louafi, B., Nessah, D., & Mahalaine, R. (2025). AI-based knowledge management systems: A review of AI techniques, applications and challenges. Journal of Electrical Systems.
[6] Alonge, M., & Isreal, O. (2025). Hybrid AI models: Combining machine learning with domain knowledge. ResearchGate.
[7] Nakash, M., & Bolisani, E. (2024, September). Knowledge management meets artificial intelligence: A systematic review and future research agenda. In European Conference on Knowledge Management (pp. 544–552). Academic Conferences International Limited.
[8] Nakash, M., & Bolisani, E. (2025). The transformative impact of AI on knowledge management processes. Business Process Management Journal, 31(8), 124–147.
[9] Li, Z. (2024). Leveraging computational algorithms for effective explicit and tacit knowledge capture: A hybrid approach combining expert interviews, machine learning, and data mining techniques [Doctoral dissertation, Hong Kong Polytechnic University]. Hong Kong, China.
[10] Gelashvili-Luik, T., Vihma, P., & Pappel, I. (2025). Navigating the AI revolution: Challenges and opportunities for integrating emerging technologies into knowledge management systems: Systematic literature review.

POSSIBILITIES OF IMPROVING INTELLECTUAL CAPITAL IN CONDITIONS OF UNCERTAINTY

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Abstract: *Intellectual capital, intangible capital, capital of uncertainty and progress. The role and influence of intangible capital or intellectual capital in the new economy. The role or possibilities of artificial intelligence in increasing intellectual capital from a management position. One of the main characteristics of intellectual capital is its invisibility. Intellectual property is an intangible asset. It does not have a hard form like real estate (plants and equipment - parts of physical capital), nor does it have a visible financial value. Intellectual capital is essentially a "hidden asset". Because of this, it is often difficult to define it and mark its economic value. All these are postulates that we dealt with during the research and writing of this work.*

Keywords *Intellectual capital, new economy, uncertainty capita, uncertainty capital, artificial intelligence.*

JEL Classification*: C53, D24, O022.*

1. INTRODUCTION

Intellectual capital is the main driver of value creation in an enterprise through the combined use of human, structural and relational capital. It consists of the knowledge, experience and skills of employees, business culture, databases, company reputation and relations with external partners. Intellectual capital is the competitive thermonuclear weapon of today. Thomas Stewart best embodies the power of intellectual capital. But, in order to use this power of intellectual capital as effectively as possible for the purpose of further development and prosperity, it is necessary to fully understand its essence, role and the way it creates value. In fact, intellectual capital most vividly and completely represents intangible resources, such as know-how, competence, innovation, corporate culture, teamwork, image, consumer loyalty. The term "intellectual capital" refers to a new view of the company's resources and a new approach to the company's value. Intellectual capital has acquired a

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new meaning - an intangible source of wealth creation. Intellectual capital is knowledge that can be turned into value, intellectual potential that can be used to create wealth, the power of the collective mind.

2. HISTORY AND MODEL OF INTELLECTUAL CAPITAL

It may seem at first glance that the theory of intellectual capital finds its foothold in managerial and organizational theories. Although it is not so, because it, like the concept of knowledge management in its entirety, is firmly based on macroeconomic fundamentals. Significant elements of the study of knowledge and intellectual capital can be found in numerous well-known economists of the 20th century. Karl-Erik Sveiby (2001) states that the term "intellectual capital" was first mentioned by John Kenneth Galbraith in a letter to the economist Michael Kalecki in 1969 asking him if he realized how much we all over the world owed to the intellectual capital he had provided over the previous decades. Thomas A. Stewart (1991) in his 1991 article, "Brain Power - How Intellectual Capital Became America's Most Valuable Asset" defined intellectual capital as the sum of everything everyone in a company knows that determines its competitiveness in the marketplace. He laid new foundations for the concept of intellectual capital, strongly believing that intellectual capital in the digital economy is, above all, mutual cooperation, collective learning of both the company and its associates, which creates ideal conditions for achieving success. Intellectual capital represents a revolution in the very way of thinking and activities of the leaders of large companies who have realized that the traditional theories dominated by land, labor and capital are outdated and impractical. Traditional accounting does not record the key people in the company. If an important expert leaves the company, accounting does not record it in any way, even though it will produce considerable losses in the future, both in personnel and in financial terms. In contrast to traditional accounting, in the digital economy, the value of personnel, i.e. the intellectual capital that the company has at its disposal and the potential benefits that the company can achieve by manipulating that capital, is first of all recorded. Therefore, the advantage is the human mind, not the hands of the employees. His ability to create new ideas, innovations in the company's business and added value very quickly became a basic tool for the company's growth and development. Intellectual capital does not have a physical property, yet it enables business at a much higher level thanks to the knowledge and ability to change and adapt to market requirements, the skills and experience of the company's employees, as well as those with whom the employees cooperate in the internal and external environment. A company's key assets are no longer based on what it owns, but on what it knows. Intellectual capital is based on the theory that the power of a company is reflected in human capital, structural capital and consumer capital. (Kolaković, 2003, p. 925) emphasizes that value is created whenever human ability (human capital) creates new business processes (structural capital) that results in better services for consumers and increases their loyalty (consumer capital).

Today, the best-known division of intellectual capital was developed by Leif Edvinsson, who views intellectual capital as the sum of human, structural and consumer capital, the interaction of which creates value for the company. According to her, the three basic elements of intellectual capital are:

a) Human capital - represents the various knowledge, skills, abilities and experience of employees that are used in the business process.
b) Structural capital - arises from the transformation of human capital, and includes various intangible elements, such as organizational structure, routines, business processes, customs, databases and intellectual property, such as patents and licenses.
c) Consumer capital - which includes relationships and connections with consumers, i.e. with customers, but also with suppliers and distributors whose consumers we are. It also includes the image, brand and identity of the company on the market.

The model of the market value of the company, which includes the tangible and intangible assets of the company, is shown in Figure 1. According to that model, each of those three parts of intellectual capital can be measured and evaluated for investment14. That is why this division has become today's standard and starting point for further research.

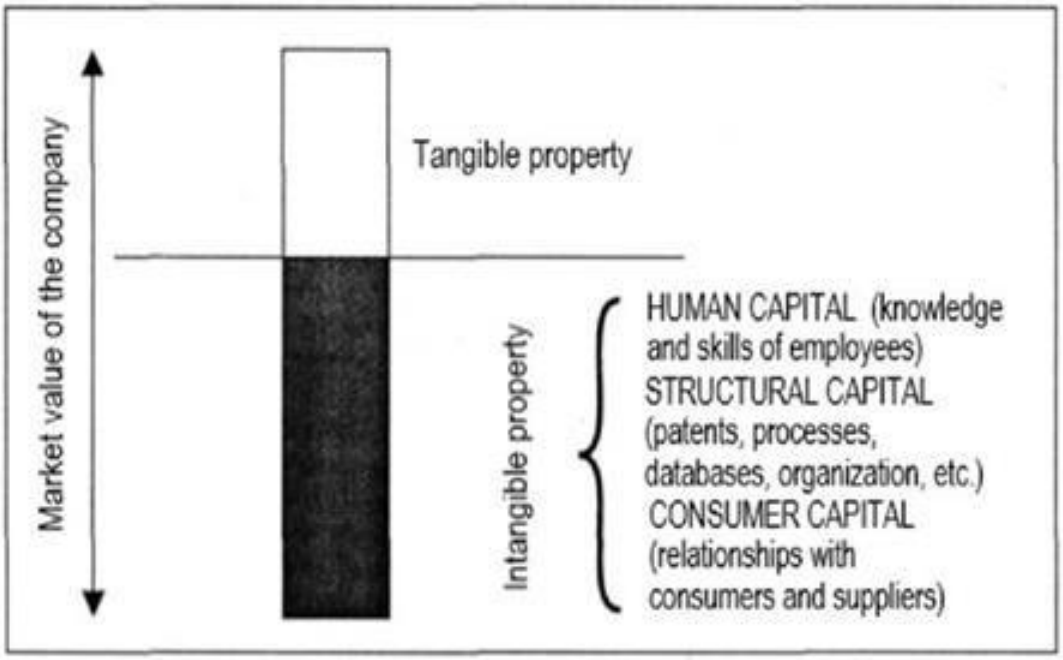

Figure 1. INTELLECTUAL CAPITAL MODEL Source (Stewart, 2001, p. 13)

In studying the role of intellectual capital, the Swedish insurance company Skandia went the furthest, where, under the leadership of Leif Edvinsson, an intellectual capital monitoring model called Skandia Navigator was developed. For a better insight into the specific factors of its success and for the possibility of their regular monitoring and improvement, a scheme of the company's market value and critical factors that create that market value was developed. Based on the scheme of Skandia's market value, which is shown in Figure 2, it is possible to analyze the role of each individual element of intellectual capital.

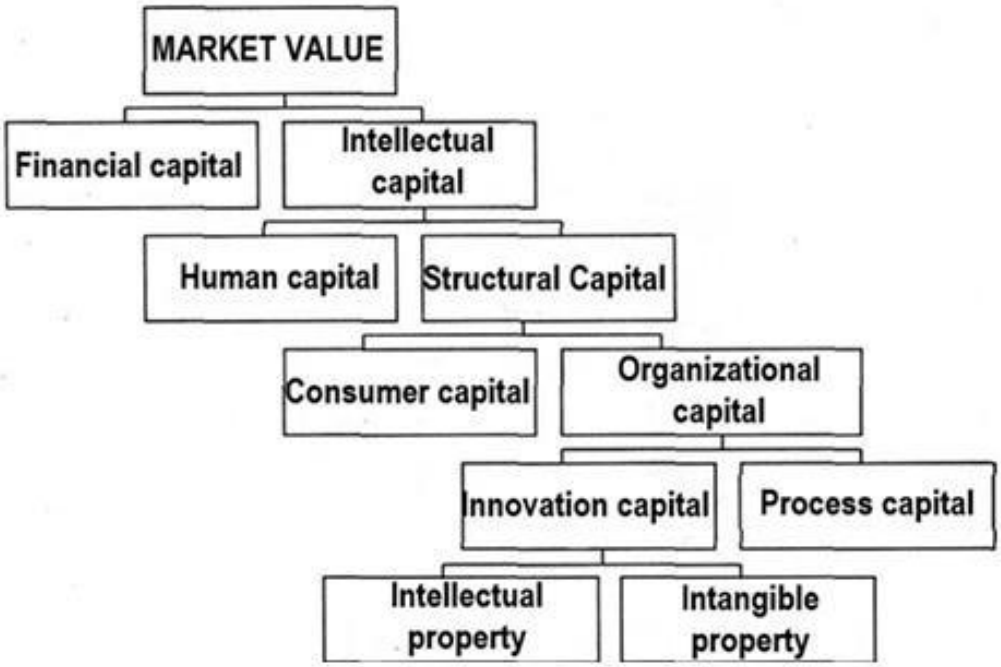

Figure 2. SCHEME OF THE MARKET VALUE OF THE COMPANY SKANDIA – SO-CALLED. SKANDIA NAVIGATOR Source: Skandia, Intellectual Capital, Supplement to Skandia's Annual Report 1995

Man, person, individual as a resource is an indispensable part of any business process. However, man is not the resource of the organization, it is his qualities; new education, knowledge he has acquired, skills, expertise, contacts he is able to achieve. Only the mentioned qualities that an individual carries can make the organization its competitive strength. In order to extract the maximum of intellectual capital, companies must plan to influence the characteristics, position and advancement of man as a carrier of knowledge and progress of the organization. Organizations must, first of all, hire a quality workforce, and invest in such personnel in education, evaluate the quality of work, work results, motivate them by rewarding them, promoting them, including them in decision-making, assigning greater responsibility, etc.

3. MANAGEMENT OF INTELLECTUAL CAPITAL

Systematic management activities aimed at identifying, evaluating, creating and extracting value from the organization's intangible intellectual property, i.e. as a process-optimal combination of human, social and organizational capital in order to maximized and increased organizational intellectual property by turning human into organizational capital. Intellectual property management represents the process of optimal combination of human, structural and relational capital in order to achieve maximum value in the realization and increase of intellectual property. Figure 3 shows the intellectual capital management model.

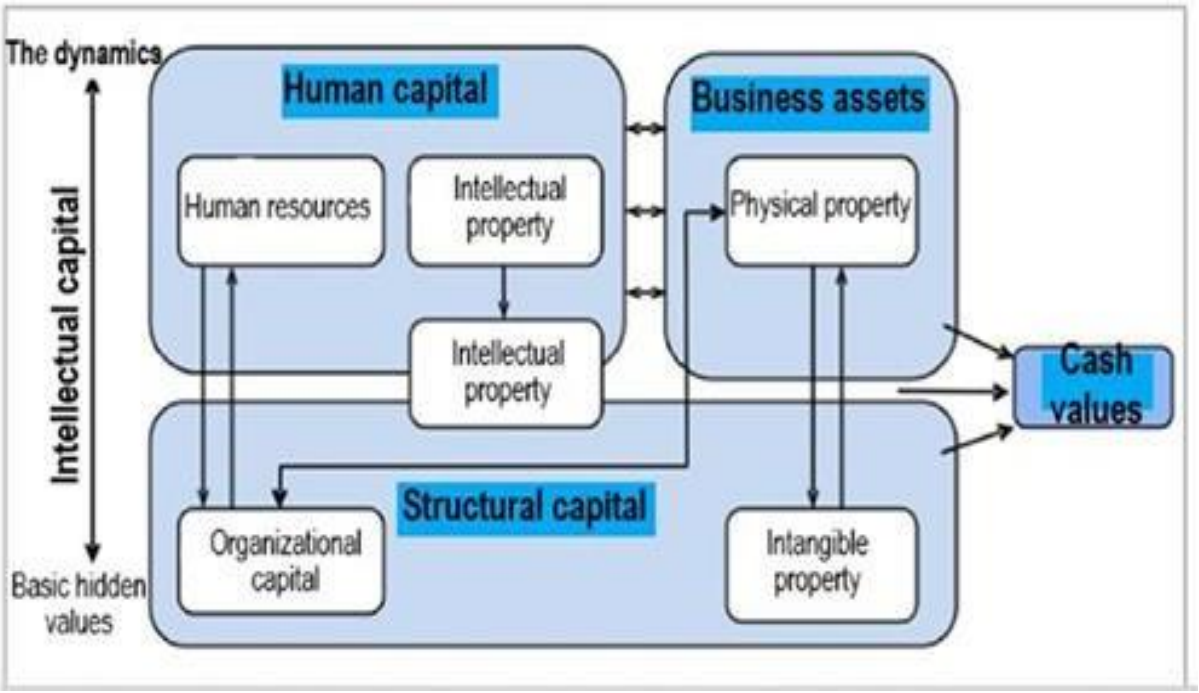

Figure 3. Intellectual capital management model

In order to be able to manage it, it is also necessary to have appropriate methods of measuring processes related to intellectual capital. Table 1 shows the method for measuring intellectual capital.

Table 1. *Methods of measuring Intellectual capital*

The method	Access	The contents
Direct methods	• Monetary evaluation • Evaluation of some components intellectual capital	• Value explorer • Valuation of intellectual capital • Total value created • Inclusive evaluation methodology • Accounting of the future • Technological intermediary • Patent Usage Index • Report on human resources • List of intellectual capital indicators • Accounting costs of human resources
Market capitalization methods	• Monetary evaluation • Evaluation of a set of components intellectual capital	• Market value of intellectual capital assessed by investor • Ratio of market and book value • Tobin's q
Methods of profit business	• Monetary evaluation • Evaluation of a set of components intellectual capital	• Yield from knowledge • Added economic value • Calculated intangible value • Coefficient of added value of intellectual capital
Scorecard methods	• Not monetary evaluation • Evaluation of individual components of the intellectual capital	• Danish guidelines • Rating of intellectual capital • List of value chain results • Merit guidelines • Knowledge revision cycle • Intellectual capital index • Scandia navigator • Monitoring of intangible assets • Harmonized list

Based on a graphic presentation of the role of intellectual capital and the central place that intellectual capital occupies in the value creation process, for success in the 21st century, it is necessary to establish a balance between financial and intellectual capital and manage all available resources, both tangible and intangible. In every company, a large number of people are dedicated to monitoring and analyzing financial and material resources. However, it is necessary to pay the same attention to the monitoring of intellectual capital, because it is the foundation on which the further growth and development of the company and its competitiveness on the market are based. And just as there is a financial capital management strategy, it is necessary to have an intellectual capital management strategy as well, because this is the only way a company can plan long-term survival on the market.

4. INFLUENCE AND CONTRIBUTION OF ARTIFICIAL INTELLIGENCE ON INTELLECTUAL CAPITAL.

Artificial intelligence continues its revolution in industries around the world, and its impact on the corporate sector is certainly not negligible. AI-based tools can make managing companies easier, in terms of conducting meetings, reviewing documents and regulatory compliance. Automated processes not only save time and resources, but also reduce the likelihood of human error. This allows managers to focus on more demanding tasks, such as human resources, developing strategies and encouraging ethical business practices. Recently, the possibility of artificial intelligence taking over management roles within companies is a current topic. [1] Given the ability of artificial intelligence to analyze large amounts of data, make data-driven decisions and automate processes, some argue that it could be a significant asset, and even as a leader - "In the future, with the development of

technology, artificial intelligence may acquire the ability to evaluate solutions, make decisions, thereby influencing the change of status. However, the idea of artificial intelligence at the helm of a company raises complex questions about the role of human judgment, ethics and responsibility. The integration of artificial intelligence into various aspects of business operations has brought about a transformation. From chat bots and virtual assistants to predictive analytics and machine learning algorithms, artificial intelligence has shown its potential in optimizing processes and decision-making, and "in the future it may even replace humans as managers." As a result, there is growing interest in the idea of artificial intelligence taking over the management of companies. The following is an example of a Hong Kong company DKV that appointed VITAL (Validating Investment Tool for Advancing Life Sciences), which is a computer program (algorithm), to the board of directors of the Hong Kong company Deep Knowledge Ventures ("DKV") in 2014. it began to be discussed what role artificial intelligence would play in corporate governance. DKV marked a historic moment when it appointed the first AI robot to the board of directors. The AI robot does not have an official position or title on the board, but DKV managing partner Dmitry Kaminsky stated that the company will not make any positive investment decisions without approval from VITAL. This company credits VITAL with saving the company from bankruptcy, and for that reason it places so much trust in him. Although the potential benefits of artificial intelligence in the field of leadership are intriguing, several ethical questions and challenges that may arise need to be addressed. One of the main concerns is related to the question of responsibility. It is important to establish clear guidelines and mechanisms to ensure AI oversight and Author's1, mr Dragan Vujović; co-author's1, prof.dr Pavle K. Popović, co-author's1, prof dr Oto Iker accountability.Another concern concerns potential biases built into AI algorithms. Artificial intelligence systems learn from historical data that may contain inherent biases and discriminatory patterns. Without careful monitoring and efforts to mitigate this, artificial intelligence can unwittingly apply bias, leading to unintended consequences and reinforcing systemic inequalities. Artificial intelligence systems do not have the ability to understand complex ethical dilemmas and moral issues. Finding the balance between artificial intelligence and human leadership is critical to the successful integration of artificial intelligence into corporate governance. As artificial intelligence continues to evolve, the course of its role in managing companies will be a key aspect of shaping future models of corporate governance.

5. CONCLUSION

At a time of rapid changes that cost many large companies, the most important is to know how to learn, because it is the only way for a company to quickly adapt to new things business conditions. The ability to learn is related to intellectual capital companies - a new and still insufficiently researched economic category. It is important to establish a process of continuous learning and improvement, which includes determining the professional, experiential and creative potential of employees in order to potentials and positions for further improvement were precisely and systematically determined intellectual capital. Intellectual capital becomes the most important factor of production in all sectors of the economy. This analysis does not pretend to be a complete presentation of the issue of Fr intellectual capital, but certainly indicates its importance and seriousness. The overriding goal is to point out the enormous creative energy that lies in intellectual capital. To effectively harness the potential of AI while ensuring its ethical and responsible use, companies must proactively address concerns related to the transparency, accountability and bias of these systems.

LITERATURE:

[1] Knowledge is today’s capital: Strategy & Leadership interviews Thomas A. Stewar
[2] Capital is transformed into another form (Kolaković, 2003, p. 925). For example, the value is created when individuals' capabilities
[3] The Intellectual Capital Model (Stewart, 2001, p. 13.)
[4] Skandia, Intellectual Capital, Supplement to Skandia’s Annual Report 1995
[5] Florian Möslein, “Robots in the Boardroom: Artificial Intelligence and Corporate Law” (2018), 736/649- 670 Research Handbook on the Law of Artificial Intelligence, dostupno na:

https://www.elgaronline.com/view/edcoll/9781786439048/9781786439048.00039.xml.
[6] Martin Petrin, "Corporate Management in the Age of AI"(2019), Vol. 2019 No. 3 Columbia Bussiness Law Review, dostupno na: https://journals.library.columbia.edu/index.php/CBLR/article/view/5118.
[7] E. Hickman and M. Petrin., "Trustworthy AI and Corporate Governance: The EU's Ethics Guidelines for Trustworthy Artificial Intelligence from a Company Law Perspective" (2021), European Business Organization Law Review (2021), available at: https://link.springer.com/article/10.1007/s40804-021-00224- 0.
[8] Videti: Gregory S. Nelson, "Bias in Artificial Intelligence" (2019), available at: https://ncmedicaljournal.com/article/55108.

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BUSINESS CONTINUITY MANAGEMENT OF VOLUNTEER FIRE DEPARTMENTS THROUGH THE APPLICATION OF THE ISO 22301 STANDARD FOR BUSINESS CONTINUITY MANAGEMENT – REQUIREMENTS

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Abstract: *According to UNEP and GRID-Arendal (2022), the number of extreme wildfires could increase by 30% by 2050 and by as much as 50% by the end of the century, which requires the improvement of safety measures and equipment. The consequences of fires include environmental, economic, and social damage. Along with the increase in wildfires, a rise in other adverse events is also expected due to climate change, as well as changes in human lifestyle, habits, needs, and activities. In an organizational context, an undesirable event is any unexpected and unplanned situation, occurrence, or condition that can have, and most often does have, a negative impact on the organization's operations, processes, resources, human resources, environment, property, and objectives. Such a situation creates difficulties for the organization in carrying out normal business activities, causes damage, compromises safety, reputation, and financial standing, or may even lead to the shutdown or cessation of the organization's operations. As a result, a volunteer fire department would be unable to carry out its core activities, thereby endangering the entire community. In the context of business continuity management, a key tool emerges: the international standard ISO 22301 on Business Continuity Management – Requirements, which defines the requirements for establishing, implementing, and continually improving a business continuity management system. Given the lack of legal obligation and the high cost of certification, the nonprofit sector rarely engages in this area of activity. Although this is not the primary goal of implementing the standard, its application enhances the recognition and distinctiveness of the nonprofit organization, making it more attractive to donors and sponsors while increasing interest in its work.*

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The main goal of implementing the standard is to develop and test crisis management plans, which bring the organization to a state of high preparedness and efficiency.

Keywords: *business continuity management, ISO 22301, organizational resilience, crisis management, adverse events;*

JEL Klasifikacija*:L15,O32, Q54*

1. INTRODUCTION

As a result of global warming, changes in human lifestyles, globalization, and other transformations that have become global problems significantly affect people, health, property, the environment, and economic activities. Such forecasts demand the intensification of safety measures and the advancement of organizations engaged in preventing the occurrence of unwanted events, focusing on both prevention and emergency response activities when such events do occur.

By combining qualitative and quantitative research methods, a comprehensive analysis of the problem areas, possible solutions, and the implementation of the international standard ISO 22301 on Business Continuity Management – Requirements is ensured, alongside an examination of the existing positive examples from practice. Qualitative methods include the review and analysis of relevant literature, international standards, guidelines, and professional articles related to risk management. Additionally, the use of case studies and real-world examples from nonprofit organizations provides clear illustrations of the application of business continuity management guidelines, as well as approaches to solving key problems related to the organization's survival and the fulfillment of its objectives. Case studies and practical examples enable an in-depth analysis of the specific requirements faced by organizations and the evaluation of the effectiveness of business continuity management. Quantitative methods include the analysis of data from existing reports and studies, as well as the comparison and confrontation of various definitions and theories related to the existence of nonprofit organizations, strategic management, and the importance of sustainable and continuous operations. Ultimately, this approach allows for the assessment of how significant decisions impact the fundamental elements of an organization's existence, as well as its achieved goals and measurable outcomes.

Furthermore, through the constant comparison of preventive and emergency response measures, the achieved results are analyzed, and the best practices are identified to be implemented within the organization's strategic framework. This paper is based on the Master's Thesis 252/OMIL/2025 titled *Business Continuity Management of Nonprofit Organizations through the Application of ISO 22301 Standard on Business Continuity Management – Requirements*. Accordingly, it emphasizes the importance of continuous operations in volunteer fire departments, which contribute to community safety and resilience, particularly in cases of adverse or catastrophic events.

2. NONPROFIT ORGANIZATIONS, VOLUNTEER FIRE DEPARTMENTS, AND PROTECTION SYSTEMS

Wilson (2016) states that nonprofit organizations face the same challenges as any other type of organization, whether they are corporations, cooperatives, educational groups, or other formal entities. Among the many types of organizations one might lead, nonprofits represent some of the greatest challenges for the modern leader. Although nonprofit organizations have existed for centuries, the Union Fire Company, founded in 1736 as the first volunteer fire company in the United States, is often considered one of the earliest examples. Over time, nonprofits have undergone numerous adaptations, including the gradual establishment of their formal definition (Franklin, Virginia). In general, nonprofit organizations provide significant support to every social community. In transitional countries, they play an even more important role by facilitating the shift from a planned economy to a market economy, that is, from socialism to parliamentary democracy. This process involves enacting new laws on nonprofit organizations, establishing registration bodies, and reducing

or completely eliminating state control over the civil sector. The need for sustainable and continuous operations places emphasis on finding tools that can ensure this, even though there is no legal obligation to do so. The nonprofit sector holds a vital position in the global society and it stands out through numerous activities without which modern life would be unrecognizable. According to global estimates, the nonprofit sector accounts for about 7.4% of total global employment, further confirming its importance within the economic and social system. According to the information available on the official websites of UNICEF, Greenpeace, and Doctors Without Borders, these nonprofit organizations achieve global reach through extensive volunteer networks. UNICEF operates in more than 190 countries with over 8,000 volunteers and procures a wide range of goods (medicines, food, medical devices, school supplies) while maintaining a strong quality control policy. It works exclusively with suppliers that comply with the ISO 9001 standard. Doctors Without Borders operates in more than 70 countries with over 63,000 volunteers and requires strict adherence to product compliance standards, ensuring that all procured products meet the relevant ISO standards. Greenpeace operates in more than 50 countries, bringing together over 15,000 volunteers, and adheres to its own internal standards while refusing to cooperate with organizations that fail to meet them.

At the end of 2020, Međimurske vode d.o.o. began the implementation of the international standard HRN EN ISO 22301:2019 – Business Continuity Management Systems, and the certificate was successfully obtained in August 2021 from DNV, under the accreditation of UKAS (London). By implementing this standard, Međimurske vode d.o.o. became the first organization in Croatia in the public water supply, drainage, and wastewater treatment sector to apply this standard.

The implementation of the ISO 22301 standard on Business Continuity Management – Requirements represents a strategic step forward for an organization that performs a public service, ensuring the systematic, efficient, and economical organization of the continuity of vital services in water supply and wastewater management. The system ensures the timely delivery of services with defined capacities and deadlines, thereby safeguarding the interests of service users and contributing to the protection of public health, safety, and the environment. Moreover, through an integrated quality management system that includes ISO 9001 and ISO 22301, along with structured documentation and processes spanning from impact and risk analysis, through operational activity planning, to annual reviews and continuous improvement, Međimurske vode d.o.o. introduces a high level of professionalism and resilience into the public water service system. Through this approach, the organization acts as a custodian of public goods and a public service provider that guarantees the uninterrupted fulfillment of the community's essential needs.

Globally, humanitarian, non-governmental, and nonprofit organizations such as Greenpeace, UNICEF, and Doctors Without Borders generally do not hold certification under the ISO 22301 standard, which pertains to business continuity management systems.

Unlike commercial entities, their operations are not based on formal ISO standards but on internal acts, operational protocols, international humanitarian principles, and national laws and regulations. Consequently, these organizations build their operations on established practices that demonstrate a high level of operational readiness, crisis management, and resilience. These practices are adapted to the specific field conditions in which they operate, where flexibility still takes precedence over formal standardization. In recent years, there has been a growing body of research addressing business continuity, with particular attention to the specific characteristics and challenges within the nonprofit sector. These studies focus on issues such as financial transparency, the role of information security in ensuring business continuity, the importance of organizational culture for resilience, and guidelines for improving continuity practices, especially within nonprofit organizations. Most of these studies were prompted by the COVID-19 pandemic, while a smaller portion deals with business continuity in the context of leadership transitions, human resource stability, and information security. The emergence of the COVID-19 pandemic revealed that the illusion of an organization as an impenetrable fortress, immune to external disruptions, no longer exists.

3. BUSINESS CONTINUITY MANAGEMENT IN ACCORDANCE WITH THE ISO 22301 STANDARD ON BUSINESS CONTINUITY MANAGEMENT – REQUIREMENTS

"Quality management system standards emerged primarily as a need for unified management of large and potentially sensitive systems" (Funda, 2012:29). The connection between business continuity management and quality management is significant, as both systems aim to increase the organization's resilience, reliability, and efficiency, although they approach this goal from different perspectives. When both of these theoretical frameworks are brought under a common denominator, it can be concluded that the standards emerged out of necessity and subsequently evolved in stages in order to develop more precise systems for protecting potentially endangered and sensitive organizations and their processes. Business Continuity Management (BCM) generally refers to a set of procedures, operations, and strategies adopted by an organization to ensure the continuity of its operations and the resumption of activities in the event of a crisis. It also involves the rapid recovery following an undesirable or unpredictable event that could disrupt normal operations. The need to implement business continuity into practice applies to all organizations that cannot allow interruptions in their operations or that require the continuous functioning of their systems, such as government institutions and public services, telecommunications and IT companies, healthcare institutions, financial organizations, logistics companies, and others. Disruption and an inability to recover can cause significant damage and loss to such organizations, while for their users, such an interruption could result in irreversible harm to health, property, or safety. Today, business continuity is an issue that, to some extent, affects almost every organization. It is evident that in the future, business continuity will become an essential tool and an integral part of organizational culture. "A business interruption results in the inability to provide services or produce goods required by interested parties, which the organization has committed to deliver" (Buntak and Kovačić, 2020:55). The goal of every organization, whether for-profit or nonprofit, is the achievement of its objectives, which can be realized by ensuring stable operations, minimizing business disruptions, and promptly removing obstacles in the event of an undesirable incident that interferes with the organization's normal functioning. Business Continuity Management (BCM) has the role of identifying, analyzing, and managing threats that may cause business interruptions, as well as developing plans for their mitigation and rapid recovery. According to Stoprd and Grgačić (2025:762), the most effective measures for avoiding undesirable events are well-implemented prevention and supervision, which not only prevent their occurrence but also reduce the need for extensive interventions and minimize the likelihood of damage. Planning, organizing, leading, and controlling represent the core features of business continuity management. According to Calder (2020), lack of preparedness leads to financial damage and reputational harm, which can cause lasting consequences for an organization, such as the loss of clients, missed business opportunities, or loss of market position. Since nonprofit organizations do not compete in the marketplace but rather in society, where they focus on individuals and key publics (e.g. sponsors, donors, beneficiaries, members, volunteers, the community, and the state), interruptions to their operations can have far-reaching consequences.

Table 1. Consequences of Business Interruption for an Organization's Key Publics

Key publics	**Impact**	**Outcome**
Members	Lack of motivation	Decline in engagement and activity
Volunteers	Lack of interest	Withdrawal or reduced support
Management	Increased pressure	Poor crisis management
Beneficiaries	Loss of confidence	Decreased interest
Sponsors and Donors	Loss of confidence	Termination of support and funding
Local Community	Doubt about reliability	Reduced support
Local Government	Doubt about capability	Possible regulatory consequences
State	Doubt about legal compliance	Possible regulatory consequences

Source: Authors, 2025

The damage caused by a business interruption in a nonprofit organization is not necessarily measured in financial losses, yet its impact can be just as devastating as in the case of for-profit organizations. For example, if a fire department were to temporarily suspend its operations for any reason, and this coincided with the occurrence of large-scale natural disasters, the consequences could be catastrophic. In such a situation, citizens would be deprived of adequate protection and professional assistance, thereby jeopardizing the safety of people and property. The damage resulting from an interruption of operations can far exceed the cost of implementing a business continuity management system.

According to the ISO 22301:2019 standard, business continuity refers to an organization's ability to continue delivering products and services during a disruption within an acceptable timeframe and at a predefined capacity. To prevent suspension or interruption of operations, ISO 22301 introduces a Business Continuity Plan that contains documented information that guides the organization to respond to disruptions, continue its operations, recover, and re-establish the delivery of products and services in alignment with its business continuity objectives. The ISO 22301 standard enables an organization to reach a state of competence, meaning that the organization becomes capable of applying knowledge and skills to achieve intended outcomes while continually improving through recurring activities aimed at enhancing performance.

"Through the ISO 22301 standard, the ISO organization defines guidelines that can be used by all organizations seeking to establish a business continuity management system" (Buntak and Kovačić, 2020:55). According to ISO (2019), the ISO 22301 standard is an international standard that provides organizations with a framework for planning, establishing, implementing, operating, monitoring, reviewing, maintaining, and continually improving a documented management system. The purpose of these activities is to protect against disruptive incidents and to ensure rapid recovery after a damaging event. "The business continuity management system emphasizes the importance of identifying all risks that an organization may face, that is, risks that could disrupt the organization's business continuity. Such risks should be mapped in order to create a risk map, and for each identified risk it should be defined how it will be mitigated or what actions will be taken if it occurs" (Kaczmerek, Nowicki, and Waszkowski, 2016:465–470; cited in Buntak and Kovačić, 2020:55).

Figure 1. Position of Business Continuity Management within Organizational Management

Source: Advisera website, available at: https://advisera.com/27001academy/hr/sto-je-iso-22301/

Since business continuity management is part of risk management, according to Advisera (website), there are overlaps between business continuity management, information security management, and IT management. The ISO 22301 standard on Business Continuity Management – Requirements was developed by leading experts in business continuity and it provides the best framework for managing business continuity within an organization. An additional advantage of this standard is that organizations can be certified by accredited certification bodies, thereby demonstrating compliance and gaining credibility with their key publics and stakeholders (Advisera, website). By obtaining certification under ISO 22301:2019, an organization demonstrates a regularly maintained and continually improved business continuity management system, the implementation of which reduces the likelihood of operational disruption and enhances the organization's ability to respond effectively and mitigate the resulting damage. Consequently, the organization achieves a stronger position in the society, particularly in the eyes of its stakeholders. According to the ISO 22301:2019 Business Continuity Standard Implementation Guide (2019:4), the purpose of the standard is not to achieve complete mitigation of the consequences of undesirable events, but rather to prepare for potential adverse incidents, with an emphasis on the organization's ability to adapt dynamically to change and to establish suitable plans to mitigate their impact. The ISO 22301 standard focuses on the managerial aspect, emphasizing the understanding of requirements, the setting of objectives, and the measurement of performance. Therefore, it is expected that this standard will increasingly be adopted by senior management, leading to its broader implementation worldwide (Kosutic, 2023).

4. IMPLEMENTATION OF THE ISO 22301 STANDARD IN THE OPERATIONS OF A VOLUNTEER FIRE DEPARTMENT

Before implementing the ISO 22301 standard, an organization must prepare thoroughly, since the process is not a quick or one-off task but a long-term, systematic approach to establishing effective business continuity management. This approach encompasses the entire organization, including organizational culture and employee awareness, the alignment of resources and responsibilities, continuous testing, and integration with the existing systems. For the implementation of a business continuity management system to be successful and purposeful, the organization must take specific actions and carry out certain activities. According to Buntak and Kovačić (2020:56), an organization must first determine which parts of its system will be covered by the business continuity management framework. In doing so, it should comply with applicable laws and align the process with its mission, vision, and objectives. The organization must also include all products, services, and processes; identify and analyze the requirements of all stakeholders, as well as their potential impact on the organization; and define plans adequate to ensure the continuity of operations. The implementation of the standard itself does not mark the end of the process but requires continuous measures and actions to maintain and ensure the stability of the implemented system. In accordance with the requirements of ISO 22301 and the general principles of business continuity management, the organization must continuously maintain and improve the system, conduct regular audits, training, and testing, and ensure that plans are updated in line with changes in both the internal and external environment. Maintaining compliance with the standard requires ongoing commitment and active management to ensure long-term organizational resilience.

According to Buntak and Kovačić (2020:56), organizations must ensure the necessary elements after establishing a business continuity management system, namely:

- professional knowledge, skills, and competencies of management that enable timely decision-making in risk situations and ensure business continuity,
- synergistic cooperation among all departments,
- timely, accurate, and adequate communication with all stakeholders,
- cooperation with suppliers, meaning that the organization–supplier relationship should be based on partnership,
- continuous education and the implementation of training involving simulated business interruptions and subsequent recovery.

As every organization, whether for-profit or nonprofit, which operates according to a set of principles such as operation, revenue management, performance measurement, transparency, and cost control, business continuity based on the ISO 22301 standard also relies on a series of principles. When applied consistently, these principles become an integral part of the organization's operations.

Table 2. Principles of the ISO 22301 Standard on Business Continuity Management – Requirements

Principle	Description
Principle of responsibility	Business continuity is the responsibility of management and is part of risk management; unclear roles and responsibilities endanger the plan.
Principle of clear objectives	Clear business continuity objectives make it easier to set priorities and allocate resources.
Principle of impact and risk assessment	The business continuity standard focuses on recognizing and planning possible risks, with an emphasis on anticipation.
Principle of communication	Emphasis is placed on timely and accurate communication with certain external or internal stakeholders.
Principle of testing	The business continuity management system is regularly tested to verify its effectiveness and introduce improvements.

Source: Authors' work based on the ISO 22301:2019 Standard on Business Continuity Management – Requirements, Business Continuity Standard Implementation Guide (2019:8)

Table 3. Benefits of Implementing the ISO 22301 Standard on Business Continuity Management – Requirements

Benefit	Description
Resilience	An effective business continuity management system demonstrates an organization's readiness for disruptions, which is particularly crucial in sectors where risk involves life, health, or property.
Increased security and resilience against failure, including protection of information technology systems	A business continuity plan supports the management of disruptions caused by all types of adverse events, including cyber threats and IT instability.
Protection of organizational value	The business continuity management system mitigates the effects of disruptions and adverse events, thereby saving time, money, and protecting the organization's reputation.
Competitive advantage	The ability to continue operations during or after a disruption, to recover quickly, and to maintain consistent delivery of products or services provides a competitive advantage, strengthens reputation, and ensures financial stability.
Added value	Implementing the ISO 22301 standard into operations makes any organization worthy of the time and resources invested. A clear organizational vision, commitment to protection, and readiness for rapid response create added value beginning with the organization's very name.

Source: Authors' own work based on the ISO 22301:2019 Standard on Business Continuity Management – Requirements, Business Continuity Standard Implementation Guide (2019:6)

"The environment in which today's organizations operate can be described as dynamically turbulent, and as a result, a large number of demands are placed on organizations by various stakeholders. To remain competitive and to ensure their existence in the market, organizations must adapt to newly emerging requirements" (Buntak, Kovačić, and Premužić, 2020:2). Accordingly, it can be stated that every process requires a certain adjustment period. However, it is crucial for organizations with established processes to decide on the implementation of processes and tools that will provide adequate and effective real-time protection of their position and operations. When implementing new business processes, management methods, or project execution strategies, appropriate implementation is required. During the implementation of new processes, it is important to ensure that the changes bring real benefits and are genuinely necessary for the organization.

Stoprd and Grgačić (2025:758–759) outline the steps for implementing the ISO 22301 standard within an organization's system as follows:

1. Identification of risks and impact assessment
2. Establishment of prevention and response strategy
3. Recovery planning and continuation of operations
4. Communication and coordination in crisis situations
5. Continuous improvement

Table 4. Recommendations for Successful Implementation of a Business Continuity Management System

Order	Recommendation	Description
1	Why implement?	Clear definition of the reasons for introducing the BCMS and alignment with the organization's management goals and strategic direction
2	Purpose of implementation	Determining the key aspects to which the BCMS will be applied
3	Involvement of key stakeholders	Involving management, members, and volunteers in risk assessment, process design, and procedure development
4	Ongoing communication	Informing all stakeholders about the reasons for implementing the BCMS and their roles during and after the procedure
5	External assistance	If there is a lack of personnel with the necessary expertise, external specialists should be engaged
6	Documentation	Processes and documentation must be understandable and updated when necessary
7	Establishing realistic rules	Overly complex rules may be unclear and unachievable
8	Suppliers	If suppliers do not align with organizational strategies, those that do should be selected
9	Education	Since business continuity is a new concept and may be unfamiliar to members, continuous and timely training must be conducted
10	Testing and control	A changing environment brings new challenges and threats; constant monitoring and allocation of resources for regular testing are key to maintaining functionality

Source: Authors' work and adaptation based on the ISO 22301:2019 Standard on Business Continuity Management – Requirements, Business Continuity Standard Implementation Guide (2019:28)

The complexity of certification and its high costs, combined with the limited practical benefits it offers, have led the nonprofit sector to selectively apply certain elements of the ISO 22301 Standard on Business Continuity Management – Requirements that are partially aligned with its operations. Although this standard is primarily used by for-profit organizations, nonprofit entities operating in

crisis areas or in the field of human protection apply elements that are consistent with the mentioned international standard. Nonprofit organizations such as the Red Cross, UNICEF, the World Health Organization, Doctors Without Borders, and similar entities should align their operations with the ISO 22301 Standard on Business Continuity Management – Requirements, given their widespread presence, the size of their human resources (including volunteers and members), and their international significance. By applying the PDCA cycle, planning becomes simpler, more structured, and adaptable, facilitating change management and continuous improvement. In the context of the PDCA cycle, within the specific field of fire protection, a transparent approach provides a foundation and clear evaluation of plans through the "Plan–Do–Check–Act" phases, which can then be systematically applied and further enhanced.

4.1.Planning

Global warming, as a pervasive global issue, has a significant impact on various geographical areas, particularly in remote and inaccessible regions. In this context, it is essential to ensure effective fire protection, especially in accordance with the ISO 22301 Standard on Business Continuity Management – Requirements, with an emphasis on continuous prevention.

Within the framework of ISO 22301, which refers to the Business Continuity Management System (BCMS), forest fires and their consequences can be viewed through the lens of risk identification and management, continuity planning, and the establishment of appropriate response mechanisms for crisis situations that may threaten operations and community safety.

4.2.Implementation

To implement the standard within the fire protection system, compliance with its requirements is crucial and is reflected through several key aspects.

Identification of risks and impact assessment**:** According to the ISO 22301 Standard on Business Continuity Management – Requirements, the first step in establishing a business continuity management system is the identification of risks and the assessment of their impact on operations. In this case, and as noted by Stoprd and Grgačić (2025:757), global warming and the projected 50% increase in the number of forest fires by 2050 represent a significant risk to human life, property, the environment, and economic activities. Forest fires can directly threaten business continuity in areas vulnerable to fire, including agricultural and forest lands, and can cause long-term ecological and economic consequences. Such forecasts demand the intensification of safety measures and the improvement of equipment to prevent unwanted events. Each year, thousands of forest fires break out, destroying millions of hectares of forests and land, polluting the air, and endangering human lives, animal habitats, and diverse native flora essential for preserving specific landscapes, all of which results in a long and complex recovery process.

The ISO 22301 Standard on Business Continuity Management – Requirements standard emphasizes the importance of a proactive approach to reducing the risk of disruptions to business activities. Prevention represents the most effective way to mitigate risks, not only from fire outbreaks but also from other adverse events that may threaten business stability. Prevention plans within the Business Continuity Management System (BCMS) should include employee training, infrastructural investments in fire protection, regular maintenance of equipment, and the development of strategies to reduce vulnerabilities in high-risk fire zones. Additionally, the implementation of effective early warning and rapid response systems for forest fires can significantly minimize negative impacts on business processes. The consequences of forest fires include health risks, the loss of entire ecosystems, and the destruction of parts of towns and settlements. Most fires occur as a result of human activity, which further highlights the need for preventive action. Fire protection in remote areas, particularly in forested and mountainous regions, represents a crucial issue due to its far-reaching ecological, economic, and social consequences.

4.3. Verification

Recovery planning and continuation of operations: Forest fires can cause severe consequences, including the destruction of ecosystems, air pollution, loss of habitats, and prolonged recovery of affected areas. For organizations operating in vulnerable regions, the ISO 22301 Standard on Business Continuity Management – Requirements requires that activities focus on developing recovery plans that enable a rapid return to normal operations. This includes creating plans for restoring property, infrastructure, human resources, and environmental protection. A key element within business continuity management is the importance of minimizing recovery time.

Communication and coordination in crisis situations: The ISO 22301 standard also places strong emphasis on effective communication and coordination in crisis situations. In the context of forest fires, it is essential to establish clear channels for communication and coordination among relevant bodies (government agencies, fire departments, local authorities, and other stakeholders) to ensure a timely and effective response. Additionally, organizations must have aligned internal and external communication plans to inform employees, customers, business partners, and the wider public in a timely manner about the status of the crisis and the measures taken or planned.

4.4. Action

Continuous improvement: According to the ISO 22301 standard, the business continuity management system must be subject to regular review and continuous improvement. Given that the fire season may become longer and that climate change is predictably intensifying, organizations must regularly update their plans in line with new information on risks, experiences from past crisis situations, and emerging technologies for fire prevention and suppression.

The existence of volunteer fire departments is reflected in their ability to respond quickly, efficiently, and with dedication to dangers that threaten people and property, as well as in their flexibility in adapting to new social changes and trends, providing support and encouraging individuals to contribute to safety and resilience (Stoprd, 2024:46). According to available information, there is currently no volunteer fire department (VFD) in the countries of the former Yugoslavia that operates in accordance with the ISO 22301 standard. The fact that the standard is primarily used in the business sector, combined with the high cost of certification (ranging from 4,500 to 15,000 euros), means that nonprofit organizations cannot afford this form of protection, as such an investment would jeopardize the organization's regular operations. The activities carried out by each volunteer fire department consist of preventive and response actions focused on fires, technical operations, natural disasters, and other public emergencies.

Implementation of the ISO 22301 Standard in a Volunteer Fire Department through Stages:

Starting Point: The implementation of the ISO 22301 standard on Business Continuity Management – Requirements emerges as a necessary step to ensure the operational capability and resilience of the organization. In the context of a volunteer fire department, continuous operational readiness is essential due to the constant need for alertness, a high level of expertise, and the ability to react quickly in the event of fires, earthquakes, floods, or other natural disasters. Systematic business continuity management enables the formalization of action plans, regular maintenance of equipment, and ongoing training of members, thereby increasing the level of preparedness and operational effectiveness.

Particular attention should be given to vulnerabilities within the structure of the VFD, which are reflected in limited financial resources, communication challenges, and variable member motivation. For this reason, the implementation of the ISO 22301 standard can serve as a tool for structured risk management, optimization of available resources, and strengthening of the organization's overall resilience in crisis situations.

Planning and Implementation: Readiness for emergency interventions, an effective internal communication system, member training, and equipment maintenance are key components of the continuous operation of a volunteer fire department.

Through risk analysis and assessment, it has been determined that during an adverse event or intervention by the volunteer fire department team, a series of undesirable situations may occur. Among the most significant are the loss of communication channels, failure of an emergency vehicle, interruption of power supply, or shortage of firefighting resources. All these issues may arise in the context of a large-scale fire that threatens human lives, residential buildings, as well as the operational equipment and resources of the VFD. Given this context, implementation of the ISO 22301 standard on Business Continuity Management – Requirements would allow the VFD to develop and establish clear business continuity plans and policies. This would ensure that, in a crisis situation, members of the organization are trained and prepared to resume their duties within the shortest possible and predefined timeframe. The goal is to prevent further escalation of the incident and to minimize its impact on human life, property, and operational capacity. A key element of such a system is the regular testing and exercising of all components of rapid recovery and operational continuity. It is essential to develop comprehensive plans, strategies, and contingency procedures that can be activated in the event of major disasters. In this way, the organization's resilience is enhanced, enabling effective and coordinated action in the most demanding situations.

Challenges: During the implementation and execution of activities aligned with the ISO 22301 standard on Business Continuity Management – Requirements, certain difficulties may arise due to the specific circumstances under which the volunteer fire department operates. One of the key challenges relates to limited financial resources, as the standard requires initial investments for establishing the system, as well as regular annual refinancing to maintain its effectiveness. Additionally, challenges may occur in the process of adaptation among members and volunteers who are unfamiliar with the standard and its principles of application. Since these individuals mostly participate on a voluntary basis, it is essential to approach training carefully, with particular emphasis on the practical benefits and importance of the standard for the VFD's daily operations.

Furthermore, technical and administrative requirements, such as ensuring adequate IT equipment and managing increased administrative workload, may also pose challenges, especially for organizations without permanently employed administrative staff. Considering this, it is recommended that the implementation of the ISO 22301 standard be carried out in stages over an extended period of time. Throughout this process, particular attention should be directed toward the continuous education of members and the gradual introduction of digital tools and administrative procedures. Such an approach will enable higher-quality and more efficient adaptation, reduce resistance to change, and, in the long term, enhance the resilience and operational readiness of the VFD.

Outcome: **Although** this is not the primary objective of the standard, its implementation increases the recognition and distinctiveness of the volunteer fire department, making it more attractive to donors and sponsors while raising interest in the organization and the profession itself. Establishing and exercising crisis management plans is the main objective of implementing the standard, ensuring a high level of preparedness and operational efficiency. The development of strategies, assessments, and plans also provides an additional educational benefit for new members and volunteers.

Future: All conducted exercises and evaluations, together with all plans, strategies, and assessments, as well as analyses of future conditions and needs, become part of the organization's legacy and evolve into its culture. The next step involves connecting fire departments that have implemented the standard and establishing a regional network of volunteer fire departments with interoperable business continuity plans (BCPs).

Table 5. Benefits of Implementing the ISO 22301 Standard on Business Continuity Management – Requirements in the Operations of the Volunteer Fire Department Budrovac

Component	Benefit	Relevant Stakeholders
Readiness for emergency interventions	Rapid and effective response in crisis situations	Local community Local government VFD
	Reduction of risks to human life and property	Local community Sponsors and donors
	Increased confidence in the capabilities of the VFD	Local government Sponsors and donors Members
Internal communication	Faster flow of information in crisis situations	VFD Members
	Clear lines of command and responsibility	VFD Members
	Improved coordination	Local government VFD Members
Education	Improvement of knowledge and skills	Members Volunteers
	Increased safety during interventions	Local community Members
	Motivation for long-term engagement	VFD Members Volunteers
Equipment maintenance	Longer equipment lifespan	VFD Sponsors and donors
	Equipment reliability	Local community Members
	Transparent resource management	Local government Sponsors and donors
Business continuity and risk management	System for preparedness and faster recovery from unexpected events	Local government Local community VFD
	Improved resource and activity planning	VFD Members and volunteers
	Attraction of sponsors and donors	VFD Members and volunteers
Added value	Enhanced reputation	VFD Members

Source: Authors, 2025

The previous Table presents a systematic overview of the key aspects and benefits of various activities within the operations of a volunteer fire department. The Table illustrates the relationship between activities, expected outcomes, and the stakeholders involved, with the aim of enhancing emergency response readiness, improving internal communication, advancing training and education, maintaining equipment, and ensuring business continuity and effective risk management. This overview clearly demonstrates how cooperation among the local community, authorities, members, volunteers, and sponsors contributes to the overall efficiency and trust in the VFD's operations. Each of the listed components, from emergency response readiness, internal communication, and education, to equipment maintenance, business continuity, and risk management, is essential for building a comprehensive and resilient organization aligned with the ISO 22301 standard. Through the synergy of these elements, the volunteer fire department becomes a prepared, modern, and reliable unit that responds effectively to challenges, protects the community, and ensures the long-term

sustainability of its operations. It is precisely this interconnection and alignment of processes that form the foundation of safety and trust in the organization's work.

For the successful implementation of the ISO 22301 standard on Business Continuity Management – Requirements in a volunteer fire department, it is essential to ensure full leadership support and the active involvement of all members. Education and raising awareness of the importance of business continuity management greatly contribute to understanding the objectives of the standard and enhancing its effectiveness. It is recommended to develop clear procedures for incident response, conduct regular exercises and continuity plan reviews, and maintain cooperation with local communities and emergency services. Implementing the ISO 22301 standard not only increases the organization's resilience to crisis situations but also strengthens public and partner confidence in its response capabilities. Through standardized processes and continuous improvement, the VFD becomes better prepared to face emergency situations, further reinforcing its fundamental humanitarian and protective role within the community.

5. CONCLUSION

Business continuity management is becoming increasingly important in the nonprofit sector, even though the application of the formal ISO 22301 standard on Business Continuity Management – Requirements is still in its early stages. While profit-oriented organizations are increasingly adopting this standard to enhance operational resilience, in the nonprofit sector, particularly within volunteer fire departments, internal policies, humanitarian principles, and proprietary operational protocols still prevail.

Despite the absence of formal certification, organizations such as UNICEF, Doctors Without Borders, and Greenpeace demonstrate a high level of preparedness, crisis management, and resilience adapted to the specific and often unpredictable field conditions in which they operate. Examples such as Međimurske vode d.o.o. confirm that the application of ISO 22301 is both feasible and beneficial within public and nonprofit-oriented organizations. By integrating quality management with business continuity management, such organizations are able to ensure service stability, protect users, and preserve the environment and public health.

This practice shows that the ISO 22301 standard can serve as a solid foundation for strengthening public trust, improving professional standards, and enhancing safety within nonprofit operations. However, the implementation of the standard is neither simple nor fast. It requires gradual execution and adaptation of the organizational structure, management processes, and organizational culture. In the nonprofit sector, these challenges are even more pronounced due to limited resources, specific missions, and a high dependence on donors and public trust.

In conclusion, the application of the ISO 22301 standard in volunteer fire departments represents a strategic step forward with great potential to strengthen the resilience, accountability, and sustainability of organizations that serve the community. The illusion of impenetrable operations under today's conditions no longer exists; resilience has become a necessity rather than a choice.

REFERENCES

[1] Advisera website, available at: https://advisera.com/27001academy/hr/sto-je-iso-22301/.
[2] BS EN ISO 22301 (2019). Security and resilence – Business Continuity Management systems – Requirements (ISO 22301:2019). The British Standard Institution. BSI Standards Limited 2019.
[3] Buntak, K., Kovačić, M. (2020). Upravljanje kvalitetom 1, practical manual, Koprivnica: University North.
[4] Calder, A. (2020) ISO22301: 2019 – An introduction to a business continuity management system (BCMS), United Kingdom, IT Governance Publishing.
[5] Franklin Virginia https://www.franklinva.com/government/departments/fire-and-rescue/fire-and-rescue-history/, accessed on September 13, 2025.

[6] Funda, D. (2012). Upravljanje kvalitetom, University of Applied Sciences Velika Gorica, Velika Gorica.
[7] Greenpeace: https://www.greenpeace.org/eu-unit/, accessed on September 14, 2025.
[8] ISO 22301:2019 Business continuity standard implementation guide. Available at: https://www.nqa.com/medialibraries/NQA/NQA-Media-Library/PDFs/NQA-ISO-22301-Implementation-Guide.pdf, accessed on August 16, 2025.
[9] Kaczmerek, M., Nowicki, T., Waszkowski, R. (2016). Ensuring Business Continuity. DEStech Transactions on Social Science. Education and Human Science, 465-470.
[10] Kosutic, D. (2023). What is ISO 22301? Available at: https://advisera.com/27001academy/what-is-iso-22301, accessed on September 5, 2025.
[11] Liječnici bez granica: https://www.doctorswithoutborders.org/who-we-are/our-history, accessed on September 14, 2025.
[12] Međimurske vode: https://medjimurske-vode.hr/implementacija-i-certifikacija-sustava-upravljanja-kontinuitetom-poslovanja-iso-22301-u-drustvu-medimurske-vode-d-o-o/, accessed on June 20, 2025.
[13] Stoprd, M. (2025). Upravljanje kontinuitetom poslovanja neprofitnih organizacija primjenom zahtjeva norme ISO 22301 Upravljanje kontinuitetom poslovanja - Zahtjevi, Master's thesis, Koprivnica: University North.
[14] Stoprd, M. Grgačić, I. Fire protection of inaccessible areas with a focus on prevention, 15. International Quality Conference, Conference manual, Kragujevac 2025, 757-765.
[15] UNEP and GRID-Arendal. (2022). *Spreading like wildfire: The rising threat of extraordinary landscape fires.* Nairobi: United Nations Environment Programme (UNEP).
[16] Unicef: https://www.unicef.org/supply/quality-assurance-medicines-and-nutrition-products, accessed on September 24, 2025.
[17] Wilson, R., Kent. (2016). Steward leadership in the nonprofit organization. IVP Books, Illinois.

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ENTREPRENEURIAL EDUCATION AS A DRIVER OF BUSINESS QUALITY IN SMALL AND MEDIUM-SIZED ENTERPRISES

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Abstract: *In conditions of intense competition and dynamic market changes, small and medium-sized enterprises (SMEs) represent the main drivers of economic development and innovation. A key factor in their success increasingly lies in the quality of business operations, which is based not only on technological and financial resources but also on the competencies and entrepreneurial knowledge of employees.The aim of this paper is to examine the role of entrepreneurial education in strengthening the quality of business operations of SMEs in Serbia. Empirical research was conducted between December 2024 and January 2025 on a sample of 98 employees from the SME sector. Data were collected using a structured questionnaire, and the results were analyzed through descriptive statistics.The research included an assessment of competencies developed through formal and informal entrepreneurial education, as well as their impact on service quality, innovation, efficiency, and customer satisfaction. The findings indicate that employees who have attended entrepreneurial education programs, developed digital and business skills, and enhanced their problem-solving abilities evaluate the quality of their organization's operations as higher compared to those who have not participated in such training.Particular emphasis is placed on the importance of practical knowledge and continuous workplace learning as mechanisms for strengthening competitiveness. As a key recommendation, the study highlights the need for stronger cooperation between educational institutions and the business sector, the development of lifelong learning programs, and customized training initiatives for employees in the SME sector.*

Keywords: *Entrepreneurial education, quality of business operations, small and medium-sized enterprises, competencies, innovativeness*

JEL Classification*:L26*

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1. INTRODUCTION

In the contemporary business environment, characterized by digital transformation, intense competition, and rapidly changing market demands, small and medium-sized enterprises (SMEs) play a crucial role in economic development and employment. The quality of business operations in these enterprises is no longer merely a matter of product or service control but has become a question of learning, innovativeness, and employee competencies.

Entrepreneurial education encompasses the acquisition of knowledge, skills, and attitudes that enable individuals to recognize opportunities, manage resources, create value, and innovate within an organization. According to the European Union, the EntreComp (Entrepreneurship Competence Framework) defines the knowledge, skills, and attitudes required for entrepreneurial activity as a lifelong competence — not only for individuals but also for organizations that strive to be agile and achieve quality outcomes. The literature increasingly emphasizes that entrepreneurial competencies such as the ability to identify opportunities, manage risk, innovate, demonstrate self-confidence, and act proactively have a significant effect on firm performance. Le et al. (2022) highlight that entrepreneurial competencies represent the foundation of SME competitiveness. Many authors (Šormaz, 2021; Vemić, Hrechyshkina, Samakhavets, 2022; Stojković Hadži Kastratović & Stanković, 2022; Vujičić et al., 2021) underline the importance of technological advancement, innovation, and education across all areas of business activity.

However, although numerous studies have linked entrepreneurial education with overall performance and business success, the direct relationship between education and business quality in small and medium-sized enterprises has been less explored. Arenda et al. (2025) found that while entrepreneurial education significantly enhances self-confidence and individual capacity, it does not necessarily have a direct impact on a company's financial performance. Entrepreneurial education can serve as an important tool for improving business quality in SMEs, but it is essential to analyze how it is implemented, which competencies are developed, and how these competencies influence the quality of processes, services, and products within organizations.

Business quality can be viewed as a multidimensional concept encompassing the reliability of services and products, customer satisfaction, process efficiency, and innovativeness (Garvin, 1987). While traditional models of quality focus on systemic and procedural aspects, modern approaches place human capital at the center, as employees with well-developed competencies are those who execute, adapt, and improve processes.

The aim of this paper is to examine the role of entrepreneurial education as a driver of business quality in small and medium-sized enterprises in Serbia. The objectives are:

1. to identify which employee competencies are most commonly developed through educational programs in SMEs;
2. to determine the extent to which employees in these enterprises perceive these competencies as contributing to business quality; and
3. to explore whether there are differences in the perception of business quality depending on whether employees have undergone training or not.

It is hypothesized that SMEs that invest in the entrepreneurial education of their employees achieve a higher level of business quality in terms of more efficient processes, greater innovativeness, improved customer experience, and enhanced flexibility in a changing environment. It is expected that employees who have completed relevant training programs have a deeper understanding of the concept of quality and are better able to participate actively in improving organizational practices.

2. LITERATURE REVIEW

In today's business environment, where change is rapid, competition is intense, and technological transformation is constant, small and medium-sized enterprises (SMEs) face the challenge not only of surviving but of achieving excellence. Business quality is no longer just about compliance with

standards or process control it has become a matter of connection between people, processes, and innovation. This is why entrepreneurial education is essential, as it serves as a mechanism that develops employees' ability to recognize opportunities, manage resources, innovate, and adapt to changing conditions. Entrepreneurial education enables organizations to enhance the competencies of employees needed for dynamic and high-quality business performance.

Research indicates that entrepreneurial competencies such as opportunity recognition, decision-making, risk management, innovativeness, and social skills have a significant impact on SME performance. For example, systematic literature reviews show that entrepreneurial competencies have become an increasingly frequent topic of research and that their development has important implications for the resource-based view theory of organizations (Khuong & Hoang, 2024). Empirical studies also associate these competencies with improved business performance, greater innovation, and sustainability (Man et al., 2022), further confirming the importance of focusing on human capital. Entrepreneurial education, on the other hand, aims precisely to develop these competencies among employees and potential entrepreneurs, and therefore represents a key tool for enhancing business quality.

However, while numerous studies have examined the link between entrepreneurship education and overall business performance, far fewer have focused directly on the relationship between education, competencies, and concrete indicators of business quality in SMEs. For instance, Arend et al. (2025) conclude that although entrepreneurial education significantly increases individuals' sense of competence and self-confidence, its impact on firm performance is not always evident. This highlights the need for a deeper understanding of how and under what conditions education leads to organizational quality, rather than merely to intention or potential. Nikolić et al. (2025) also emphasize that education and entrepreneurial skills are key factors in improving business performance.

A review of the literature further suggests that for the effective application of entrepreneurial education and competencies to business quality, organizational culture and support systems play a crucial role including continuous learning, knowledge sharing, and feedback mechanisms. Hammouda (2024) notes that technological educational methods (such as online tools and simulations) can positively influence the development of entrepreneurial competencies, but their impact on business quality remains underexplored.

Research findings indicate that entrepreneurial education has the potential to become a strategic driver of business quality in SMEs, but only if it is aligned with competency development and organizational support. For education to truly result in improved business quality, SMEs must develop supportive infrastructure, recognize human capital as a strategic resource, and enable employees to translate their competencies into practical, value-creating actions.

3. RESEARCH METHODOLOGY

For the purposes of this study, an empirical research was conducted between December 2024 and January 2025 on a sample of 98 employees from small and medium-sized enterprises (SMEs) in Serbia operating in the sectors of trade, services, manufacturing, and hospitality. The sample was formed using purposive sampling by selecting enterprises with clearly defined business processes and experience in employee training. Out of the total number of respondents, 57 were women (58.2%) and 41 were men (41.8%). The age structure shows that the largest proportion of respondents were between 31 and 40 years old (32.7%), followed by those aged 41–50 (28.6%), while respondents under 30 years accounted for 21.4%, and those over 50 years for 17.3%. This structure provides a solid basis for analyzing the influence of life and work experience on the practical application of entrepreneurial knowledge.

Regarding educational background, most respondents had secondary education (46.9%), followed by higher education (36.7%), while 9.2% held a master's or doctoral degree, and the smallest proportion had completed only primary education (7.2%). Data on work experience indicates that the highest

percentage of respondents had between 10 and 20 years of experience (40.8%), followed by those with up to 10 years (33.7%), while 25.5% had more than 20 years of work experience.

The research was conducted using a structured questionnaire consisting of a total of 20 questions: four questions related to demographic characteristics, while sixteen questions focused on assessing the impact of entrepreneurial education and competencies on the quality of SME business operations. Responses were provided on a five-point Likert scale (1 – strongly disagree; 5 – strongly agree).

The questions were designed to cover four key indicators of development through entrepreneurial education: (1) acquisition of entrepreneurial knowledge and skills, (2) development of innovativeness and proactivity, (3) the ability to improve process quality and customer satisfaction, and (4) the transfer of education into practice and business results.

The reliability of the instrument was tested through a statistical calculation of internal consistency, resulting in a Cronbach's α value of 0.87, indicating a high level of reliability. Data were collected anonymously, using both electronic questionnaires and printed forms, depending on the company's internal procedures and preferences. Prior to the research, respondents were informed about the purpose of data collection, emphasizing voluntariness, confidentiality, and the exclusive scientific use of the results, thereby ensuring full adherence to ethical research standards.

The methodological framework was designed to provide answers to the following research questions:

1. To what extent does entrepreneurial education influence the quality of business operations in SMEs?
2. Does such education help employees develop competencies relevant to the quality of business processes?
3. Are there differences in the perception of business quality between employees who have received training and those who have not?
4. Which aspects of education do employees consider crucial for improving business quality?

This methodological approach made it possible to obtain reliable empirical findings on how the development of competencies through entrepreneurial education contributes to the improvement of business quality in small and medium-sized enterprises in Serbia.

4. RESEARCH RESULTS

The results of the conducted research, which aimed to examine the role of entrepreneurial education in improving the quality of business operations of small and medium-sized enterprises (SMEs) in Serbia, clearly demonstrate the connection between employees' developed competencies and the way enterprises achieve their business goals. An analysis of the responses from 98 employees revealed that most respondents had the opportunity to participate in some form of formal or informal entrepreneurial education, whether through internal training, professional seminars, or continuous professional development programs. These forms of education contributed to enhancing employees' ability to take a more active role in business decision-making and to improving operational processes.

Most of the respondents stated that the education they received helped them acquire knowledge and skills that improved their understanding of their work and how it affects the quality of provided services or products. Employees believe that education helped them better recognize customer expectations and identify actions that lead to higher customer satisfaction. In practice, this translates to fewer mistakes, greater efficiency, and more stable workflows, all of which are key indicators of business quality. Most respondents emphasized that they now feel more confident in making decisions and more willing to take responsibility for their work outcomes.

The results also show that entrepreneurial education significantly influences employees' motivation to propose new ideas and business improvements. Employees who had access to training programs rated themselves as considerably more innovative and responsive to change. Their self-confidence and willingness to go beyond their regular duties represent an important quality that contributes to building an organization's competitive advantage. More than four-fifths of respondents believe that

their work significantly affects the quality of operations and that they possess competencies that can contribute to the organization's growth. This perception indicates a high level of awareness of their individual role within the organization, forming a strong foundation for developing quality within SMEs.

An important finding of the study is that employees who have participated in educational programs differ significantly from those who have not. The first group reports a greater personal capacity for innovating business processes, making decisions more easily, and more frequently proposing new solutions that improve quality. Their average scores regarding the impact of their work on business quality were substantially higher than those of the second group. This confirms that education is not merely an additional component but an integral part of quality performance within organizations.

However, although employee competencies are at a high level, the study revealed that organizational support is considerably weaker compared to the individual motivation of respondents. Many enterprises lack a clearly defined system for providing feedback and encouraging competency development. Employees stated that their contributions to work quality are often insufficiently recognized and that proposed innovations are not always implemented in practice. This finding indicates a gap between employees' abilities and the opportunities the organization provides for applying them.

Employees gave the lowest scores to questions related to the lack of rewards for quality contributions, the absence of accessible training during employment, and the lack of systems for sharing knowledge among colleagues. Although employees feel they possess the necessary knowledge and potential, organizations sometimes slow down the transformation of this potential into concrete quality improvements. During the research, several respondents pointed out that their innovation proposals were not implemented or that high-quality performance was expected without adequate conditions for its development. This situation indicates that while knowledge and motivation exist, the organizational system often fails to provide sufficient support.

From a demographic perspective, employees with longer work experience, particularly those over 40 years of age, were more likely to associate their education with improved business quality. They also possess so-called "tacit expertise," which is crucial for maintaining process stability. Conversely, younger respondents tend to associate entrepreneurial education with innovation and digital business improvements. This generational complementarity represents an important opportunity for team-based quality development in SMEs.

The results also reveal that the formal level of education is not the only decisive factor in ensuring quality, since a large proportion of employees with secondary education are directly involved in operational processes and significantly influence final outcomes. Nevertheless, educational programs focused on developing entrepreneurial skills further strengthen their ability to improve work quality and reduce errors in daily activities.

The findings confirm that entrepreneurial education has a strong positive impact on the business quality of SMEs in Serbia. It contributes to the development of employee competencies, enhances innovation and proactivity, increases process efficiency and customer satisfaction, and helps create organizations capable of adapting to market challenges and continuously improving their operations. However, to fully realize the potential of education, SMEs must provide stronger support to employees in implementing what they have learned. In other words, organizations must establish systems that enable knowledge to become quality.

This research shows that employees represent the key link in the quality chain, but success depends on how much opportunity they are given to apply their knowledge. When an organization recognizes its employees as drivers of development, entrepreneurial education becomes a strategic tool leading to greater competitiveness and a sustainable future for SMEs.

5. DISCUSSION

The results obtained provide a clear picture of how entrepreneurial education influences the quality of business operations in small and medium-sized enterprises (SMEs). The findings indicate that employees highly value the competencies they have gained through education and believe these competencies significantly impact efficiency, innovation, and customer satisfaction. This confirms that human resources represent the most valuable developmental potential of SMEs, aligning with modern theories of quality management and business competitiveness.

One of the most notable findings is the employees' strong sense that their work has a direct and decisive impact on the quality of products and services. Most respondents believe that applying the acquired knowledge leads to fewer errors, improved communication, and more efficient business processes. This perception reflecting a high level of professional responsibility and engagement represents a powerful factor in enhancing business quality. In practice, this means employees are willing to take initiative and influence the final outcome of their work, which is one of the defining characteristics of an entrepreneurial mindset.

The results also confirm that entrepreneurial education stimulates employee innovation. Respondents demonstrated a pronounced readiness to propose new ideas and improvements, as well as to actively seek solutions when business problems arise. Since innovation is considered the foundation of quality and modern business performance, it can be concluded that organizations investing in employee education create an environment where creativity, motivation, and continuous improvement are central to business practice.

Interestingly, respondents who participated in various educational programs achieved significantly better results in all assessed aspects of business quality compared to their colleagues who did not take part in such training. This difference was particularly evident in areas such as identifying customer needs, adapting to market changes, and recognizing opportunities for business improvement. This finding empirically confirms that systematic employee education is a key instrument for building competitive advantage. In other words, educated employees enhance organizational quality.

However, while individual employee potential is clearly evident, organizational support for their development is often limited. Many respondents pointed to a lack of adequate feedback, structured training programs, and formal reward systems for innovation. This is particularly significant because even the most effective educational programs will not yield the desired results if organizations do not provide the conditions necessary for applying newly acquired knowledge.

For this reason, a gap is evident between employees' high competency levels and their insufficiently utilized potential in practice. Such a situation implies that SMEs must devote greater attention to developing internal support systems for employees through mentorship, feedback, motivational policies, and opportunities for continuous professional growth. These mechanisms transform knowledge into quality and ensure the sustainability of achieved results.

From an age structure perspective, the findings reveal an interesting combination of experience and innovation. Older employees often rely on knowledge gained through long-term experience, which contributes to process stability. Conversely, younger workers emphasize the importance of digital and modern entrepreneurial skills, enhancing organizational agility. This combination of experience and innovation can be viewed as a key model for team-based quality development in small and medium-sized organizations, showing that different generations contribute to quality in complementary ways.

When considering the educational structure of respondents, it becomes evident that employees across all qualification levels play an important role in business quality. Those with secondary education are often closest to operational processes and directly influence customer experience, while highly educated employees contribute to process improvements and performance analysis. Entrepreneurial education, therefore, holds value for all employee categories, regardless of their formal education level, confirming its universal applicability.

Based on the theoretical framework and research findings, it is clear that business quality in SMEs cannot be viewed solely through technical, procedural, or externally defined standards. Quality is primarily the result of human effort expertise, motivation, creativity, and readiness to evolve alongside the market. Therefore, investing in employee development is not merely an enhancement of the existing system but a condition for organizational survival in the modern market. If SMEs wish to increase efficiency and competitiveness in the long term, they must promote a learning culture as an integral part of organizational strategy. When knowledge is actively shared, ideas are recognized and valued, and mistakes are treated as opportunities for improvement, the organization creates the foundation for lasting quality. Such a model has shown the best results in practice within more developed economies.

The findings of this research convey an important message for the SME sector: quality can be improved from within, through people, not just through technical or control mechanisms. Motivated, competent, and engaged employees become the true drivers of a quality strategy. Their contribution becomes visible through reduced costs, better work organization, higher customer satisfaction, and the creation of new market value. Entrepreneurial education serves as a powerful catalyst for business quality in small and medium-sized enterprises, but its full effect is achieved only when combined with adequate organizational support. SMEs that recognize the importance of this synergy secure a stronger market position, greater resilience to change, and the capacity for sustainable growth. Employees have demonstrated the knowledge, competencies, and willingness to contribute but it is up to organizations to provide the environment that enables them to do so.

6. CONCLUSION

The quality of business operations in modern small and medium-sized enterprises (SMEs) represents one of the key factors for survival and development in conditions of intense market change. The results of the research conducted clearly indicate that entrepreneurial education has a significant and direct impact on improving business quality, as it contributes to the development of employee competencies essential for efficient task performance, innovation, and customer satisfaction. Through the analysis of employee perceptions, it was found that they largely recognize the connection between the knowledge acquired through education and the results achieved within their organizations. Confidence at work, willingness to take initiative, and awareness of the consequences of their actions show that employees understand their role in ensuring quality.

A significant finding of the research is that employees who have undergone some form of entrepreneurial education differ substantially from those who have not, particularly in their self-assessment of efficiency, ability to recognize opportunities for improvement, and decision-making. This confirms that the development of entrepreneurial competencies is not only educational but also a strategic process that influences the overall business performance. Education encourages employees to challenge established practices and introduce initiatives that can contribute to the long-term competitiveness of SMEs. In this way, it becomes a driving force through which companies achieve higher quality, adaptability, and operational stability.

On the other hand, the results also point to certain limitations in the practice of SMEs in Serbia. Although employees possess knowledge and motivation, organizational support for their development and the application of competencies is still not at a satisfactory level. The lack of adequate feedback, systematic reward mechanisms, and continuous training represents a major obstacle that slows down the transformation of acquired knowledge into real business advantages. This confirms that the development of human capital and the improvement of the organizational environment must be interdependent processes if a high level of quality is to be achieved.

Considering the obtained findings, it can be concluded that entrepreneurial education has a dual contribution: it directly affects employees by developing their abilities and indirectly affects the organization by improving the quality of processes, services, and customer relations. The key to success lies in organizations recognizing education as an investment rather than a cost and shaping a

learning culture that ensures knowledge is not confined to individuals but becomes a driver of collective success.

The results of this research clearly confirm that the future of the SME sector in Serbia depends on the ability of organizations to develop, motivate, and support their employees. Entrepreneurial education is not merely a tool for individuals but a strategic source of quality, innovation, and growth for the entire organization. When employees' knowledge and motivation are combined with a supportive organizational system, a foundation is created for sustainable competitive advantage and continuous improvement in overall business quality. In other words, human resources are the bearers of quality, and entrepreneurial education is the tool that enables it. For this reason, investing in the development of human capital represents the most important and most profitable investment for modern SMEs striving to secure a stable and successful market position.

LITERATURE

[1] Arend, R., Unal, A., & Bilodeau, R. (2025). Does Entrepreneurial Education Matter for the Performance of Medium-Sized Venture Entrepreneurs? Administrative Sciences, 15(3), 75. https://doi.org/10.3390/admsci15030075

[2] European Commission. (2016). Entrepreneurship Education – the EntreComp Framework. Retrieved from https://single-market-economy.ec.europa.eu/smes/learn-and-plan-entrepreneurship/entrepreneurship-education_en

[3] Gunartin, Pratikto, H., Winarno, A., & Restuningdiah, N. (2023). The Role of Entrepreneurial Competencies: Successful Key SMEs a Literature Review. International Journal of Professional Business Review, 8(7), e01955. https://doi.org/10.26668/businessreview/2023.v8i7.1955

[4] Hammoda, B. (2024). The impact of educational technologies on entrepreneurial competencies: A systematic review of empirical evidence. Knowledge Management & E-Learning, 16(2), 309–333. https://doi.org/10.34105/j.kmel.2024.16.015

[5] Khuong, N. M., & Hoang, Q. T. (2024). Entrepreneurial competencies – A systematic literature review. Journal of International Entrepreneurship, 23(1), 54–130. https://doi.org/10.1007/s10843-024-00356-7

[6] Le, Q. H. (2022). Role of entrepreneurial competence: The competitiveness of small and medium-sized enterprises. Retrieved from https://www.econstor.eu/bitstream/10419/261310/1/1808746562.pdf

[7] Man, T., Lau, T., & Snape, E. (2022). Entrepreneurial Competencies and SMEs' Performance in Bangladesh. Sustainability, 14(20), 13643. https://doi.org/10.3390/su142013643

[8] Monday, S. B. (2024). Entrepreneurial Education and Business Performance. World Journal of Entrepreneurial Development Studies, 9(7), 194-205.

[9] Mulder, M., & Hulsink, W. (2008). Entrepreneurial Education and Training in a Small Business Context: Insights from the Competence-Based Approach. Wageningen University.

[10] Nikolić, M., Vujičić, S., Momčilović, O., & Ranisavljević, M. (2025). The impact of education and entrepreneurial skills on the financial performance of agricultural entrepreneurs. Economic of Agriculture, 72(3), 963–982. https://doi.org/10.59267/ekoPolj2503963N

[11] Sendra-Pons, R. Peris-Ortiz, & M. C. (2022). A review of entrepreneurship education research and practice. Journal of Management & Business Education.

[12] Sreenivasan, A. (2023). Twenty years of entrepreneurship education: a bibliometric review. Education + Training. PMC.

[13] Stojković Hadži S., Kastratović E.,Stanković Lj. (2022) Inovacija kao način povećanja konkurentnosti privrede, Trendovi u poslovanju,vol. 10, br. 1, str. 18-25

[14] Šormaz G. Značaj preduzetništva i inovativnosti za ekonomski razvoj Republike Srbije, Trendovi u poslovanju, 2021, vol. 9, br. 2, str. 30-39

[15] Vemić, M., Hrechyshkina, O., Samakhavets, M. (2022). „On the potentialities of an innovation council concept in the Belarusian research and technological development, International Journal of Economics and Law, April 2022 ,Vol.12, No. 34

[16] Vidal, D. D. (2021). Enhancing entrepreneurial competencies through podcasts and digital tools. Journal of Small Business & Enterprise Development.

[17] Vujičić, S., Ravić, N., & Nikolić, M. (2021). Uticaj planiranja na razvoj inovacija u malim i srednjim preduzećima. Trendovi u poslovanju, 17(1), 78–83

CULTURAL INFLUENCES ON HUMAN CAPABILITIES AS A COMPETITIVE ADVANTAGE IN FIRMS IN SERBIA USING LINEAR REGRESSION AND AI MODEL

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Abstract: *This study investigates the influence of organizational culture factors on the perception of human capabilities as a source of competitive advantage in domestic and foreign companies operating in Serbia. Using linear regression and Multilayer Perceptron (MLP) neural network analyses, we identify key predictors and their relative importance. For domestic firms, teamwork, employee competence, and systematic goal monitoring emerge as the most critical factors, reflecting Serbia's collectivist and stability-oriented cultural context, as informed by Hofstede's cultural dimensions. In contrast, foreign firms prioritize innovation, visionary leadership, and balancing short- and long-term demands, aligning with individualistic and performance-driven values of their Western origins. The MLP models demonstrate robust predictive performance, with training and testing relative errors indicating reliable generalization. By integrating linear and nonlinear modeling approaches, this research provides a nuanced understanding of how cultural contexts shape the role of human capabilities in fostering competitive advantage, highlighting distinct organizational priorities between domestic and foreign firms.*

Keywords: *organizational culture, human resources, competitiveness, organization, national culture.*

JEL Klasifikacija*:O15, M14*

1. INTRODUCTION

There are numerous factors which influence effective company performance[4], but organizational culture, human capital, and innovative capabilities are considered to be the fundamental resources of

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[4] Wojtczuk-Turek,A., The role of organizational culture and human capital management in process organization, Service Management, vol. 14, no. 3, pp. 39–48, 2014.

competitive advantage[5]. Modern managers believes that "companies win or lose based on the cultures they create"[6] i.e that "the key to long-term success and competitiveness lies not in individual strategies or in effective resource management, but in the cultural dimension."[78]. The attitude towards employees, the values that are nurtured, the way of thinking and attitudes will shape the way people behave and their attitude towards work, and they are the bearers of the ultimate success or failure of the company.

The rest of the paper will present the results of research into the impact of organizational culture factors on human capabilities as a source of competitive advantage in domestic and foreign companies operating in Serbia.

2. METHODOLOGY

The research was conducted using a questionnaire based on the Denison Organizational Culture Model through in-person data collection. The sample consisted of 1,000 participants, and the data were analyzed using IBM SPSS software.

The study utilized a blend of traditional statistical methods and artificial intelligence techniques to thoroughly explore organizational culture factors. Initially, linear regression was employed to assess the significance of individual factors impacting human capital in both domestic and foreign firms. Key metrics, including R^2, adjusted R^2, ANOVA significance, and standardized coefficients, were used to evaluate the model's fit and the relative impact of each factor.

To enhance the regression findings and detect potential nonlinear relationships, a Multilayer Perceptron (MLP) neural network was applied. The MLP model generated normalized importance scores for each factor, enabling a ranking of their influence on human capital. Comparative analysis between domestic and foreign companies revealed distinct priorities: domestic firms emphasized teamwork and technical expertise, whereas foreign firms focused on innovation, leadership, and balancing strategic objectives.

This combined methodology provides a deeper understanding of the human element in organizational culture, integrating linear insights from regression with nonlinear patterns and rankings identified by AI, thereby delivering valuable guidance for managerial and HR practices.

3. RESULTS

3.1. Interpretation of regression results

The obtained values of the coefficient of determination ($R^2 = 0.526$ for domestic and $R^2 = 0.457$ for foreign companies), table 1, indicate that the regression models explain a significant portion of the variance in the dependent variable. Considering that the study was conducted on a large sample of over 1,000 companies and deals with complex phenomena of organizational culture, such high percentages of explained variance can be regarded as very good results. In management and organizational research, where employee attitudes and behaviors are influenced by numerous latent and interdependent factors, R^2 values between 0.3 and 0.5 are already considered evidence of valid and stable models. Therefore, the results of this study confirm that the analyzed aspects of organizational culture have a strong and practically relevant impact on the perception of human capabilities as a source of competitive advantage.

[5] Liu, Y. and Hussain, I.A., The impact of organizational culture on organizational performance: The mediating role of employee engagement, in International Journal on Culture, History, and Religion, vol. 7, no. SI2, pp. 693–709, 2025, https://doi.org/10.63931/ijchr.v7iSI2.238.

[6] Alvesson M. (2002), Understanding organization culture, SAGE Publications, London, p. 2

[7] Bakacsi, G., Takács, S., Karácsonyi,A. and Imrek, V., "Eastern European cluster: Tradition and transition, Journal of World Business, vol. 37, no. 1, pp. 69–80, 2002, https://doi.org/10.1016/S1090-9516(01)00075-X.

[8] Janićijević, N. (1997), Organizaciona kultura:kolektivni um preduzeća, ULIXES Novi Sad, Fculty of economics, Belgrade, p. 23

Table 1.Model fit indicators for regression models

Company Type	R	R^2	Adjusted R^2	Std. Error of the Estimate	F (ANOVA)	Sig.
Domestic (N=859)	0.725	0.526	0.523	0.829	157.577	0
Foreign (N=141)	0.676	0.457	0.433	0.894	18.803	0

Dependent variable: The capabilities of people are viewed as an important source of competitive advantage.

R^2 indicates that the regression model explains 52.6% of the variance in domestic companies and 45.7% in foreign companies. Both models are statistically significant ($p < .001$).

Several relevant sources discussing the interpretation of R^2 in social and organizational research are given in the table 2 as well as benchmark values for R^2 interpretation in social and organizational research, table 3.

Table 2. Interpretation of R^2 values in social and organizational research

Model / Sample	R^2	Sample Size (N)	Interpretation	References
Domestic companies	0.526	859	Explains a substantial portion of variance in the dependent variable; considered very good given the complexity of organizational culture.	Hair et al. (2019); Cohen (1988); Falk & Miller (1992)
Foreign companies	0.457	141	Explains a significant portion of variance; above commonly accepted thresholds for valid and stable models in management research.	Hair et al. (2019); Cohen (1988); Falk & Miller (1992)

Hair et al. (2019)[9] states that in the social sciences, R^2 values between 0.20 and 0.50 can be considered acceptable, given the complexity of phenomena influenced by many factors. Cohen[10] provides guidelines for effect size (f^2), where R^2 values of about 0.02 (small), 0.13 (medium), and 0.26 (large) represent different degrees of explained variance in social research. Thus, anything above 0.26 already indicates a substantial model. Falk & Miller (1992)[11] note that an R^2 value of 0.10 is the minimum acceptable threshold, while 0.30 or higher is considered satisfactory in social research.

Table 3. Benchmark values for R^2 interpretation in social and organizational research

Source	Guideline / Thresholds
Cohen (1988)	Small effect: $R^2 \approx 0.02$; Medium effect: $R^2 \approx 0.13$; Large effect: $R^2 \approx 0.26$
Hair et al. (2019)	R^2 values between 0.20 and 0.50 acceptable in social sciences, due to complexity of constructs
Falk & Miller (1992)	Minimum acceptable R^2: 0.10; satisfactory: ≥ 0.30
General management research	R^2 between 0.30–0.50 usually considered valid and stable; > 0.50 strong explanatory power

[9] Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. , Multivariate Data Analysis (8th ed.), Cengage Learning EMEA, United Kingdom, 2019.

[10] Cohen, J., Statistical Power Analysis for the Behavioral Sciences (2nd ed.), Lawrence Erlbaum Associates, united States of America, 1988.

[11] Falk, R. F., and Miller, N. B., A Primer for Soft Modeling, University of Akron Press, 1992.

For domestic Companies the model explains approximately 52.6% of the variance in the dependent variable ($R^2 = 0.526$). Adjusted $R^2 = 0.523$ indicates a very stable result, with minimal risk of overfitting. Standard Error = 0.829 reflects the average prediction error, which is relatively moderate. All predictors are statistically significant ($p < 0.05$).

Table 4. Regression Coefficients

Dom / For	Factor	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.	Collinearity Statistics	VIF
		B		Beta			Tolerance	
Domestic companies	(Constant)	0.294	0.114		2.587	0.01		
	Problems seldom arise because we have the skills necessary to do the job	0.163	0.03	0.162	5.489	0	0.643	1.56
	Leaders set goals that are ambitious, but realistic	0.084	0.032	0.086	2.656	0.01	0.532	1.88
	Innovation and risk taking are encouraged and rewarded	0.147	0.028	0.156	5.296	0	0.644	1.55
	We continuously track our progress against our stated goals	0.151	0.033	0.146	4.507	0	0.529	1.89
	We are able to meet short-term demands without compromising our long-term vision	0.128	0.032	0.118	4.008	0	0.641	1.56
	People work like they are part of a team	0.266	0.028	0.295	9.538	0	0.582	1.72
Foreign companies	(Constant)	0.584	0.35		1.665	0.1		
	Problems seldom arise because we have the skills necessary to do the job	0.273	0.087	0.264	3.153	0	0.579	1.73
	Leaders set goals that are ambitious, but realistic	−0.079	0.078	−0.085	−1.017	0.31	0.573	1.74
	Innovation and risk taking are encouraged and rewarded	0.294	0.085	0.316	3.464	0	0.485	2.06
	We continuously track our progress against our stated goals	0.235	0.09	0.217	2.614	0.01	0.59	1.7
	We are able to meet short-term demands without compromising our long-term vision	0.035	0.101	0.03	0.35	0.73	0.564	1.77
	People work like they are part of a team	0.088	0.077	0.089	1.153	0.25	0.682	1.47

a. Dependent Variable: The capabilities of people are viewed as an important source of competitive advantage

The strongest predictor, table 4 is:

- People work like they are part of a team ($\beta = 0.295$, $p < 0.001$).

Other significant predictors include:

- Problems seldom arise because we have the skills necessary to do the job ($\beta = 0.162$, $p < 0.001$)
- Innovation and risk taking are encouraged and rewarded ($\beta = 0.156$, $p < 0.001$)
- We continuously track our progress against our stated goals ($\beta = 0.146$, $p < 0.001$)
- We are able to meet short-term demands without compromising our long-term vision ($\beta = 0.118$, $p < 0.001$)
- Leaders set goals that are ambitious, but realistic ($\beta = 0.086$, $p = 0.008$)

Conclusion: In domestic companies, all aspects of teamwork, innovation, planning, and leadership significantly contribute to the perception of human capabilities as a source of competitive advantage, with teamwork being the most influential factor.

For foreign Companies $R = 0.676$ indicates a solid overall correlation. $R^2 = 0.457$ means the model explains around 45.7% of the variance. Adjusted $R^2 = 0.433$ is slightly lower but still represents a solid result. Standard Error = 0.894 shows a slightly higher prediction error than for domestic companies.

Significant predictors, table 4, are:

- Innovation and risk taking are encouraged and rewarded ($\beta = 0.316$, $p = 0.001$) – the strongest factor.
- Problems seldom arise because we have the skills necessary to do the job ($\beta = 0.264$, $p = 0.002$)
- We continuously track our progress against our stated goals ($\beta = 0.217$, $p = 0.010$)

Non-significant predictors ($p > 0.05$) include:

- Leaders set goals that are ambitious, but realistic ($p = 0.311$)

- People work like they are part of a team (p = 0.251)
- We are able to meet short-term demands without compromising our long-term vision (p = 0.727)

It could be concluded that, in foreign companies, key factors influencing human capabilities as a source of competitive advantage are innovation, problem-solving, and goal monitoring. Teamwork, leadership, and balancing short- and long-term objectives are not statistically significant.

Both models are statistically significant and practically usable. Domestic companies emphasize teamwork and a broad set of factors—all predictors are significant. Foreign companies emphasize innovation and technical skills, while leadership and teamwork do not significantly affect the perception of competitive advantage.

4. MLP (MULTI-LAYER PERCEPTRON)

Although linear regression offers useful insights into the importance and direction of individual predictors, it is restricted to identifying linear relationships between independent and dependent variables. Complex phenomena like organizational culture, human capabilities, and related constructs are often shaped by nonlinear interactions among various factors.

To enhance the regression findings, a Multilayer Perceptron (MLP) neural network was employed. The MLP enables:

Assessing the importance of predictors based on their impact on the dependent variable.

Identifying nonlinear patterns that linear models may overlook.

Confirming and refining regression results by evaluating whether predictors deemed significant in linear regression maintain their relevance in a more adaptable model.

For the MLP analysis, the datasets were divided into training and testing subsets to assess the model's predictive accuracy. For domestic firms, 70% of the data was allocated to training and 30% to testing, while for foreign firms, a comparable split of roughly 72% training and 28% testing was used. This method ensures the model generalizes effectively, minimizing overfitting and providing reliable insights into the significance of organizational culture factors.

In this study, MLP analysis was conducted separately for domestic and foreign companies. By comparing the results of linear regression with those of the MLP, we achieve a deeper and more comprehensive understanding of how organizational culture factors influence perceptions of human capabilities as a driver of competitive advantage.

Table 5. MPL Model summary for domestic and foreign companies

		Domestic companies	**Foreign companies**
Training	Sum of Squares Error	45.42	4.221
	Relative Error	0.152	0.084
	Stopping Rule Used	1 consecutive step(s) with no decrease in error[b]	1 consecutive step(s) with no decrease in error[b]
	Training Time	00:00.8	00:00.0
Testing	Sum of Squares Error	39.298	4.679
	Relative Error	0.321	0.207

Dependent Variable: The capabilities of people are viewed as an important source of competitive advantagea

b. Error computations are based on the testing sample.

MLP Analysis for Domestic and Foreign Companies

Domestic Companies

As shown in Table 5, the Multilayer Perceptron (MLP) model for domestic companies exhibited a robust fit, achieving a training relative error of 0.152 and a testing relative error of 0.321. The dependent variable was defined as "The perception of human capabilities as a key driver of competitive advantage." According to Table 6, the most significant predictor was "Employees collaborate as a cohesive team" (100% normalized importance), followed by "The workforce possesses the skills needed to perform tasks effectively" (97.8%), and "Progress toward defined objectives is consistently monitored" (93.8%). Other notable factors included leadership approaches (86.1%), encouragement of innovation and risk-taking (84.8%), and managing both immediate and future-oriented demands (62.9%). These results indicate that teamwork, employee expertise, and systematic goal monitoring are pivotal in domestic firms for recognizing human capabilities as a competitive strength.

Foreign Companies

For foreign companies, as presented in Table 4, the MLP model also performed well, with a training relative error of 0.084 and a testing relative error of 0.207. The dependent variable remained consistent, but the hierarchy of predictor importance varied. Per Table 6, the leading factor was "Innovation and risk-taking are promoted and rewarded" (100% normalized importance), followed by "Leaders establish ambitious yet achievable goals" (84.4%), and "The ability to address short-term needs without sacrificing long-term objectives" (74.7%). Team collaboration (67.8%), goal monitoring (64.0%), and task-related skills (48.2%) were less prominent. This suggests that foreign firms prioritize innovation, forward-thinking leadership, and balancing competing priorities, in contrast to the domestic emphasis on teamwork and operational proficiency.

Comparative Insights

The findings reveal distinct priorities: domestic companies emphasize teamwork and employee skills, while foreign firms focus on innovation and visionary leadership as critical drivers of human capabilities for competitive advantage, figure 1.

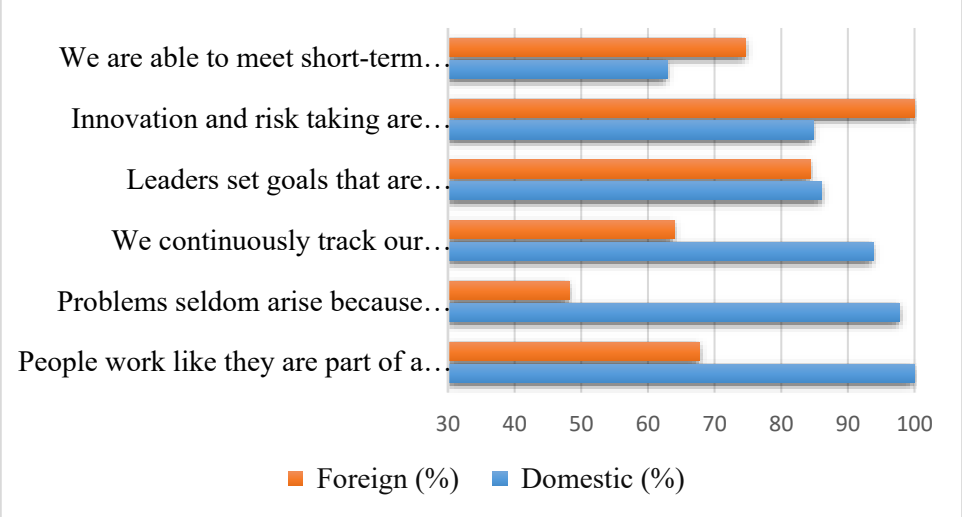

Figure 1. Comparison of Factor Importance in Domestic vs. Foreign Companies

Cultural Context and Hofstede's Framework

Geert Hofstede's framework outlines six key dimensions for understanding national cultures: 1) Power Distance, 2) Individualism vs. Collectivism, 3) Masculinity vs. Femininity, 4) Uncertainty Avoidance, 5) Long-Term vs. Short-Term Orientation, and 6) Indulgence vs. Restraint. Serbia, aligned with an Orthodox cultural cluster, exhibits high Power Distance and Uncertainty Avoidance, coupled with low Individualism and Masculinity, reflecting values rooted in its religious and

historical context[12][13][14]. Within Europe, Serbia shares cultural similarities with Spain and Portugal but is distinct in its "feminine" values, emphasizing cooperation, social unity, and quality of life, unlike the more "masculine" Iberian orientation[15]. In contrast, Western European countries and the United States—common origins of foreign firms in Serbia—tend to be more individualistic, performance-oriented, and assertive[16]. This cultural divergence explains why Serbian domestic firms prioritize teamwork and stability, while foreign firms emphasize innovation and leadership vision, reflecting their cultural norms.

Linking Results to Cultural Dimensions

Table 6 connect the study's findings to Hofstede's cultural dimensions. Foreign firms, often originating from Western Europe, exhibit organizational practices shaped by individualistic, assertive, and performance-driven values. Conversely, domestic Serbian firms emphasize teamwork, employee competence, and stability, aligning with the collectivist and "feminine" cultural tendencies of Serbia.

Table 6. Mapping Organizational Culture Factors to Hofstede's Dimensions with MLP Importance

Factor MLP	Domestic(%)	Foreign (%)	Related Hofstede Dimension(s)	Justification
People work like they are part of a team	100	67.8	Collectivism vs. Individualism (low IND/Coll)	Teamwork reflects collectivist values and emphasizes shared goals. Most important for domestic firms, less for foreign firms.
Problems seldom arise because we have the skills necessary to do the job	97.8	48.2	Uncertainty Avoidance (UAI)	Technical competence reduces uncertainty and enables predictability. Very important in domestic firms, lower in foreign firms.
We continuously track our progress against our stated goals	93.8	64	Uncertainty Avoidance (UAI)	Tracking goals reduces uncertainty. Stronger effect for domestic firms.
Leaders set goals that are ambitious, but realistic	86.1	84.4	Masculinity (MAS) / Power Distance (PDI)	Ambitious goals reflect achievement orientation; leadership links to power distance. Important in both groups, slightly higher in foreign firms.
Innovation and risk taking are	84.8	100	Uncertainty Avoidance (low UAI) /	Willingness to innovate and take risks is typical of low-UAI and

[12] Kirin, S., Mitrović,M., Borović, S. and Sedmak, A. ,Impact of the life cycle of company to job satisfaction, Tehnički vjesnik, vol. 23, no. 3, pp. 819–825, 2016, https://doi.org/10.17559/TV-20140715103959.

[13] Bakacsi, G., Takács, S., Karácsonyi,A. and Imrek,V., Eastern European cluster: Tradition and transition, Journal of World Business, vol. 37, no. 1, pp. 69–80, 2002, https://doi.org/10.1016/S1090-9516(01)00075-X.

[14] Tung, R. L., The cross-cultural research imperative: The need to balance cross-national and intra-national diversity," Journal of International Business Studies, vol. 39, no. 1, pp. 41–46, 2008, https://doi.org/10.1057/palgrave.jibs.8400331.

[15] Bakacsi, G. et al.,op. cit.

[16] Hofstede, G., Hofstede, G. J. and Minkov, M., Cultures and organizations: Software of the mind, 3rd ed. New York, NY: McGraw-Hill, 2010.

Factor MLP	Domestic(%)	Foreign (%)	Related Hofstede Dimension(s)	Justification
encouraged and rewarded			Individualism (IND)	individualistic cultures. Most critical for foreign firms.
We are able to meet short-term demands without compromising our long-term vision	62.9	74.7	Long-Term Orientation (LTO)	Balances immediate results with long-term planning. Slightly more important for foreign firms.

5. COMPARATIVE RESULTS OF REGRESSION AND MLP MODELS

The integration of regression analysis and MLP neural network models allowed both linear and nonlinear patterns to be captured. Regression identified the significance of individual factors, while MLP ranking highlighted their relative importance and potential interactions. This combined approach provides robust insights into the role of human capital in organizational culture and the cultural differences between domestic and foreign firms, offering practical implications for management and HR strategies.

The linear regression models for domestic and foreign companies identified significant predictors of perceived human capabilities, highlighting differences in the relative importance of teamwork, technical competence, leadership, and innovation. However, regression assumes linearity and may not fully capture complex interactions between organizational culture factors. To address this limitation and gain deeper insights, we applied a Multilayer Perceptron (MLP) neural network, which is capable of modeling nonlinear relationships and providing a ranked importance of predictors.

By comparing the results of linear regression with the MLP analysis, we can assess the robustness of the findings and explore whether the same factors retain their influence when nonlinear effects are considered. This dual approach allows for a more comprehensive understanding of how organizational culture drives perceptions of human capabilities in both domestic and foreign companies, and highlights potential differences in the prioritization of factors across company types.

Overall, the integration of regression and MLP analyses provides robust evidence that organizational culture significantly shapes perceptions of human capabilities as a source of competitive advantage. The contrast between domestic and foreign firms underscores the importance of recognizing cultural embeddedness when designing HR and management strategies in increasingly globalized business environments.

The table 7 presents standardized regression coefficients (Beta) and their significance levels alongside the normalized importance scores from the Multilayer Perceptron (MLP) model. For domestic companies, teamwork and problem-solving skills emerge as the strongest predictors of human capital as a source of competitive advantage. For foreign companies, innovation and leadership orientation dominate. The integration of regression and AI models provides complementary insights into both linear effects and nonlinear importance rankings.

7. Comparative Results of Regression and MLP Models for Domestic and Foreign Companies

Factor (Independent Variable)	Domestic Companies – Regression (Beta, Sig.)	Domestic Companies – MLP (Normalized Importance %)	Foreign Companies – Regression (Beta, Sig.)	Foreign Companies – MLP (Normalized Importance %)
People work like they are part of a team	**.295, p<.001**	**100.00%**	.089, n.s.	67.80%
We continuously track our progress against our stated goals	.146, p<.001	93.80%	.217, p<.05	64.00%
Innovation and risk taking are encouraged and rewarded	.156, p<.001	84.80%	**.316, p<.01**	**100.00%**
We are able to meet short-term demands without compromising our long-term vision	.118, p<.001	62.90%	n.s.	74.70%
Problems seldom arise because we have the skills necessary to do the job	.162, p<.001	97.80%	.264, p<.01	48.20%
Leaders set goals that are ambitious, but realistic	.086, p<.01	86.10%	n.s.	84.40%

Regression coefficients are standardized Betas. Only significant coefficients are bolded;

n.s. = not significant ($p > 0.05$). MLP results show normalized importance (max factor = 100%).

Dependent variable: The capabilities of people are viewed as an important source of competitive advantage.

6. CONCLUSION

This study demonstrates that organizational culture significantly influences perceptions of human capabilities as a source of competitive advantage in companies operating in Serbia. Regression analysis shows that for domestic firms, teamwork, technical competence, and goal tracking are all statistically significant predictors, with the model explaining approximately 52.6% of the variance ($R^2 = 0.526$, Adjusted $R^2 = 0.523$). For foreign firms, the model explains around 45.7% of the variance ($R^2 = 0.457$, Adjusted $R^2 = 0.433$), with innovation, leadership, and strategic balancing emerging as key predictors, while teamwork and operational skills are less influential. Complementing the regression findings, MLP analysis highlights the relative importance of predictors, confirming linear results and revealing potential nonlinear relationships: domestic firms prioritize teamwork and technical competence, whereas foreign firms emphasize innovation and visionary leadership. These results align with Hofstede's cultural dimensions, reflecting Serbia's collectivist and "feminine" orientation versus the more individualistic and performance-driven norms of foreign companies' home countries. Overall, the combined use of regression and AI models provides a comprehensive understanding of how organizational culture shapes human capital, offering actionable insights for management and HR strategies in cross-cultural business environments.

By situating these results within Hofstede's cultural framework, the study highlights how differences in national culture shape organizational practices even when firms operate in the same local environment. Serbia, belonging to the Orthodox cultural cluster, is characterized by high power

distance and uncertainty avoidance, combined with relatively low individualism and *masculinity*[17]. *These traits foster cooperative* teamwork and caution, consistent with the findings for domestic firms. In contrast, foreign companies emphasize innovation and leadership vision, which align with the cultural norms of more individualistic and performance-driven societies[18].

LITERATURE

[1] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. , Multivariate Data Analysis (8th ed.), Cengage Learning EMEA, United Kingdom, 2019.

[2] Cohen, J., Statistical Power Analysis for the Behavioral Sciences (2nd ed.), Lawrence Erlbaum Associates, united States of America, 1988.

[3] Falk, R. F., & Miller, N. B., A Primer for Soft Modeling, University of Akron Press, 1992.

[4] Wojtczuk-Turek, A., The role of organizational culture and human capital management in process organization, Service Management, vol. 14, no. 3, pp. 39–48, 2014.

[5] Liu, Y. and Hussain,I.A., The impact of organizational culture on organizational performance: The mediating role of employee engagement, International Journal on Culture, History, and Religion, vol. 7, no. SI2, pp. 693–709, 2025, https://doi.org/10.63931/ijchr.v7iSI2.238.

[6] Kirin,S., Mitrović,M., Borović, S. and Sedmak, A., Impact of the life cycle of company to job satisfaction, Tehnički vjesnik, vol. 23, no. 3, pp. 819–825, 2016, https://doi.org/10.17559/TV-20140715103959.

[7] Bakacsi,G., Takács,S., Karácsonyi,A. and Imrek,V., Eastern European cluster: Tradition and transition," in Journal of World Business, vol. 37, no. 1, pp. 69–80, 2002, https://doi.org/10.1016/S1090-9516(01)00075-X.

[8] Tung, R. L., The cross-cultural research imperative: The need to balance cross-national and intra-national diversity, Journal of International Business Studies, vol. 39, no. 1, pp. 41–46, 2008, https://doi.org/10.1057/palgrave.jibs.8400331.

[9] Hofstede,G., Hofstede,G. J. and Minkov, M., Cultures and organizations: Software of the mind, 3rd ed. New York, NY: McGraw-Hill, 2010.

[10] Alvesson, M. (2002), Understanding organization culture, SAGE Publications, London

[11] Janicijevic, N., Organizaciona kultura: kolektivni um preduzeca, ULIXES Novi Sad, Faculty of Economics, Belgrade, 1997.

[17] Bakacsi et al., Kirin et al., Tung, op. cit.

[18] Hofstede et al., op. cit.

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TOURIST GUIDE AS AN IMPORTANT FACTOR OF SERVICE QUALITY AND MARKETING OF DESTINATIONS

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Abstract: *Tourist guides represent one of the key links in the chain of implementing tourist trips, whether in organized arrangements or individual travel. Although guiding travellers is among the oldest professions in tourism, in modern practice this occupation remains under-researched and often overlooked in both theory and practice. This paper analyses the roles of tourist guides, their required competencies, and the changes that have occurred due to the development of the tourism market, new tourist needs, and modern technologies. The role of the guide is no longer limited to providing information and managing groups. Today, guides are also expected to act as educators, entertainers, advisors, and even technical support for tourists. Accordingly, the range of necessary skills and knowledge has expanded. Traditional competencies such as hospitality, communication skills, and punctuality are now complemented by emotional intelligence, the ability to engage tourists in co-creating experiences, digital literacy, and charisma. The paper relies on recent research and analyses that highlight the need to redefine training programs for tourist guides, with particular emphasis on continuous education and adaptation to changing market conditions. The conclusion confirms the importance of tourist guides as a factor in the quality of tourism services and their impact on tourist satisfaction, both with the trip and the destination as a whole, thus reinforcing their role in promoting tourist destinations. All of the above points to the necessity of further research in this field in order to systematically improve the profession.*

Keywords: *tourist guide, services, marketing, destination, roles*

JEL Classification*: Z30*

1. INTRODUCTION

In tourism, there are numerous specific professions that are exclusively related to this economic activity, among which is the job of a tourist guide. This profession emerged and developed alongside

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the growth of tourism movements, making it one of the main components of modern tourism[4]. Without tourist guides, it is unimaginable today to carry out organized tourist trips offered by travel agencies and tour operators, as well as the increasingly common individual trips on the market[5], and their role is significant because of the direct or indirect impact they have on tourist satisfaction.[6] [7] [8] [9].

The profession of a tourist guide can be considered the "Cinderella" of the tourism industry: attractive, useful, but often neglected[10], and being a tourist guide represents a dream job for many people[11] [12]. Despite the fact that guiding is one of the oldest activities, it is currently not sufficiently valued[13], which is why Pond[14] refers to guides as the "orphans" of the tourism industry. This is also reflected in the number of academic papers on the topic of tourist guiding, which is not as well represented as other topics in the field of tourism. According to Galí and Camprubí[15] most research on tourist guiding takes a qualitative approach and focuses on the role and performance of local guides.

The subject of this paper are tourist guides, their role in the realization of travel, and the qualities expected of them. The paper focuses on recent research in this field and provides an overview of the changes that have been recorded in the past few years, with the aim of establishing a starting point for future research on the topic of tourist guiding.

2. RESEARCH METHODOLOGY

The paper analyses existing knowledge about tourist guides, with a special focus on their role in the realization of travel, as well as the necessary competencies for performing the job effectively. The comparative method was also used to compare the results of different studies and draw certain conclusions, while the critical method was applied to provide specific suggestions on how the obtained results could be implemented in practice.

3. THE CONCEPT, ROLES, AND COMPETENCIES OF TOURIST GUIDES

In the tourism sector, where tourists from different parts of the world meet, professional and ethical tourist guides play a very important role in presenting the image of the country as a whole, as well as

[4] Garabinović D., Ćuruvija I., Ćuruvija M., Menadžment unapređenja kvaliteta usluga turističkih vodiča i turističkih pratilaca u Srbiji razvojem jezičkih kompetencija. U A. Skorup, i M. Staletović, Zbornik radova osme nacionalne naučno-stručne konferencije sa međunarodnim učešćem „Trendovi u poslovanju 2024", 2024, str. 271-283.

[5] Ćuruvija I., Ćuruvija, M., Modeli edukacije turističkih vodiča. Trendovi u poslovanju, Vol. 5, No. 1, 2017, pp. 17-24. https://doi.org/10.5937/trendpos1701017C.

[6] Arabacıoğlu, D., & Dedeoglu, B. B., The Moderating role of information quality in the relationship between guides' communication skills and tour satisfaction. Journal of Quality Assurance in Hospitality & Tourism, Vol. 26, No. 4, 2023, 813-832. https://doi.org/10.1080/1528008X.2023.2264510

[7] Hwang J., & Lee J. (J.), Relationships among Senior Tourists' Perceptions of Tour Guides' Professional Competencies, Rapport, Satisfaction with the Guide Service, Tour Satisfaction, and Word of Mouth. Journal of Travel Research, vol. 58, No. 8, 2019, pp. 1331-1346. https://doi.org/10.1177/0047287518803199.

[8] Kuo N.-T., Cheng Y.-S., Chang,K.-C., & Chuang L.-Y. (L.), The Asymmetric Effect of Tour Guide Service Quality on Tourist Satisfaction. Journal of Quality Assurance in Hospitality & Tourism, Vol. 19, No. 4, 2018, pp. 521–542. https://doi.org/10.1080/1528008X.2018.1483283.

[9] Syakier W. A., & Hanafiah M. H., Tour Guide Performances, Tourist Satisfaction And Behavioural Intentions: A Study On Tours In Kuala Lumpur City Centre. Journal of Quality Assurance in Hospitality & Tourism, Vol. 23, No. 3, 2021, pp. 597–614. https://doi.org/10.1080/1528008X.2021.1891599.

[10] Tsegaw W. E., & Teressa D. K., Tour Guiding Quality Assurance Mechanisms and Respective Tourist Satisfaction: Evidence from South Ethiopia. Journal of Tourism and Hospitality, Vol. 6, No. 6, 2017. https://doi.org/10.4172/2167-0269.1000317.

[11] Pond K., The Professional Guide: Dynamics Of Tour Guiding. Van Nostrand Reinhold, New York, 1993.

[12] Ibid [5]

[13] Ibid [10]

[14] Ibid [11]

[15] Galí N., & Camprubí R., Guiding: a comprehensive literature review. Scandinavian Journal of Hospitality and Tourism, Vol. 20, No. 4, 2020, pp. 317–334. https://doi.org/10.1080/15022250.2020.1802774.

of specific destinations[16]. Their role in meeting the needs of tourists is significant, but it is often not sufficiently recognized by other stakeholders in tourism or decision-makers. In order to influence this situation to some extent, the following section provides an overview of the concept, roles, and competencies of tourist guides.

3.1. The Concept of a Tourist Guide

The concept of a tourist guide has been defined in various ways, containing similar elements but differing from author to author. Pond[17] notes that existing definitions of a tourist guide largely overlap and vary from country to country, and even within the tourism industry. What adds further confusion is the use of different English terms for the same profession, namely the parallel use of "tour guide" and "tourist guide". Additionally, defining the concept of a tourist guide is complicated by the fact that, as a result of labor division and specialization, several professions have emerged that are similar in the nature of their service contact with tourists - tourist guide, tour leader, agency representative, and animator. In practice, these professions not only touch upon each other but also overlap, which is particularly evident in the tasks performed by tourist guides and tour leaders[18].

According to the definition in the Merriam-Webster dictionary, "a tourist guide is a person who leads people on trips through an area and explains interesting parts about it"[19].

In Serbia, the most significant definition is the one provided in the Tourism Law, as it later forms the basis for other important elements such as licensing. According to this definition, "a tourist guide is a person who has passed the professional exam for tourist guides and provides services of guiding, showing, and professionally explaining natural, cultural-historical, archaeological, ethnographic, economic, and other points of interest."[20].

However, the most comprehensive definition is provided by the European Committee for Standardization (CEN), which harmonized the definitions. According to it, a tourist guide is a person who guides visitors in the language of their choice and interprets the cultural and natural heritage of an area, which person normally possesses an area-specific qualification usually issued and/ or recognized by the appropriate authorities[21]. This definition has also been adopted by the World Federation of Tourist Guide Associations[22], the umbrella organization that brings together guides from around the world, which recognizes the term "tourist guide" as the correct English term. The key elements of this comprehensive definition that should be highlighted are:

1. Guiding visitors in a chosen language – It is of utmost importance for a tourist guide to have knowledge of the language in which they conduct tours, as without it, communication, which is the fundamental element of tourist guiding, cannot be established;
2. Interpretation of cultural and natural heritage – In the context of tourist guiding, interpretation refers to explaining, as well as adapting information to the interests of the group;
3. Profession specific to a particular area – Whether referring to a small area (site, city) or a larger one (region or country), this is one of the most important characteristics of the tourist guiding profession; it is unlikely that a single person could possess enough extensive knowledge to be a guide in, for example, all countries of Europe.
4. Possession of qualifications – Qualifications can also be formally recognized by the state, in which case we refer to licensed guides; this element varies from country to country, and in

[16] Ibid [10]
[17] Ibid [11]
[18] Rabotić B., Turističko vođenje u Srbiji sa posebnim osvrtom na pravnu regulativu. Turističko poslovanje, Vol. 5, 2010, str. 103-119.
[19] https://www.merriam-webster.com/dictionary/tour%20guide
[20] Zakon o turizmu, „Službeni glasnik Republike Srbije", br. 17/2019, Član 3, Stav 1, Tačka 36.
[21] Newlands R., Tourism services / Tourist guiding services - European standards, Guidelines Internetion@l, Issue 9, 2005, 40-41.
[22] https://wftga.org/about/constitution/

some, the profession of tourist guiding is regulated by law (as in Serbia, Austria, Greece, etc.), allowing only those who hold a license to practice it. Additionally, there are countries where the profession is not legally regulated, but numerous organizations issue qualifications (for example, in Scotland, anyone can work as a guide, but those with a "blue badge" qualification are recognized as individuals who perform the job at a high standard).

If the aforementioned definitions are analysed in more detail, it can be concluded that they also imply certain competencies and roles that tourist guides should possess. Viewed in this way, the competencies derived from the definitions are: language proficiency, the ability to interpret, and professional knowledge of the cultural and natural characteristics of the region in which they work. Similarly, we can identify the roles of tourist guides as providing services of guiding, showing, and professionally explaining. However, an analysis of other scholarly works reveals additional competencies and roles that guides perform within the context of travel experiences.

3.2. The Role of Tourist Guides

In the previous lines, certain roles of a tourist guide have already been mentioned based on the analysis of definitions of this profession, namely providing guiding, showing, and professional explaining services. However, the role of a guide in the realization of travel is much more complex than that.

The primary role of tourist guides has been to lead tourists, provide them with information, and try to enhance their travel experience. It often happens that they are the only ones at the destination who have prolonged contact with tourists[23], which can directly influence the impression formed about the destination[24].

Research on the role of tourist guides often takes a functional perspective, focusing on the guide's performance (i.e., quality of work), tourist satisfaction, and their willingness to return to a destination. There are also studies that describe the guide's role as an ambassador and their influence on the destination's image[25]. As a starting point for examining the role of guides, it should be noted that through their work they greatly impact guest satisfaction - not only with the tour itself but with the destination as a whole[26]. Across various studies on this topic, the following roles of guides have been identified: leader, interpreter, mediator, navigator, and representative. Additionally, the role of a "bridge" between different cultures has been added, all within the context of globalization.

In their study Wong et al.[27] provided an overview of the roles of tourist guides based on the analysis of numerous works on this profession. They identified the following roles: storyteller, animator, intermediary, translator, information provider, host, ambassador, mediator, educator, teacher, mentor, lecturer, motivator for responsible behaviour, coordinator, travel manager and organizer, problem solver, and others.

However, today's tourism and tourist demands have changed. Tourists have more travel experience, are better educated[28] and have easier access to information. In addition, due to technological advancements, many traditional functions of guides are being transferred to information technologies,

[23] Rabotić B., Tourist guides in contemporary tourism. In International conference on tourism and environment, 2010, pp. 353-364.
[24] Látková P., Jordan E., Vogt C., Everette M., & Aquino C., Tour Guides' Roles and Their Perceptions of Tourism Development in Cuba. Tourism Planning & Development, Vol. 15, No. 3, 2017, pp. 347–363. https://doi.org/10.1080/21568316.2017.1349687.
[25] Wong C. U. I., Ren L., Ma C., Lam J. F. I., What do today's Chinese tourists expect from tour guides? A mixed-method approach to understanding the evolving guide roles. Journal of Hospitality and Tourism Management, Vol. 59, 2024, pp. 102-115. https://doi.org/10.1016/j.jhtm.2024.04.002.
[26] Ibid [10]
[27] Ibid [25]
[28] Ibid [25]

such as the digitization of interpretation in numerous museums around the world[29]. All of this affects the transformation of the traditional roles that guides have held until now.

One of the more recent studies on the roles of tourist guides was conducted in 2024 in China[30], aiming to identify changes in the roles guides perform during trips compared to the roles they held before the emergence of new tourist demands. The study involved in-depth interviews with guides, which provided initial insights that were later verified through surveys of tourists, all related to the roles of guides. The result was a list of five dimensions encompassing 28 roles of tourist guides.

The five mentioned dimensions are: group management, information provision, consultation, positive change fostering, and ICT facilitation (offering assistance with technology). A detailed overview is presented in Table 1.

Table 1. Dimensions of Tourist Guides' Roles

Dimension	Roles
Group management	Cheer leader Tension reliever Emergency handler Arbitrator Harmony maintainer Conflict resolver Safety guard Problem solver Group manager Entertainer Decision maker
Information provision	Introducer Information provider Storyteller
Consultation	Gourmet recommender Shopping consultant Esthetic consultant Shopping quality inspector
Positive change fostering	Spiritual mentor Environment protection advocate Adventurer Healthy lifestyle advocate Leisure expert Experience designer
ICT facilitation	ICT facilitator Information filter Social media content generator photographer

Source: Wong C. U. I., Ren L., Ma C., Lam J. F. I., What do today's Chinese tourists expect from tour guides? A mixed-method approach to understanding the evolving guide roles. Journal of Hospitality and Tourism Management, Vol. 59, 2024, pp. 102-115. https://doi.org/10.1016/j.jhtm.2024.04.002

The results obtained from the study indicate that traditional dimensions related to the roles of tourist guides, such as group management and providing information, remain significant. However, it is important to highlight the emerging dimensions in these roles, particularly the consultative roles, especially those related to food recommendations and shopping advice. This can be explained by the fact that today's tourists are overwhelmed with information and find it difficult to make purchasing decisions, viewing guides as individuals who provide verified, reliable, and neutral information.

[29] Ibid [25]
[30] Ibid [25]

If we consider traditional literature, the guide roles identified in the study and classified under the fourth and fifth dimensions are neither represented nor previously researched. This can be explained by changes in tourist expectations and demands, as well as broader shifts in the global environment. The fourth dimension, in particular, focuses on encouraging positive changes, where the guide not only inspires tourists to improve themselves but also emphasizes the guide's role in protecting the destination's environment. The fifth dimension, which involves providing assistance with technology especially to guests who are not tech-savvy, represents a set of entirely new roles expected of tourist guides. This aligns with studies showing that the use of modern technologies has become an indispensable component of travel[31], and that technological advancement is transforming both the tourist experience and tourism operations, including the profession of tourist guiding[32].

Changes in the roles of tourist guides were also noted in the work of Ren et al.[33], which highlighted the continuity of guide roles, ranging from "serving roles" to "roles that facilitate change". Five main driving forces were identified: tourists' needs for adaptation, demographic changes, rapid technological development, increased special interests, the pandemic, and tourists' preference for remote destinations. Instead of expecting only "serving roles," tourists now welcome roles that can encourage positive changes, reflecting a motivational shift toward deeper, more meaningful travel experiences.

All of the aforementioned roles are extremely complex, and for this reason, only individuals who are specially trained and qualified can perform this work effectively, with such professionals being developed through quality education[34].

3.3. Competencies of Tourist Guides

In order to fulfil all the roles assigned to them, guides must meet certain criteria, meaning they need to possess the appropriate traits and competencies. The following section provides an overview of the literature related to this topic.

In the professional literature, there are few studies dedicated to the traits and competencies that tourist guides should possess in order to effectively perform all the roles required during travel experiences. Štetić[35] lists the following competencies and traits as important for this work: hospitality, responsibility, kindness, cordiality, being well-informed, punctuality, as well as maintaining appearance (clothing) and behaviour in accordance with etiquette. Todorović[36] cites traits and qualities considered important for tourist guides according to Russian authors, including ethical behaviour, humane treatment of tourists, principledness, honesty, fairness, patience, and knowledge of social and personality psychology. Cohen[37] identifies the basic traits of tourist guides as sociability, instrumental competence, interaction skills, and communicativeness.

In her master's thesis[38] examining the impact of tourist guides' quality on the overall quality of tourism services, Ćuruvija I. investigated the importance of the following traits: good physical appearance, age, appropriate style of dress, manner of expression and pleasant voice tone, being well-informed, broad general education, punctuality, responsibility, kindness, cordiality, tolerance, and

[31] Law R., Chan I. C. C., & Wang L., A comprehensive review of mobile technology use in hospitality and tourism. Journal of Hospitality Marketing & Management, Vol. 27, No. 6, 2018, pp. 626–648. https://doi.org/10.1080/19368623.2018.1423251.

[32] Ibid [25]

[33] Ren L., Wong C. U. I., Ma C., & Feng Y., Changing roles of tour guides: From "agent to serve" to "agent of change". Tourist Studies, Vol. 24, No. 1, 2023, pp. 55-74. https://doi.org/10.1177/14687976231200909 (Original work published 2024).

[34] Ibid [5]

[35] Štetić S., Vodička služba u turizmu (naučite da vodite). Cicero, Beograd, 2003.

[36] Todorović A., Sociologija turizma. IRO Privredna štampa, Beograd, 1982.

[37] Cohen E., The tourist guide: The origins, structure and dynamics of a role. Annals of Tourism Research, Vol. 12, No. 1, 1985, pp. 5-29. https://doi.org/10.1016/0160-7383(85)90037-4.

[38] Ćuruvija I., Turistički vodiči kao faktor unapređenja kvaliteta usluga u turizmu, magistarski rad. Fakultet za Sport i turizam, Novi Sad, 2006.

resourcefulness. The study confirmed that traits related to temperament, abilities (particularly intellectual), and physical constitution of tourist guides vary in their significance for work quality. Specifically, traits related to physical constitution were generally rated as less important, those related to temperament as somewhat more significant, while traits associated with intellectual abilities were rated as highly important for the quality of a tourist guide's work. Specifically, dress style and voice tone (within the traits related to a tourist guide's physical constitution and appearance), punctuality, resourcefulness, tolerance, cordiality, and responsibility (from the group of traits indicating temperament), as well as both examined traits from the group of intellectual abilities, being well-informed and general education, were identified as important and highly important.

One of the fundamental competencies of tourist guides, which is unlikely to change over time, is language proficiency, particularly in a foreign language, as the primary means of communication with tourists. Reading, writing, listening, and speaking skills need to be continuously developed in order to enhance the linguistic competencies of tourist guides[39].

As tourism develops and changes, the roles of tourist guides also evolve, as demonstrated in the previous section of this work. Consequently, it is necessary to consider new competencies for guides that will enable them to adapt to these emerging market demands.

Experience in the field has been identified as an important characteristic for the quality of tourist guides, as they work with diverse people and encounter various situations. Experience helps them meet tourists' needs and respond effectively to everyday challenges. Inexperienced tourist guides must pay close attention to many factors, carefully assess each situation, and respond calmly, with communication and guidance from experienced colleagues providing significant support in this process[40].

Tourist guides often use humour to entertain tourists. Research has shown that a tourist guide's humour positively predicts tourists' reactions and their subsequent promotion of the destination through word of mouth. Furthermore, humour has been shown to increase trust in the tourist guide and enhance the perceived value of well-being[41]. It is important to emphasize that the type of humour used matters; tourist guides must ensure that they employ only appropriate humour, avoiding anything that could offend members of the group or people in the surrounding area.

Another important competency for tourist guides is building a relationship with the group, often referred to as "rapport," which increases satisfaction with the guide's service and the overall tour experience. Research results[42] have shown that professional skills and a professional attitude positively impact the relationship with the tourist guide, especially among older tourists, which in turn enhances satisfaction with the guide's service and the tour itself. Additionally, the study highlighted the important role of product knowledge as a moderating factor.

In order to meet the needs and expectations of twenty-first-century tourists and the challenges of the global communication environment, tourist guides must become highly qualified experience mediators, including embracing technology to orchestrate unforgettable experiences[43]. This observation aligns with research findings regarding guide roles[44] related to assisting with technology.

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[39] Ibid [4]

[40] Miljković J., Ćuruvija I., Ćuruvija M., The Development Of The Tourist Guide's Role In Research Papers Throughout The Years. CTTH, Novi Sad, 2022.

[41] Fu T., Li S., Xu J., Liu M., & Chen G., Examining tour guide humor as a driver of tourists' positive word of mouth: A comprehensive mediation model. International Journal of Contemporary Hospitality Management, Vol. 35, No. 5, 2023, pp. 1824–1843. https://doi.org/10.1108/IJCHM-05-2022-0587.

[42] Hwang J., & Lee J. (J.), Relationships among Senior Tourists' Perceptions of Tour Guides' Professional Competencies, Rapport, Satisfaction with the Guide Service, Tour Satisfaction, and Word of Mouth. Journal of Travel Research, vol. 58, No. 8, 2019, pp. 1331-1346. https://doi.org/10.1177/0047287518803199.

[43] Weiler B., & Black R., The changing face of the tour guide: one-way communicator to choreographer to co-creator of the tourist experience. Tourism Recreation Research, Vol. 40, No. 3, 2015, pp. 364-378. https://doi.org/10.1080/02508281.2015.1083742.

[44] Ibid [25]

To satisfy tourists seeking personalized and meaningful experiences, guides in some cases must actively engage tourists in co-creating their own guided tour experiences[45], reflecting contemporary trends where tourists want to experience rather than just see a destination. This underscores the necessity for tourist guides to develop competencies that match the experiences offered at the destination where they work. For example, if tourists are to participate in pottery-making, guides must possess at least basic knowledge and potentially the skills required for the activity.

An interesting study conducted in Amsterdam on tours in the Red District examined guides as filters of information, highlighting the importance of the guide's personal profile in interpreting this experience for tourists[46]. This finding can be linked to the significance of emotional intelligence in the work of tourist guides, which Min confirmed through research[47].

Possessing charisma is also one of the more recent traits emerging in the literature on tourist guides. Research has confirmed that charismatic guiding effectively increases tourists' trust, the quality of interaction, self-disclosure, and emotional solidarity, while revealing services further strengthens trust and the emotional connection between tourists and guides[48].

All of the above points highlight the necessity for tourist guides to possess certain competencies in order to provide services to tourists in the most effective and appropriate way during their travels.

4. CONCLUDING REMARKS

Summarizing all of the above, it can be concluded that tourist guides are extremely important for the quality of tourism services in the destination as well as for the overall quality of tourist experiences, and their influence of destination's marketing. As demonstrated in this work, tourist guides have numerous roles in the realization of tourist trips, which require a variety of competencies. Research has shown that the roles of guides evolve and expand over time, in line with changes occurring in the tourism market. In addition to traditional roles, such as group management and providing information, new roles have emerged in the form of consulting, encouraging positive changes, and assisting with the use of technology. Corresponding to these evolving roles, the necessary competencies for guides also change. Alongside traditional competencies, such as hospitality, communicativeness, and punctuality, new competencies are now emphasized, including emotional intelligence, knowledge of modern technologies, charisma, and skills for actively engaging tourists in co-creating their experiences.

The results obtained regarding changes in roles and necessary competencies provide a foundation for developing new training and education programs for tourist guides, or for updating existing ones, so that guides are equipped to meet the new demands placed upon them. It should be noted that in today's era of rapid change, it is essential to continuously work on improving skills and competencies in all areas, including tourist guiding. This primarily refers to ongoing training programs designed for individuals already working as guides, should be thoroughly examined and used by the creators of tourist guides' curricula and programmes, ensuring alignment with contemporary market requirements.

[45] Ibid [43]

[46] Zerva K., & Nijkamp P., Tour guides as information filters in urban heterotopias: Evidence from the Amsterdam red light district. Tourism Management Perspectives, Vol. 18, 2016, pp. 42–50. https://doi.org/10.1016/j.tmp.2015.12.020.

[47] Min J. C. H., A short-form measure for assessment of emotional intelligence for tour guides: Development and evaluation. Tourism Management, Vol. 33, No. 1, 2012, pp. 155–167. https://doi.org/10.1016/j.tourman.2011.02.014.

[48] Hu C. (A.), Hu X. (S.), & Zhang Y., How important is charisma? The impacts of charismatic tour-guiding and service disclosure on tourist trust, self-disclosure, interaction quality, and emotional solidarity. Tourism Management Perspectives, Vol. 58, 2025, 101367. https://doi.org/10.1016/j.tmp.2025.101367.

LITERATURE:

[1] Arabacıoğlu, D., & Dedeoglu, B. B. (2023), The Moderating role of information quality in the relationship between guides' communication skills and tour satisfaction. Journal of Quality Assurance in Hospitality & Tourism, 26(4), 813-832. https://doi.org/10.1080/1528008X.2023.2264510.

[2] Cohen, E. (1985), The tourist guide: The origins, structure and dynamics of a role. Annals of Tourism Research, 12(1), 5-29. https://doi.org/10.1016/0160-7383(85)90037-4.

[3] Ćuruvija I., Ćuruvija, M. (2017), Modeli edukacije turističkih vodiča. Trendovi u poslovanju, 5(1), 2017, 17-24. https://doi.org/10.5937/trendpos1701017C.

[4] Ćuruvija, I. (2006), Turistički vodiči kao faktor unapređenja kvaliteta usluga u turizmu, magistarski rad. Fakultet za Sport i turizam, Novi Sad.

[5] Fu, T., Li, S., Xu, J., Liu, M., & Chen, G. (2023), Examining tour guide humor as a driver of tourists' positive word of mouth: A comprehensive mediation model. International Journal of Contemporary Hospitality Management, 35(5), 1824–1843. https://doi.org/10.1108/IJCHM-05-2022-0587.

[6] Galí, N., & Camprubí, R. (2020), Guiding: a comprehensive literature review. Scandinavian Journal of Hospitality and Tourism, 20(4), 317–334. https://doi.org/10.1080/15022250.2020.1802774.

[7] Garabinović, D., Ćuruvija, I., Ćuruvija, M. (2024), Menadžment unapređenja kvaliteta usluga turističkih vodiča i turističkih pratilaca u Srbiji razvojem jezičkih kompetencija. U A. Skorup, i M. Staletović, Zbornik radova osme nacionalne naučno-stručne konferencije sa međunarodnim učešćem „Trendovi u poslovanju 2024" (str. 271-283).

[8] https://wftga.org/about/constitution/

[9] https://www.merriam-webster.com/dictionary/tour%20guide

[10] Hu, C. (A.), Hu, X. (S.), & Zhang, Y. (2025), How important is charisma? The impacts of charismatic tour-guiding and service disclosure on tourist trust, self-disclosure, interaction quality, and emotional solidarity, Tourism Management Perspectives, 58, 101367. https://doi.org/10.1016/j.tmp.2025.101367.

[11] Hwang, J., & Lee, J. (J.) (2019), Relationships among Senior Tourists' Perceptions of Tour Guides' Professional Competencies, Rapport, Satisfaction with the Guide Service, Tour Satisfaction, and Word of Mouth. Journal of Travel Research, 58(8), 1331-1346. https://doi.org/10.1177/0047287518803199.

[12] Kuo, N.-T., Cheng, Y.-S., Chang, K.-C., & Chuang, L.-Y. (L.) (2018), The Asymmetric Effect of Tour Guide Service Quality on Tourist Satisfaction. Journal of Quality Assurance in Hospitality & Tourism, 19(4), 521–542. https://doi.org/10.1080/1528008X.2018.1483283.

[13] Látková, P., Jordan, E., Vogt, C., Everette, M., & Aquino, C. (2017), Tour Guides' Roles and Their Perceptions of Tourism Development in Cuba. Tourism Planning & Development, 15(3), 347–363. https://doi.org/10.1080/21568316.2017.1349687.

[14] Law, R., Chan, I. C. C., & Wang, L. (2018), A comprehensive review of mobile technology use in hospitality and tourism. Journal of Hospitality Marketing & Management, 27(6), 626–648. https://doi.org/10.1080/19368623.2018.1423251.

[15] Miljković, J., Ćuruvija, I., Ćuruvija, M. (2022). The Development Of The Tourist Guide's Role In Research Papers Throughout The Years. CTTH, Novi Sad.

[16] Min, J. C. H. (2012), A short-form measure for assessment of emotional intelligence for tour guides: Development and evaluation. Tourism Management, 33(1), 155–167. https://doi.org/10.1016/j.tourman.2011.02.014.

[17] Newlands, R. (2005), Tourism services / Tourist guiding services - European standards, Guidelines Internetion@l, Issue 9, 40-41.

[18] Pond, K. (1993), The Professional Guide: Dynamics Of Tour Guiding. Van Nostrand Reinhold, New York.

[19] Rabotić, B. (2010), Tourist guides in contemporary tourism. In International conference on tourism and environment, 353-364.

[20] Rabotić, B. (2010), Turističko vođenje u Srbiji sa posebnim osvrtom na pravnu regulativu. Turističko poslovanje, 5, 103-119.
[21] Ren, L., Wong, C. U. I., Ma, C., & Feng, Y. (2023), Changing roles of tour guides: From "agent to serve" to "agent of change". Tourist Studies, 24(1), 55-74. https://doi.org/10.1177/14687976231200909 (Original work published 2024).
[22] Štetić, S. (2003), Vodička služba u turizmu (naučite da vodite). Cicero, Beograd.
[23] Syakier, W. A., & Hanafiah, M. H. (2021), Tour Guide Performances, Tourist Satisfaction And Behavioural Intentions: A Study On Tours In Kuala Lumpur City Centre. Journal of Quality Assurance in Hospitality & Tourism, 23(3), 597–614. https://doi.org/10.1080/1528008X.2021.1891599.
[24] Todorović, A. (1982), Sociologija turizma. IRO Privredna štampa, Beograd.
[25] Tsegaw, W. E., & Teressa, D. K. (2017), Tour Guiding Quality Assurance Mechanisms and Respective Tourist Satisfaction: Evidence from South Ethiopia. Journal of Tourism and Hospitality, 6(6). https://doi.org/10.4172/2167-0269.1000317.
[26] Weiler, B., & Black, R. (2015), The changing face of the tour guide: one-way communicator to choreographer to co-creator of the tourist experience. Tourism Recreation Research, 40(3), 2015, 364-378. https://doi.org/10.1080/02508281.2015.1083742.
[27] Wong, C. U. I., Ren, L., Ma, C., Lam, J. F. I. (2024), What do today's Chinese tourists expect from tour guides? A mixed-method approach to understanding the evolving guide roles. Journal of Hospitality and Tourism Management, 59, 102-115. https://doi.org/10.1016/j.jhtm.2024.04.002.
[28] Zakon o turizmu, „Službeni glasnik Republike Srbije", br. 17/2019.
[29] Zerva, K., & Nijkamp, P. (2016), Tour guides as information filters in urban heterotopias: Evidence from the Amsterdam red light district. Tourism Management Perspectives, 42–50. https://doi.org/10.1016/j.tmp.2015.12.020.

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A QUALITY OF CREATIVE GAMES

Prof. Slavko Arsovski PhD, [1]

Abstract: *A creative games are now recognized as driver for better understanding, analysis, modeling and improvement of whole human life. They are answer on human needs for playing and upgrading their talents, knowledge, and success. A creative game is product developed by interdisciplinary and multydisciplinary teams and game users have expiriences about its performances expressed by quality.*

On the other side, quality is not anly performance expressed by user's satisfaction. More, quality is process for achieving needs and requests using different stages in development process.

The purpose of the paper is to connect processes of game development and quality development. The goal is to developed holistic wiev of its integration and more profound treated relations among its.

The novely of the research is new model of integration with two segments/processes integrated into product-game which is adopted with higher level of introduction in praxis using Smart and Intelligent Technologies (SIT).

Research methodology is based on analysis of two processes: creative game development and quality development based on well-known methods, techniques, and tools supported by SIT. Also, the key of understanding this integration is analysis and sintesis subprocesses in Society 5.0/6.0.

Practical results of research presented in the article is possibility to analysis process development of games and quality and its integration and assessment of quality of creative games.

Keywords: *creative games, quality, integration model, quality assessment*

JEL Classification*: L15*

1. INTRODUCTION

A creative games is part of mental games. According Oxman N. (2016) a cucle of creativity have eigh dimensions, i.e.: (1) art, (2) science, (3) design, and (4) engineering with added axis: (5) information, (6) behavior, (7) utility, and (8) knowledge. In academic institutions creative games developed some dimensions without its integration in culture, nature, perception, production, economy, philosophy, etc. It is reason for using inter - and multidisciplinary approach and combing perspectives (Engstrom H., 2020.). Each game is developed based on recognized needs of users and

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developers, as key stakeholders and its results could express through quality assessment. It is reason why is necessary to integrate game development and quality development.
Play, imagination, and creativity are base for creative games. A creative product is assessed by its novelty (originality) and utility (usefulness).

Wallas G. (1926) recognised four stages of the creative process: (1) preparation, (2) incubation, (3) illumation, and (4) verification after that is process of implementation of Creative Problem Solving model. A most of creative games is developed to support process of learning, modeling, analysis, introduction in praxis and monitoring and uppgrading. So Bubenkova L. And Pietrikova E. (2024) proposed approach for computer games design and development for creating University course through using Unity Engine Exploration and using three interations.

Ortiz P.A. and Akcaova G. (2024) defined the concept of game based learnig. The article is presented in purpose to make action for educations, innovations, policy makers, and education leaders. The proposed concept have four interrelated processes: (1) player with goals, motivation and learning and training, (2) game system with rules and challenges wich are connected through, (3) action and interaction, and (4) progress and feedbacks.

Rouse R. (2004) in his book try to answer on crutial questions: (1) what players want, (2) brainstorning a gave idea, (3) game analysis, (4) focus maintaing and changing, (5) elements of gameplay, (6) AI in game plaing, (7) specifity of multy-players games, (8) game development documentation including tools and stories, (9) the design document, (10) play testing etc.

Testing-and game assessment are related to quality. In work of Frackiewics P. ert al. (2022). For it is used concept of quantum games with using quantum computers for the description of any 2X2 bimatrix game.

2. LITERATURE REVIEW

Literature review is devided in two parts, i.e.: (1) for creative games and (2) for quality design development. In area of creative games development, besides previos literature sources is area of psychhology and role-playing games (Bowman S.L. and Liberoth A., 2018).

In this approach is presented key aspects: (1) development psychology with theory of wind, (2) cognitive psychology and neuroscience, (3) behavior psychology and motivation, (4) clinical psychology, (5) personality, attitudes and social psichology, (6) psichology of role-playing, (7) psychoanalitic theories (Frend, Jung), and concept of satisfaction, happiness and quality of life.

In area of quality development there are a lot of references based on work of Feigenbaum A.V. (2001), Juran J.M. (1992), Deming W.E. (1986), Ishicawa K. (1985), and relative new work of Foster T. (2004), Summers D. (2010), Siviy J.M., Penn M.L. and Stodard R. (2007). In last twenty years a lot of references covered different tematic fields of quality as Quality 5.0/6.0, Quality Excellence, Quality Modelling, leadership, resilience, quality techniques and tools, sustainability, innovations, smart and intelligent systems and design quality not only in industry with areas as government, service, education, sciences, arts and other social sciences etc.

In last ten yearsh author contanued to work in these areas (cca. 150 references) and tried to develop new quality aspects presented in three monographs referenced as Arsovski S. (2016) Quality Science (in Serb), Arsovski S. (2023) Squering the Quality and Arsovski S. (2025) in press with title „Quality and Peace: the futureis is inside us“. In this period is published a lot of articles presented in International Journal and Conferences Preceedings, Quality Festivals and other conferences in Serbia, Montenegro and Croatia. On this way are prepered base for research related to integrate quality and games.

Extension of gamefication of quality in organizations is presented in work of Nagarney A. and Li D. (2015). For it they used methods related to Operation Research. They QS game-Model regording borh quality and game elements, with:
a) ISO IEC 2500 standard terms and definition:

- attribute,
- measure,
- measurement,
- software quality characteristics, and
- quality model.

b) Game element definitions:

- balance,
- symmetry,
- regularity,
- predictability,
- sequentality,
- economy,
- unity,
- proportionality,
- simplicity and
- grouping.

Fuhrmann M. et al. (2015) researched game based on relationship between quality and lost within production network, a simulation base game. It is caled Quality Intelligence-Game or Q-1-Game and is designed as one player game with posibility as multi player gaming.

Kern C. et al. (2017) defined education game Q-KEY2 with two connected group: (1) reality with employee's and (2) sfere of reaction with model supplied by the simulation, processing of decisions and participants.

Srikanth M. et al. (2022) described game for improving Crop Quality (SC) for it they: (a) create a trajectory network in smart agriculture based on crop quality estimation, (b) secure supply chain in smart agriculture using game theory, (c) agriculture approach to trajectory network and game theory for quality crop growth and supply chain, (d) parameters use to improve Crop Quality and Protect the Supply Chain which Use a Trajectory network and Game Theory, and (e) implementation work.

Ploder C., Dilger T. And Bernsteiner R. (2020) analyzed improving knowledge transfer in simulation games based on cognitive load theory with six layers: (1) shop floop layer, (2) manufacturing execution layer, (3) ERP system layer and process management, (4) data analitics layer, (5) enterprise governance, and (6) governments and external authorities.

Hauge J.B., Duin H. and Oliveira M. (2008) analized structure of PRIME Serios Game with following entities in real world and Virtual Business Environment (VBE) in real world: (1) client, (2) Internet, (3) Cluster VBE Server and in VBE are: (4) Business Units. Purpose of evaluation of the game is: (1) providing verification of the concepts and design of the software and (2) check the functionality and stability of the software within a real work environment. After evaluation is possible to redesign and/or implementation of the PRIME game prototype.

Komal M., Khalil Z. And Sirshar M. (2015) analyzed quality assurance standards in game development in purpose for defining: (1) the influence of system quality and service quality to customer satisfaction and loyalty in on-line game industry, (2) perceptual view inconsistency, (3) general framework for evaluation phase in games development methodologies, (4) game development Life Cycle Guidelines, (5) defining usability quality metrics for game prototype using software attributes and other.

Trisnadoli A., Hendradjaya B. and Sunindyo W. (2015) defined proposed quality requrements for mobile game in general:

- mobile game provide clearly goals and players can reach the goals,
- player does not found error at the mobile game,
- mobile game is easy to learn by player,

- mobile game manual of help feature,
- mobile game provide quick respomse from player's action,
- challenges, strategy, and game story are in balance,
- the expirience is fun for players,
- player get appropriate reward from game,
- player can express themself, etc.

Ogland P. (2023) based research on TQM principles and Critical System Trinking. The loop of Total System Intervention has thre interconnected stages: (1) creativity, (2) choice and, (3) implementation with mess in center of log related to interacting issues to be resolved. Each phas is further described according game design/development.

3. MODEL OF INTEGRATING PROCESSES OF CREATIVE GAMES AND QUALITY

The proposed model of integrating processes of creative games and quality on level of organisation/supply chain based on smart and AI technologies is based on:

- quality culture in Society 4.0/5.0,
- stakeholders net based on internal and external IoT/IoE,
- Smart and Intelligent Technologies (SIT) and their adaption and introduction in integrating process, and
- *V* connection of: (1) Smart and Intelligent Quality (SIQ) and (2) Smart and Intelligent Games (SIG).

Both processes in *V* diagram have own subprocesses matually connected *(Figure 1)*. In the middle of *V* diagram is presented net of stakeholders responsable for each subprocesses in both side of *V* diagram.

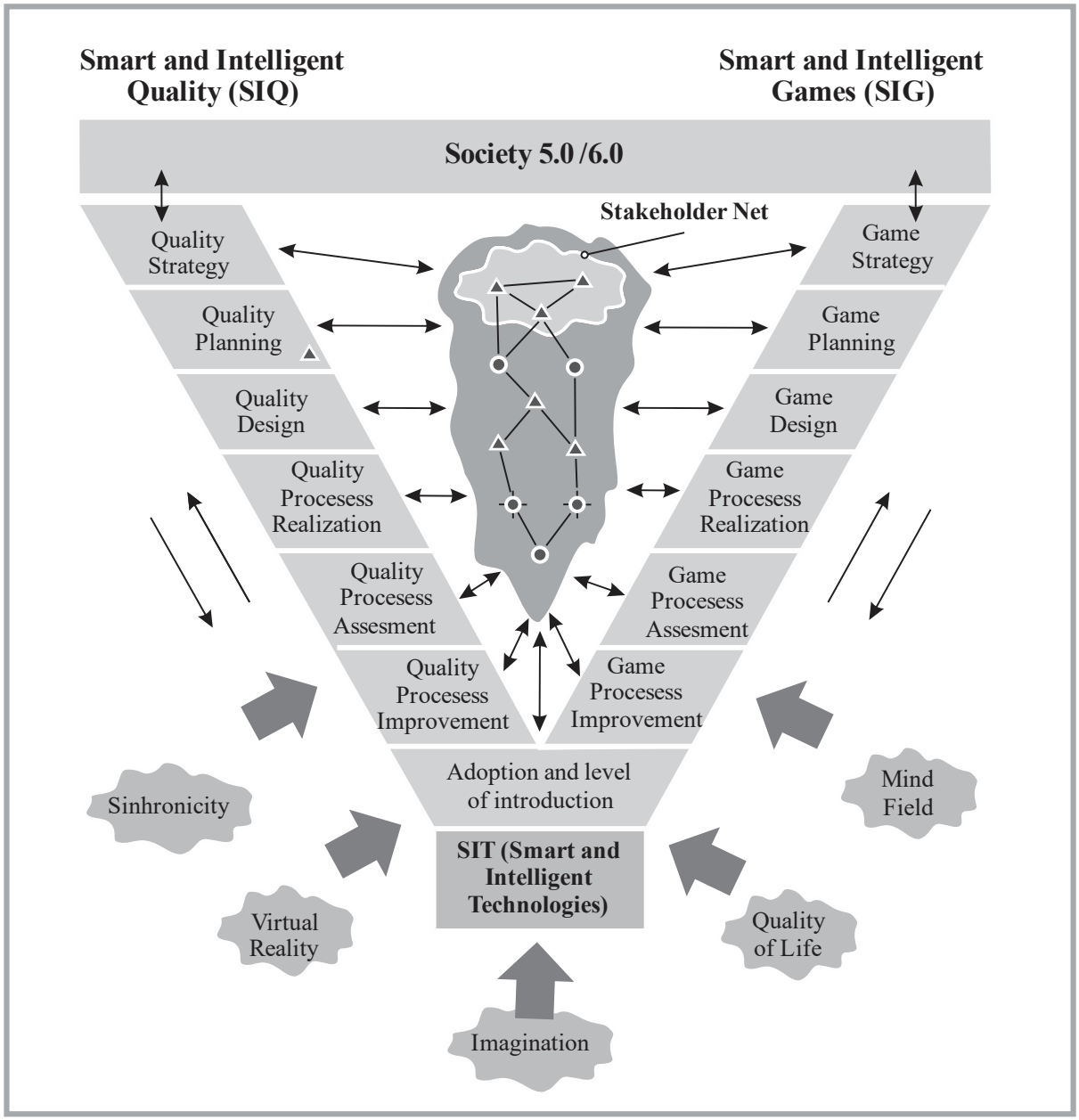

Figure 1. *Model of integrating processes of creative games (SIG) and Smart and Intelligent Quality (SIQ)*

In designing SIQ and SIG active role have: (1) sinhronicity, (2) virtual reality, (3) imagination, (4) quality of life, (5) mind field and other paradigms, theories, methods, and tools.

Smart and Intelligent Quality (SIQ) strategy is first strategy sub-process based on following inputs:

- adapted strategy business plan according stakeholders requerements analysis and needs of Society 5.0/6.0,
- analysis of existing strategy process in organization/supply chain,
- requirements of standards and good production practice,
- requirements of law and regional/proffesional declarations and contracts.

Based on the inputs is designing system for governance of business strategies (SIQ) with sub-processes:

- decomposition of strategy process,
- design business model and strategy busines plan,
- establishing strategy development team(s),
- definining tasks and responsibility of team members,

- performing strategic analysis,
- withing and adopting smart and intelligent strategic business plan (SISBP),
- implementation and control of SISBP,
- improvement of business processes,
- planning and designing system for management business strategics based on knowledge and AI.

Proposed structure of SIQ is based on literature from strategy Mihtzberg H. et al. (2003), Burgelman R., Christensen C. and Wheelwright S. (2009) and new references relateg to quality and game. So Magner T.J. (2014) analyzed performances and leadership in multilayer on line gaming, Lopes M.C. et al. (2013), Kark R. (2011), Gendler T.S. (2007), Binini I., Huemer W. and Molinary D. (2024), Kaplan C.A. (2025), Huston S. (2012).

Apraskin A.A. and Bertova A. (2020) analized a new role of leadership on Super Smart Digital society, as part of Society 5.0/6.0. In analysis of Smart and Intelligent Strategy high impact has quality culture for creating and sustaining organizations (Malhi R.S., 2013). In *Figure 2* is presented model of quality of culture on all society levels.

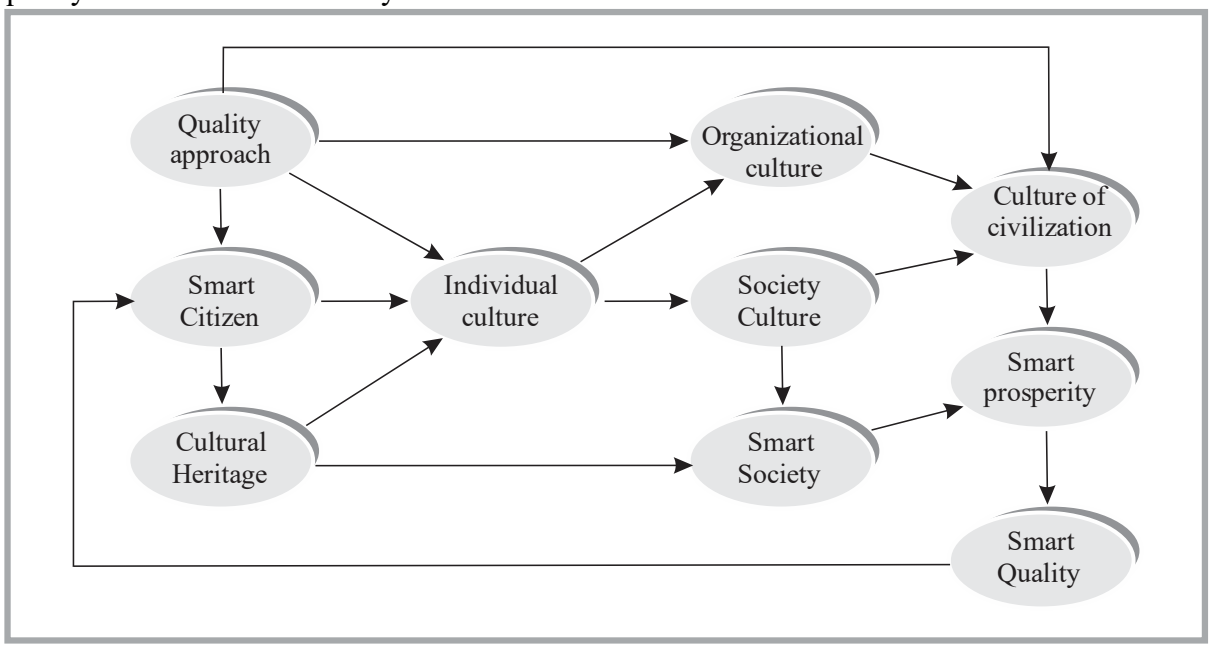

Figure 2. *Model of quality of culture*

Escudeiro P.M. et al. (2013) analized quality criteria for games and emphasized folloving dimensions:

1. pedagogical dimension,
2. technical dimension, and
3. organizational dimension.

Also, they analyzed game engine supporting the game-learning document with two connected phases:

- digital art with knowledge and AI, and
- serios game about Digital Art.

Suryapranata L.K.P. et al. (2017) analized aspect of quality measurement for serios games with matrix with category groups (player related and software related) and quality factors as: fun, balance, usability, understability, attractiveness, learnability, compliance, operability, effectiveness, efficiency, satisfaction, user health and safety, accessability, attention, relevance, confidence, and satisfaction.

Wagan A.A. et al. (2023) analyzed AI eroblad game based learning, and quality expirience. The base for this model are motivation level, analysis cognitive behavior and learning expirience. On higher level are evoluate matrix for learning outcomes, and on highest level are content designing, content management and organizing and using VR and AI.

4. CONCLUSION

The proposed model of integrating processes of creative games and quality IS develop according existing theoretical approaches as system modeling, process management, smart leadership, game theory, VR, smart and intelligent technologies impact, quality sciences etc. This model have three main areas: (1) quality, (2) game and stakeholder management. In the article is presented the part of existing literature related for some interactions among them and way how is posible to design creative games using quality principle with support of stakeholders management and communication using smart and intelligent systems, all as part of concept fitled Society 5.0/6.0 with high impact of culture on quality and creative games.

This presented analisis is only first step for recognising, analizis, design and implementation of holistic approach of quality and creative game in purpose to improve human life in the future.

REFERENCES

[1] Apraskin A.A. and Bertova A. (2020). Leader's Strategy in Super Smart Digital Society.
[2] Arsovski S. (2016). Nauka o kvalitetu (in inglish Quality Science), Centar za kvalitet, Fakultet inženjerskih nauka, Kragujevac.
[3] Arsovski S. (2023). Kvadratura kvaliteta (in inglish Quality Squaring), Centar za kvalitet, Fakultet inženjerskih nauka, Kragujevac.
[4] Arsovski S. (2023). The Sustainable Transition from Quality 4.0 to Quality 5.0: A Role of Sustainable, Spiritual and Intelligent Leadership in Creation of Capital for Future, Quality Festival 2023, pp. 3-19.
[5] Binini I., Huemer W. and Molinary D. (2024). A Game of Perspectives: On the Role of Imagination in Throught Experiments, Springer.
[6] Bowman S.L. and Liberoth A. (2018). Psychology and Role-Playing Games, In Sagal J.P. and Defrenling S. (eds) Role Play game Studies, Transmedia foundations, Routledge, new York, pp. 245-264.
[7] Bubenkova L. And Pietrikova E. (2024). Game Development: Enhancing Creativity and Independent Creation in University Courses, 5th International Computer Programing Education Conference (ICPEC), Article No. 12, pp. 12.1-12.13.
[8] Burgelman R., Christensen C. and Wheelwright S. (2009). Strategic Management of Technology and Innovation, Fift Edition, Mc Grow Hill, Irwin.
[9] Deming W.E. (1986). Out of the Crisis, Cambridge, MIT Press.
[10] Engstrom H. (2020). Game Development Research, University of Skoude, Sveden.
[11] Escudeiro P.M. et al. (2013). Quality Criteria for Education Games, EAI Endorsed Transactions on game base Learning, Vol. 13.
[12] Feigenbaum A.V. (2001). How to Manage for Quality in Today's Economy, Quality Progress, pp. 28-32.
[13] Foster T. (2004). Managing Quality: An Integrative Approach, Pearson Education International, New Jersey.
[14] Frackiewics P. ert al. (2022). Nach Equilibria of Quantum Games in the Special Two-Parameter Strategy Space, Applied science, 12, 11500.
[15] Fuhrmann M. et al. (2015). Improving a game-based education tool for quality management in production networks 48th CIRP Conference on manufacturing Systems-Cirp CMS 2015, Elsevier, pp. 692-696.
[16] Gendler T.S. (2007). Philosophical Thought Experiments, Intuitions, and Cognitive Equilibrium, Blackwell Publishing.
[17] Hauge J.B., Duin H. and Oliveira M. (2008). Using evaluation as quality assurance tool in the development of serios games, Proc. of the Fourth Conf. on Web International Systems and Technologies, pp. 394-401.
[18] Huston S. (2012). Smart strategy: Intelligence, Gaming and Agility, American journal of Economics and Business Administration 4(3).

[19] Ishicawa K. (1985). What is Total Quality Control? The Japanese Way, Englewood Cliffs, New York Prentice Hall.
[20] Juran J.M. (1992). Juran on Quality by Design: Free Press, New York.
[21] Kaplan C.A. (2025). Superintelligence design white paper: Self-aware Superintelligence, IQ Company of Croig A. Caplan.
[22] Kark R. (2011). Games managers Play: Play as a Form of Leadership Development, Academy for management learning & Education, Vol. 10, No. 3, pp. 507-527.
[23] Kern C. et al. (2017) Q-KEY2 an educational game for improving employee's quality awareness, 20th Exellence in Services International Conference, University of Verona, Italy, pp. 375-384.
[24] Komal M., Khalil Z. And Sirshar M. (2015). A Comprehesive Study on Quality Assurance in Game Development, International Journal of Computer and Comunication System Engineering, Vol. 2(1), pp. 11-19.
[25] Lopes M.C. et al. (2013). Business Games for leadership development: A systematic review, Simulation & Gaming, SAGE
[26] Magner T.J. (2014). Performance and leadership in multiplayer gaming, Theses and Disertations 511, Peperdine University
[27] Malhi R.S. (2013). Creating and Sustaining: A Quality Culture, J. Def. Manag S3:002.
[28] Mihtzberg H. et al. (2003). The Strategy Process: Concepts, Content, Cases, Pearson, Prentice Hall.
[29] Nagarney A. and Li D. (2015). A Supply Chain Network Game Theory Model with Prtoduct Differentiation, Outsourcing and Distribution, and Quality and Price Competition, Annals of Operation Research, 228(1), pp. 479-503.
[30] Ogland P. (2023). Expliciting the politics of Critical Systems Thinking by game Theory: A TQM Study, Systemist, Vol. 44(1), pp. 1-31.
[31] Ortiz P.A. and Akcaova G. (2024). The Concept of Game-based Learning, Creative Commons Attribution 4:0 International.
[32] Oxman N. (2016). Age of entlagement, Journal of Design and Science, 1.
[33] Ploder C., Dilger T. and Bernsteiner R. (2020). Improving knowledge transfer in simulation games based on cognitive load theory, p-ISSN, doi:10-36315/2020end039.
[34] Rouse R. (2004). Game Design: Theory & Practice, Second edition, Worldware Publishing.
[35] Siviy J.M., Penn M.L. and Stodard R. (2007). CMMI and Six Sigma: Partners in Process Improvement, Relationships with quality.
[36] Srikanth M. et al. (2022). A new Way to Improve Crop Quality and Protect the Supply Chain is to use a Trajectory network and game Theory, Mathematical Statistician and Enginnering Applications, Vol. 73, No. 4, pp. 10600-10610.
[37] Summers D. (2010). Quality, Prentice Hall, Boston.
[38] Suryapranata L.K.P. et al. (2017). Quality measurement for servios games, 217 International conference on Applied Computer and Communication Technologies, Jacarta, Indonesia, 217 IEEE.
[39] Trisnadoli A., Hendradjaya B. and Sunindyo W. (2015). A proposal of Quality Model for Mobile Games, The 5th International Conference on Electrical Engineering and Informatics, bali, Indonesia, pp. 432-436.
[40] Wagan A.A. et al. (2023). Artificial Intelligence Enabled game-Based Learning and Quality of Expirience: A novel and Secure Framework (B-AIQoE), Sustainability, 15, 5362.
[41] Wallas G. (1926). The art of thought, Harcourt Brace Joraneric, New York.

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CULTURAL TOURISM – AN ELEMENT OF IMPROVING THE QUALITY OF THE OFFER AND COMPETITIVENESS OF THE TOURIST DESTINATION

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Dušan Garabinović, PhD [2]
Milan Zajić, MSc [3]

Abstract: *Tourism occupies an increasingly important position in the global economy. Attractions are the main reasons tourists visit a certain destination, and cultural attractions are among the main types of attractions. Culture represents one of the main potentials for the growth and development of tourism. The tangible and intangible cultural heritage of the destination is characterized by its ability to attract tourists. Tourism that focuses on cultural attractions is known as cultural tourism. The subject of this paper is cultural tourism as an element of improving the quality of the offer and the competitiveness of the tourist destination. The mentioned subject is realized through the presentation of the development and importance of cultural tourism as a specific form of tourist movements, as well as cultural tourists whose main motive for visiting is precisely culture, i.e. its different forms. The aim of this paper is to present the strong connection between culture and tourism, which are recognized as two powerful drivers of economic and cultural development.*

Keywords: *culture, cultural tourism, tourism offer, quality, tourist destination*

JEL Classification*: L83, Z30*

1. INTRODUCTION

Tourism undoubtedly represents a very important segment of the economic development of every country, given its economic, sociological and ecological factors, which bring incredible changes to the environment. The importance that the tourism industry has gained in the last decade of the last century represents the backbone of its further development.

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Many authors have dealt with the definition of tourism, which does not mean that the research is complete and that there is a single definition. In the second half of the twentieth century, more significant considerations and studies of this activity began. Unlike primary needs, secondary needs, which include tourist needs, are constantly changing, their number is increasing, while the quantity, type and method of satisfaction are also constantly changing.

In addition to natural resources, which can represent the potential for tourism development, another important element is culture.

The cultures of countries often represent a strong motive for tourist movements. In addition, the culture of a people, their customs and history define a series of cultural and historical monuments and heritage that are interesting and attract tourists to visit them.

Special interest tourism is extremely developed, which also conditions the possibility of developing special forms of tourism. Cultural tourism, as one of the types of selective forms, includes visits to cultural resources, by which we also mean the way of life of the local community, which can also offer it as a tourist product. Cultural tourism is a form of domestic and international tourism whose goal is, among other things, the discovery and enjoyment of historical monuments and monumental heritage, focusing on movable and immovable cultural goods, and provides the opportunity to visit and participate in activities that authentically represent the cultural heritage of local communities. Intangible cultural heritage is of particular importance.

The subject of this paper is cultural tourism as an element of improving the quality of the offer and the competitiveness of the tourist destination. The mentioned subject is realized through the presentation of the development and importance of cultural tourism as a specific form of tourist movements, as well as cultural tourists whose main motive for visiting is precisely culture, i.e. its different forms. The aim of this paper is to present the strong connection between culture and tourism, which are recognized as two powerful drivers of economic and cultural development.

The term culture (lat. *culture* – cultivation) dates back to the 13th century and first appeared in the French language, followed by the words cultivator and cultivate – which means to cultivate (land). Then, with the invention of fire and the development of agriculture, culture rises to a higher level. This is later followed by the development of spiritual culture, which gradually frees man from dependence on nature, and teaches him how to rationally manage and use natural resources.[4] Culture is learned human behaviour. Unlike biological heritage, which is passed on genetically, cultural heritage is passed on to new generations through learning, with language, writing, religion and other symbols playing a major role. Therefore, culture is acquired after birth, through learning.

According to the Huxsley's model, culture consists of a set of superstructures, namely:[5]

- Mentifacts – form a worldview and connect people into a spiritual and moral community. These are religion, language, magic, folklore and customs, artistic traditions, literature, science. They represent the main and oldest elements of culture.
- Sociofacts – connect people into one social community. At the level of the individual, they include family relations, relations between the sexes, the principles of raising children, and at the level of society - political culture, communication culture, common laws and the like.
- Artifacts – these are elements of material culture, which includes technical means and products for satisfying basic human needs (food, housing, clothing, means of communication).

[4] Grčić M., Geografija kultura i civilizacija. Geografski fakultet, Beograd, 2014.
[5]New World Encyclopedia. (n.d.). Culture. Retrieved June 1, 2021, from https://www.newworldencyclopedia.org/entry/Culture

2. CULTURAL TOURISM AND CULTURAL TOURIST

Culture is a prerequisite for the development of tourism, and tourism is an effective way of valorising culture. Every tourist trip has some element of culture, precisely because it moves the participant from one cultural environment to another. Local culture is an important feature of the destination, and thanks to tourism, it becomes the basis of its social and economic development.

It is important to note that according to Richards, culture can be viewed from two aspects:[6]

1. Culture as a "process" – derived from anthropology and sociology, which consider culture mainly as an innate code of behaviour of a certain social community.
2. Culture as a "product" – comes from literary criticism. Culture is considered the product of individual or group activities that can bear the epithet of "high" or the epithet of "low" culture. Thus, the products of famous artists would be considered as "high" culture, while certain TV programs would be characterized as "low" culture.

In the field of tourism, these two different approaches seem to overlap and integrate.

In other words, tourism, accompanied by other social influences, can act as a catalyst for transforming culture as a process into culture as a product, thereby isolating and separating cultural products from their initial social context.

Cultural tourism focuses on cultural attractions and activities as the main reasons for travel. The complexity of the interests of cultural tourists and the multitude of resources that cultural tourism encompasses make it difficult to define the concept of cultural tourism. It is a complex and multifaceted phenomenon, which is why it is approached by a typology, i.e. the isolation of certain specific sub-sectors.

There is cultural tourism, and there is also talk about tourist culture. Culture and tourism are closely related. It is very important to distinguish certain aspects of culture from the point of view of tourism. Reisinger[7] lists three such aspects: tourist culture, "host" culture and tourist culture. Tourist culture is the culture that tourists bring with them when visiting another country. Since they behave differently when traveling than at home, their culture also depends on the so-called residual culture. In addition to national cultures, the cultures of individual groups of tourists (backpackers, adventurers, etc.) are also taken into account. "Host" culture refers to the culture of the destination, i.e. the community with which tourists come into contact. Tourist culture is the result of the behaviour of all participants in the tourism process – both tourists and those who provide them with services. It is a consequence of the mixture of tourists, hosts and residual cultures, i.e. a special type of culture that emerges in each destination. It differs from the everyday culture of both tourists and hosts, because both behave differently in contact with each other.

When talking about cultural tourism, it is also necessary to define the concept of a cultural tourist. Jelinčić[8] points out that knowledge of the typology and motivation of cultural tourists is the basis for a strategy for the development of cultural tourism, in order to specify the target groups, but also the market itself. According to Jovicic[9], McKercher and Hilary du Cross proposed the most widely accepted typology in 2002:

- Intentional cultural tourist – a person who sets out on a trip motivated by culture and achieves a "deep" cultural experience.
- Sightseeing cultural tourist – a person who also travels for cultural reasons, but his experience is more superficial and consists mainly of visiting famous cultural attractions.

[6] Richards G., Cultural Tourism in Europe. Wallingford, CAB International, 1996.
[7] Reisinger Y., International Tourism: Cultures and Behaviour. Butterworth Heinemann, Oxford, 2009.
[8] Jelinčić D.A., Abeceda kulturnog turizma (drugo izdanje). Meandarmedia/Meandar, Zagreb, 2008.
[9] Jovicic D. (2016). Cultural tourism in the context of relation between mass and alternative tourism. Current Issues in Tourism, Vol. 19, No. 6, 2016, pp. 605-612. https://doi.org/10.1080/13683500.2014.932759.

- Incidental cultural tourist – a person who does not visit a destination for culture, but unplannedly visits and consumes some cultural content on site and achieves a "deep" experience;
- Informal cultural tourist – a person who has a relatively weak motive to visit a destination for culture, and the experience he or she achieves is "shallow".
- Secondary cultural tourist - a person who has no motive at all to visit a destination for culture, but participates in some cultural activities and achieves a "shallow" experience.

These five types of cultural tourists can be classified into two key groups: the first group includes those tourists for whom culture is the main motivation to travel. The second group refers to tourists for whom culture is only a supplementary, secondary or even incidental motivation when traveling.[10]

Based on research conducted by a group of authors[11], it was concluded that only 15% of the tourism market consists of intentional cultural tourists, 30% of sightseeing cultural tourists, 20% of incidental cultural tourists, 20% of casual cultural tourists, and 15% of serendipitous cultural tourists.

3. CULTURAL TOURISM – TYPES AND ELEMENTS OF THE TOURISM OFFER

The essence of tourism is its ability to transform certain resources into a product. Tourism products are the physical and psychological experiences that travellers gain by visiting different destinations.

Cultural tourism includes the following subcategories:[12]

- Heritage tourism, including built heritage, architectural and archaeological sites, world heritage sites, art, folklore, legends, historical events and figures;
- Thematic cultural routes, based on historical, artistic, spiritual and religious, architectural, culinary and linguistic themes;
- Cultural city tourism in historic cities, modern cities and European Capitals of Culture;
- Ethnic tourism, which involves exploring local traditions, local crafts, minority cultures or indigenous cultures;
- Festival and event tourism – attracting visitors to cultural festivals, music, and art festivals;
- Religious tourism – attracting visitors to religious sites and buildings, places of relicts and pilgrimage routes, including visitors who visit religious sites for their architectural and cultural significance;
- Creative cultural tourism – performing arts, visual arts, literature, cinema, audio-visual productions, design and printed works.

Gastronomy is one of the elements of cultural tourism that should be given special attention. Sustainable management of the gastronomic offer in the sphere of tourism should be encouraged.[13] It is similar with event tourism.[14] Promotion is an important element of successful cultural tourism. Culture should be promoted, especially in areas characterized by multiculturalism.[15]

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[10] Ibid.

[11] Petroman I., Petroman C., Marin D.,Ciolac R., Văduva L., & Pandur I., Types of cultural tourism. Scientific Papers: Animal Science and Biotechnologies, Vol. 46, No. 1, 2013, pp. 385-388. p. 387.

[12] UNWTO. (2012). *Tourism and Intangible Cultural Heritage*. Madrid: UNWTO. ISBN 978-92-844-1479-6.

[13] Garabinović D., Ćuruvija I., & Ćuruvija M., Management of development of a sustainable gastronomic tourism offer of the Moravica administrative district (Serbia). In III International conference on advances in science and technology, Proceedings COAST 2024, Herceg Novi, 29 May – 01 June, 2024 (pp. 706-716). Faculty of Management, Herceg Novi, Montenegro, 2024.

[14] Garabinović D., Ćuruvija M., Ćuruvija I. (2022). Unapređenje menadžmenta događaja u Moravičkom upravnom okrugu kao turističkoj destinaciji. U A. Skorup, i S. Skorup (Ur.) Zbornik radova šeste nacionalne naučno-stručne konferencije sa međunarodnim učešćem „Trendovi u poslovanju 2022" (str. 307-317). Visoka poslovna škola strukovnih studija „Prof. dr Radomir Bojković", Kruševac, 2022.

[15] Ćuruvija M., Ćuruvija I., Garabinović D., Promocija multikulturalnosti putem Web-sajtova lokalnih turističkih organizacija sa teritorije Vojvodine. U A. Skorup, i M. Stevanović (Ur.) Zbornik radova pete nacionalne naučno-stručne konferencije sa međunarodnim učešćem „Trendovi u poslovanju 2021" (str. 273-285). Visoka poslovna škola strukovnih studija „Prof. dr Radomir Bojković", Kruševac, 2021.

Cultural routes are a project of the Council of Europe and refer to the revitalization of European cultural itineraries (routes), directions that have been followed by travellers eager for cultural content over the past centuries. The routes are thematic in nature and relate to various aspects of culture (history, art, philosophy, lifestyle, tradition, etc.). Some of the topics are, for example, Vikings, Celts, parks and gardens, baroque, rural life, pilgrimages, military architecture, etc. Each should point to common European values and in their implementation often results in the "networking" of several countries. In addition to common routes covering several countries, individual countries also have their own local cultural routes (for example, the Loire castles in France). Likewise, the European Cultural Routes program includes three such routes in Serbia: the Route of the Roman Emperors, the Transromanica, and the Fortresses on the Danube.[16]

Many scholars have identified a shift from cultural tourism to creative cultural tourism. For example, D'Auria[17] argued that creative tourism is considered an evolution of cultural tourism towards more engaging and authentic experiences. Fernandez[18] suggested that the evolution of the tourism production system is driven by creative tourism models. These and many other studies have confirmed the link between cultural and creative tourism. Creative tourism can be defined as "spending a holiday learning a specific skill that belongs to the culture of the host country"[19].

The Council of Europe's cultural routes have great potential for creating new tourism products, as well as for developing remote areas, which are far from urban centres and where people live in small settlements or isolated places, generally lack infrastructure and have limited employment opportunities. Moreover, by passing mainly through rural areas, cultural routes can contribute to heritage protection, sustainable development, economic viability, transnational cooperation, job creation, as well as awareness of cultural heritage.[20]

The European Union's "European Capital of Culture" project is a good example of the integration of culture and tourism, i.e. the transformation of culture into a tourist product. Every year, one or several cities with a rich cultural heritage become the European Capital of Culture.

This project was launched in 1983 with the aim of highlighting the cultural richness and diversity of European cities and two years later it came to life with the announcement of Athens as the first host. Since then, numerous cities have been chosen to hold this title, such as Berlin, Paris, Lisbon, Genoa, Luxembourg, Liverpool, Maribor, etc.[21] The European Capital of Culture in 2022 was Novi Sad.

This project is of exceptional importance, because the temporary status of the cultural capital guarantees potential tourists an extraordinary offer of high-quality and diverse cultural content, which certainly has an effect on the volume of tourist traffic and realized tourist spending.

4. CULTURAL TOURISM – MASS OR SELECTIVE TYPE OF TOURISM

The World Tourism Organization's forecasts point out that in the future, accelerated growth could be achieved by certain types of tourism that are characterized by a lower degree of massification and enable better dispersion of tourists in the receptive region. This primarily refers to cultural tourism, cruises, short city breaks, congress and conference trips (MICE industry) and ecotourism. In theory and practice, various terms are used: specific forms of tourism, selective types of tourism, special interest tourism, thematic tourism, niche tourism, alternative tourism, small-scale tourism. Future

[16] Rabotić B., Selektivni oblici turizma. Visoka turistička škola strukovnih studija, Beograd, 2013.
[17] D'Auria A., Urban cultural tourism: Creative approaches for heritage-based sustainable development. International Journal of Sustainable Development, Vol. 12, No. 2/3/4, 2009, pp. 275–289. https://doi.org/10.1504/ijsd.2009.032782.
[18] Fernandez T., More than sun, beach and heritage: Innovating Mediterranean tourism through creative tourism. Interactions, co-operation, competitiveness and economic development. 2010 RESER Conference papers. Gothenburg, Sweden, 2010.
[19] Richards G., & Raymond C., Creative tourism. ATLAS News, 23, 2000, pp. 16-20.
[20] Council of Europe, Resolution CM/Res(2013)66 confirming the establishment of the Enlarged Partial Agreement on Cultural Routes (EPA), 2013.
[21] Vujović S., Cvijanović D., Štetić, S., Destinacijski koncept razvoja turizma. Monografija. Institut za ekonomiku poljoprivrede, Beograd, 2012.

development will be largely marked by specific tourist products, content and activities intended for certain narrow segments of tourist demand, the so-called market niches. Such types of tourist traffic, better known as selective forms of tourism, are usually seen as sustainable, at least from the perspective of the tourist destination.[22]

The early 1990s marked a significant period of transformation in cultural tourism, which, in contrast to its initial orientation towards an elite clientele, found a new opportunity for development in its orientation towards the mass tourism market. This has been attributed to a number of factors: the growth of education among general tourist demand, economic globalization, which is largely dependent on the globalization of culture, the view that all tourist trips include a cultural dimension, and the efforts of many recreational tourism destinations to enrich their traditional offer by including cultural content, etc.[23] Fifteen years ago, cultural tourism was a small niche in the tourism market, but today it is recognized as one of the main subtypes of tourism.[24] A large number of tourists, an increased number of tourist arrangements intended for cultural tourism, as well as increased pressures on the physical and socio-cultural environment are some of the typical characteristics of mass tourism, which cultural tourism did not have at the beginning of its development, but its main goal was to profile itself as an alternative to mass tourism. From the previously mentioned factors, it could be concluded that cultural tourism as an alternative form of tourism at the end of the twentieth century, through a process of transformation, acquired certain characteristics of mass tourism.[25] From this we can conclude that Butler's[26] statement was correct: "Although cultural tourists are usually seen as "good" tourists who travel in small numbers and cause little damage, they can undoubtedly act as a "Trojan horse" that opens up each region to the less acceptable, negative effects of mass tourism." Therefore, Jovicic[27] states that an ethical approach is one of the crucial ones for the proper, sustainable development of tourism, as a complex economic, geophysical and socio-cultural phenomenon.

4. CONCLUSION

Tourism plays a vital role in the development of various destinations around the world. Considering that culture is a significant component in every aspect of human life, it is possible to assume that everything is cultural, and therefore tourism is somehow cultural tourism. Accordingly, culture is seen as one of the primary elements of tourism development. However, this broad and holistic approach is not particularly useful in identifying those cultural values important for tourism and vice versa, and it is necessary to specifically and precisely define cultural tourism as a form focused on cultural attractions and activities as the main reasons for traveling. In cultural tourism, it is necessary to distinguish several terms, such as: tourist culture - the culture that tourists bring with them when visiting another country; "host" culture – refers to the culture of the destination, i.e. the community with which tourists come into contact; and tourist culture - the result of the behaviour of all participants in the tourism process – both tourists and those who provide them with services. The concept of cultural tourism emerged at the end of the 20th century and was focused on visiting famous historical sites and viewing historical monuments, works of art and cultural events, while today cultural tourism is recognized as one of the main sub-types of tourism that is increasingly relevant, and for this reason it is necessary to create such a cultural image of the destination that tourists will

[22] Stanić Jovanović S., Small form tourism – Contemporary trend and durable development opportunity, Case Study of Surčin Tourist Destination. Quaestus, No. 6, Faculty of Management in Tourism and Commerce, Timisoara, 2015, pp. 214-230.
[23] Jovicic D., Cultural tourism in the context of relation between mass and alternative tourism. Current Issues in Tourism, Vol. 19, No. 6, 2016, pp. 605-612. https://doi.org/10.1080/13683500.2014.932759.
[24] Richards, G. & Raymond, C. (2000). *Creative Tourism*. ATLAS News, 23, pp.16-20.
[25] Jovicic D., Cultural tourism in the context of relation between mass and alternative tourism. Current Issues in Tourism, Vol. 19, No. 6, 2016, pp. 605-612. https://doi.org/10.1080/13683500.2014.932759.
[26] Butler R. W., Alternative Tourism: Pious hope or trojan Horse? Journal of Travel Research, Vol. 28, No. 3, 1990, pp. 40-45. https://doi.org/10.1177/004728759002800310.
[27] Jovicic D., Key issues in the implementation of sustainable tourism. Current Issues in Tourism, Vol. 17, No. 4, 2013, pp. 297-302. https://doi.org/10.1080/13683500.2013.797386.

remember. On this occasion, we must be aware of local diversity, because tourists are looking for authenticity and diversity. Also, tourism management should focus on involving in cultural activities those tourists who are only partially motivated or not motivated at all by culture, and who represent 15% of the total number of tourists.

Although at one time, the predictions of some authors were in favour of reducing the development of mass tourism in contrast to the development of small-scale tourism, the fact is that mass tourism in its current form and form will not disappear and cease to exist. What is possible is that certain forms of alternative tourism, with already expressed significant prospects for development (as is the case with cultural tourism), will transform in terms of transitioning to mass tourism. In addition, there is also the possibility of combining mass with small-scale tourism, which appears to be a particularly interesting development concept for many tourist destinations around the world.

By improving cultural tourism, the basis for a better tourist offer is created. The number, quality and uniqueness of the cultural content of such an offer can attract new or lead to a longer stay of existing tourists. The key is to strengthen the competitive position of the tourist destination on the regional and global tourist market.

LITERATURE:

[1] Butler, R. W. (1990). Alternative Tourism: Pious hope or trojan Horse? Journal of Travel Research, 28(3), 40-45. https://doi.org/10.1177/004728759002800310.

[2] Council of Europe (2013). Resolution CM/Res(2013)66 confirming the establishment of the Enlarged Partial Agreement on Cultural Routes (EPA).

[3] Ćuruvija, M., Ćuruvija, I., Garabinović, D. (2021). Promocija multikulturalnosti putem Web-sajtova lokalnih turističkih organizacija sa teritorije Vojvodine. U A. Skorup, i M. Stevanović (Ur.) Zbornik radova pete nacionalne naučno-stručne konferencije sa međunarodnim učešćem „Trendovi u poslovanju 2021“ (str. 273-285). Visoka poslovna škola strukovnih studija „Prof. dr Radomir Bojković“, Kruševac.

[4] D'Auria, A. (2009). Urban cultural tourism: Creative approaches for heritage-based sustainable development. International Journal of Sustainable Development, 12(2/3/4), 275–289. https://doi.org/10.1504/ijsd.2009.032782.

[5] Fernandez, T. (2010). More than sun, beach and heritage: Innovating Mediterranean tourism through creative tourism. Interactions, co-operation, competitiveness and economic development. 2010 RESER Conference papers. Gothenburg, Sweden.

[6] Garabinović, D., Ćuruvija, I., & Ćuruvija, M. (2024). Management of development of a sustainable gastronomic tourism offer of the Moravica administrative district (Serbia). In III International conference on advances in science and technology, Proceedings COAST 2024, Herceg Novi, 29 May – 01 June, 2024 (pp. 706-716). Faculty of Management, Herceg Novi, Montenegro.

[7] Garabinović, D., Ćuruvija, M., Ćuruvija, I. (2022). Unapređenje menadžmenta događaja u Moravičkom upravnom okrugu kao turističkoj destinaciji. U A. Skorup, i S. Skorup (Ur.) Zbornik radova šeste nacionalne naučno-stručne konferencije sa međunarodnim učešćem „Trendovi u poslovanju 2022“ (str. 307-317). Visoka poslovna škola strukovnih studija „Prof. dr Radomir Bojković“, Kruševac.

[8] Grčić, M. (2014). Geografija kultura i civilizacija. Geografski fakultet, Beograd.

[9] Jelinčić, D.A. (2008). Abeceda kulturnog turizma (drugo izdanje). Meandarmedia/Meandar, Zagreb.

[10] Jovicic, D. (2016). Cultural tourism in the context of relation between mass and alternative tourism. Current Issues in Tourism, 19(6), 605-612. https://doi.org/10.1080/13683500.2014.932759.

[11] New World Encyclopedia. (n.d.). Culture. Retrieved June 1, 2021, from https://www.newworldencyclopedia.org/entry/Culture

[12] Petroman, I., Petroman, C., Marin, D., Ciolac, R., Văduva, L., & Pandur, I. (2013). Types of cultural tourism. Scientific Papers: Animal Science and Biotechnologies, 46(1), 385-388.

[13] Rabotić, B. (2013). Selektivni oblici turizma. Visoka turistička škola strukovnih studija, Beograd.
[14] Reisinger, Y. (2009). International Tourism: Cultures and Behaviour. Butterworth Heinemann, Oxford.
[15] Richards, G., & Raymond, C. (2000). Creative tourism. ATLAS News, 23, pp.16-20.
[16] Richards, G. (1996). Cultural Tourism in Europe. Wallingford, CAB International.
[17] Stanić Jovanović, S. (2015). Small form tourism – Contemporary trend and durable development opportunity, Case Study of Surčin Tourist Destination. Quaestus, No. 6, Faculty of Management in Tourism and Commerce, Timisoara, 2015, pp. 214-230.
[18] UNWTO. (2012). *Tourism and Intangible Cultural Heritage*. Madrid: UNWTO. ISBN 978-92-844-1479-6.
[19] Vujović, S., Cvijanović, D., Štetić, S. (2012). Destinacijski koncept razvoja turizma. Monografija. Institut za ekonomiku poljoprivrede, Beograd.
[20] Jovicic, D. (2013). Key issues in the implementation of sustainable tourism. Current Issues in Tourism, 17(4), 297-302. https://doi.org/10.1080/13683500.2013.797386.

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STANDARDS AND QUALITY FACTORS IN ARCHITECTURE, URBANISM AND CIVIL ENGINEERING

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Abstract: *Standards are an integral part of design and planning in architecture urbanism and civil engineering. Different temporal, social, economic and political contexts have influenced the change and relationships of architecture, urbanism and civil engineering according to standards. We can follow the genesis using the historical method through the analysis of those relationships. The basic motive that precedes the introduction of standardization in the area is to achieve the same standard of quality of city life in any urban segment, regardless of its position and structure. In addition to aesthetics, standardization has a particular impact on the quality of life. The quality of urban life refers to a number of factors, both physical and social, psychological, etc., which have been established through previous research. They are extremely important in the modern context of research that will deal with the inclusion of user needs during design and planning. The Strategy for the Development of Quality Infrastructure in the Republic of Serbia for the Period 2025-2030 also requires concrete steps in order to fulfill the intended goals. One of the elements in the wider network of factors of national quality are standards and standardization in architectural and urban planning and design. As a part of organizations of actors of quality infrastructure, in cooperation and cohesion with other national quality factors, they can successfully respond to challenges and improve quality infrastructure.*

Keywords: *Architecture 1, Urbanism 2, Standards 3, Urban quality of life 4, Network 5*

JEL Classification*: Z32, L26, Q13*

1. INTRODUCTION

Various countries in the world have, within their laws and legal acts, regulated regulations regarding planning, design, construction and the standards that accompany them. The specific political environment and organization of the former SFR Yugoslavia, within which today's Serbia was also

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located in the second half of the 20th century, placed the state at the forefront of decision-making and planning when it comes to construction. The so-called free market, in addition to competition, brought a large space for corruption, which is today a problem in many countries of liberal capitalism, as well as countries where capital has overridden the public interest. State-owned companies dealt with the entire area and architectural and urban solutions were selected based on a competition. Clear regulations and standards determined high-quality projects and their implementation.

At the end of the twentieth century, due to the collapse of the SFRY and the transition, existing regulations slowly disappeared, respect for existing ones became increasingly minimal, existing laws and norms were ignored, circumvented and avoided, so that from that period until today, we have been recording a decline and an avalanche of bad solutions and disastrous decisions, which in architecture and urbanism have another important aspect of the problem, which is the permanence and difficult, sometimes almost impossible correction of mistakes made in this way. Serbia is specific in relation to the surrounding countries, as well as to the former socialist countries of the Eastern Bloc, so we will observe it in that context, with all its specificities, but also as part of the wider environment, when we talk about standards and quality.

Urban planning rules and regulations, starting from the broader level of architectural space, have begun to be bypassed and neglected in Serbia, with the weakening of the rule of law and the denial or non-inclusion of the profession. This is sufficiently demonstrated by the fact that thirty years have passed since the last regulation for the design of residential buildings and apartments.[4]

On the other hand, a shift in priorities has been observed in the strategic documents adopted in the previous decade. On the one hand, a new rulebook for the design of residential buildings was issued, while on the other hand, the main goals of the energy policy of the Republic of Serbia were set, which concern stopping the deterioration of the housing stock, creating conditions for improving energy efficiency in the housing sector and bringing average housing conditions closer to European Union standards.[5,6]

This paper reports new efforts and improvements in energy efficiency standards for the development of a platform that integrates built environment data with IoT sensors in a campus-wide web system, called Otaniemi3D, which provides information on energy consumption, occupancy and user comfort by integrating building information models and IoT devices through open messaging standards (O-MI and O-DF) and IFC models. This describes design criteria, system architecture, workflow and proof of concept with potential use cases that integrate IoT with the built environment. Initial results show that both end-users and other research groups can benefit from such platforms, either by consuming the data in their daily lives or using the data for more advanced research.[7]

The paper compares the basic standards used in the field of architecture, urban planning and construction and the new standard ISO 19650, which represents a completely different approach and context that arose precisely as a result of the modern digital revolution. The aim of the paper is to present the importance of standards for planning and design, as well as the differences and importance of accepting and implementing new standards that are a consequence of new paradigms in design quality. The requirements for improving qualitative factors in BIM-based design projects have made it necessary to develop a verification and evaluation process for BIM-based architectural design. The

[4] Đorđević, A., (2014) Standardi u planiranju i projektovanju stambenih objekata u Srbiji – domen energetske efikasnosti, Beograd, Arhitektonski fakultet.

[5] Nacionalna strategija održivog razvoja, (2005) Službeni glasnik RS, br. 55/05, 71/05-ispravka i 101/07 Pravilnik o uslovima, sadržini i načinu izdavanja sertifikata o energetskim svojstvima zgrada (2011), Službeni glasnik RS br. 61/11

[6] Đorđević, A., op. cit.

[7] Dave, B., Buda, A., Nurminen, A., Främling, K., A framework for integrating BIM and IoT through open standards, Automation in Construction, Volume 95, 2018, Pages 35-45.

aim of this study is to develop and implement BIM-based quality control requirements to improve the quality of architectural design.[8]

2. ISO STANDARDS AND EXCELLENCE IN ARCHITECTURE

ISO standards and excellence in architecture are primarily about quality, safety and sustainability in design and construction. These are ISO 9001 for quality management, ISO 14001 for environmental management and ISO 45001 for health and safety at work, which focus on improving performance and compliance with regulations. In this paper, we research the importance of ISO standards in architecture, urban planning and construction today and the great need for their application and respect.

The ISO 9001 standard: Quality management for architectural practices, enables client satisfaction by ensuring that the project complies with the highest standards. Project delivery is improved, clear workflows and responsibilities are established, delays and errors are reduced during the design and construction phases. Also, client satisfaction is based on the alignment of architectural projects with their requirements and the trust that arises as a result of reliable and high-quality service.[9] Increased efficiency has been achieved by identifying weaknesses in project management and reducing costs through optimizing resource allocation.

As society places greater emphasis on sustainability and environmental management, particularly within the architecture, engineering and construction (AEC) sectors, it is vital to understand the effectiveness of the tools available to deliver change in these areas. The AEC sectors contribute to a significant impact on the environment, both in terms of materials used and waste produced. They are also seen as being environmentally negative. Therefore, the use of ISO 14001 is of increasing importance in terms of demonstrating a commitment to working towards being more sustainable within their operations.[10]

ISO 14001: Environmental management in architecture promotes sustainable design by addressing environmental impact. Architects play a key role in minimizing resource use and improving energy efficiency in buildings. Sustainable design practices include energy efficient and environmentally friendly materials, thus reducing the environmental impact of construction projects. Compliance with environmental regulations ensures compliance with legal requirements for sustainable construction practices and avoids penalties and project delays for non-compliance. Differentiation in the market is achieved through a commitment to sustainability by attracting environmentally conscious clients and associates.

ISO 45001: Safety and health at work in architecture ensures safety in all architectural projects by identifying and mitigating hazards in the workplace. This is vital for the protection of teams working on site and during the design process. A safer working environment is achieved through risk reduction during construction and on-site inspection. Workers, contractors and stakeholders are protected. Compliance with health and safety regulations, laws and standards reduces the likelihood of legal problems and project suspensions. The reputation itself is improved in this way, through a commitment to safety and well-being and strengthens client trust and professional relationships.

The integrated benefits of ISO standards for architects through the combination of ISO 9001, 14001 and 45001 creates a holistic approach to managing quality, sustainability and safety in architectural practice. One of the advantages is certainly comprehensive risk management. At the same time, it deals with quality, environmental and safety risks and improves decision-making and project

[8] Choi, J., Lee, S., Kim, I. (2020) Development of Quality Control Requirements for Improving the Quality of Architectural Design Based on BIM, Applied Sciences, 10(20), 7074. https://doi.org/10.3390/app10207074.

[9] Heras-Saizarbitoria, I., Boiral, O. (2013) ISO 9001 and ISO 14001: towards a research agenda on management system standards, International journal of management reviews, 15(1), 47-65.

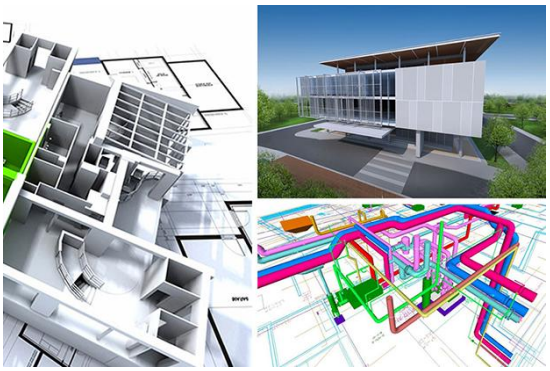
[10] Horry, R., Booth, C. A., Mahamadu, A. M. (2022) Towards a consensus of expert opinions on implementing ISO 14001 in the architecture, engineering and construction sectors of the UK, WIT Transactions on Ecology and the Environment, 258(2022), 329-341.

planning. Competitive advantage positions architecture firms as industry leaders and increases eligibility for large projects that require compliance with ISO standards.[11] Cooperation that harmonizes processes with contractors, clients and other stakeholders has improved, as well as better communication that reduces conflicts.

In 2014, the first edition of the standard ISO 37120 on "Sustainable development of communities - Indicators for urban services and quality of life" was published, and the second edition was updated in 2018. The intention was to standardize and equalize urban indicators among different countries. The committee asserts that "standardization in the field of sustainable cities and communities will encompass the development of requirements, frameworks, guidelines and support techniques and tools to achieve sustainable development, taking into account smartness and resilience [...]" and therefore contribute to the UN Sustainable Development Goals (ISO 2021). According to ISO, the document is "applicable to any city, municipality or local government that commits to measuring its performance in a comparable and verifiable way, regardless of size and location" (ISO 2018).[12] A concept guided by the ISO 37120 standard for city services and quality of life is suggested as unified framework for smart city dashboards. The slow (annual, quarterly, or monthly) ISO 37120 indicators are enhanced and complemented with more detailed and person-centric indicators that can further accelerate the transition toward smart cities.[13]

3. INTERNATIONAL STANDARD BIM - ISO 19650

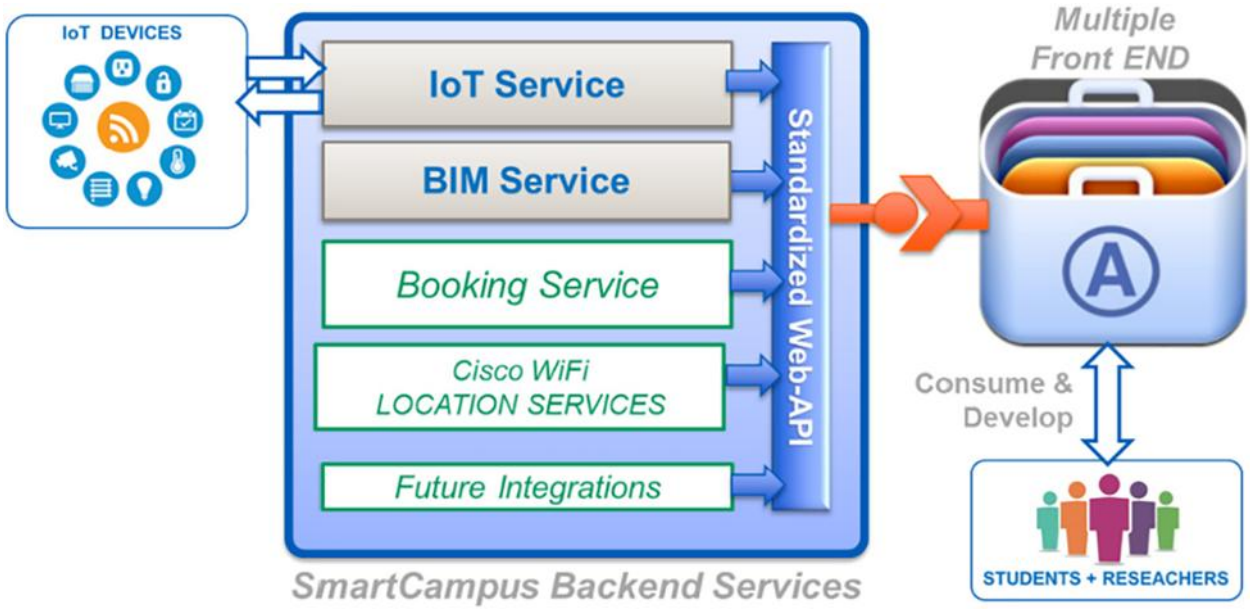
Governments and the architecture, engineering and construction (AEC) industry around the world have devoted much attention to the application of building information modeling in their projects due to the many advantages it offers, which has called for educational institutions to include BIM in their curricula and to qualify new graduates with the competencies and expertise necessary to keep pace with developments and to provide personnel to AEC companies.[14] Building Information Modeling (BIM) represents a paradigm shift in the Architecture, Engineering and Construction (AEC) industry as companies reposition themselves from a people, technology and process perspective to improve efficiency and quality.[15] .



Picture 1. The 3D metaverse serves: space where architects, clients, and stakeholders can meet virtually.
Source: https://tgs.tech/images/news/2022/2022-01-03-bim-01.jpg (2025)

[11] Aydın, M. (2025) Evaluating ISO 45001: 2018 and OHSAS 18001: 2007 with Insights for occupational health and safety (OHS) standards in the construction industry, Journal of Architectural Sciences and Applications, 10(1), 55-71.
[12] Kühner, T. (2023) Development of Indicator Set for Implementation of International Urban Agendas in Cities of the Global South, Doctoral thesis University of Brasilia, Faculty of Architecture and Urbanism.
[13] Zdraveski, V., Mishev, K., Trajanov, D., Kocarev, L. (2017) ISO-standardized smart city platform architecture and dashboard. IEEE Pervasive Computing, 16(2), 35-43.
[14] Raad, L., Maya, R., Dlask, P. (2023) Incorporating BIM into the academic curricula of faculties of architecture within the framework of standards for engineering education., International Journal of BIM and Engineering Science, 6(2), 45-62.
[15] Ganah, A., Lea, G. (2021) A global analysis of BIM standards across the globe: A critical review, Journal Of Project Management Practice (JPMP), 1(1), 52-60.

The built environment provides significant opportunities for IoT (Internet of Things) applications and can be singled out as one of the most important aspects of IoT-related research. Although IoT deployments in the built environment are growing exponentially, there is a gap in integrating the two in a systematic way through open standards and systems. From a technology perspective, there is a need for convergence of various fields, from building information systems and building services to building automation systems and IoT devices, all the way to end-user services, in order to develop user-oriented smart applications.

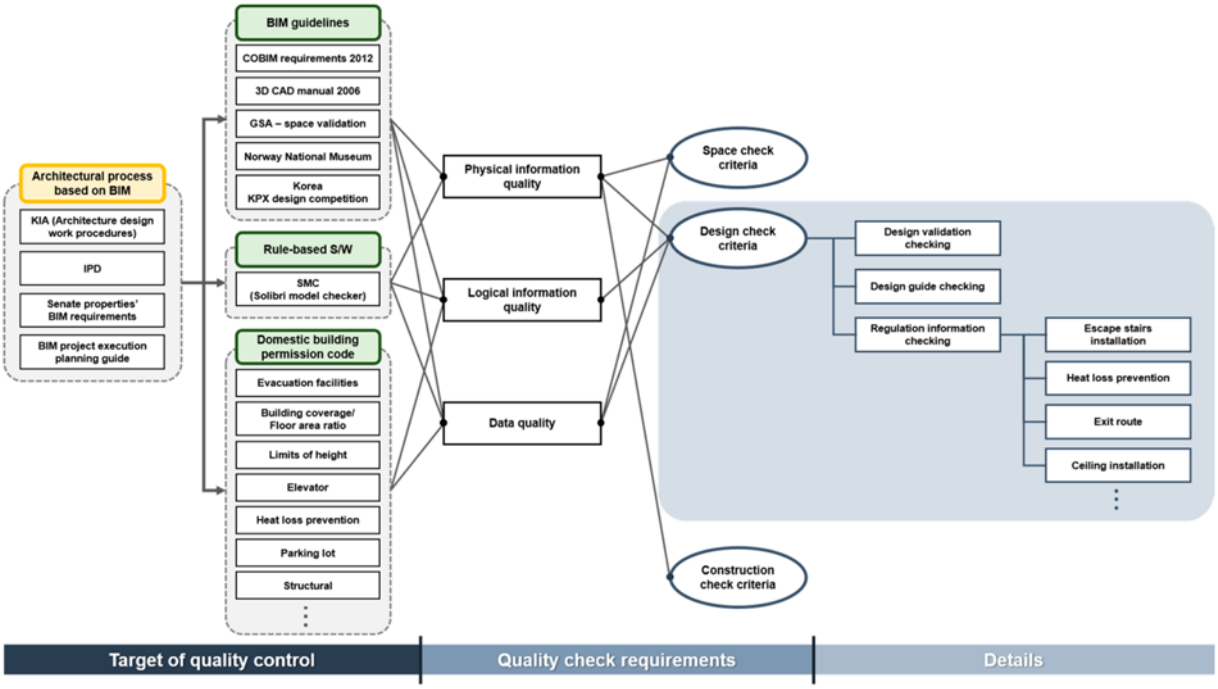


Picture 2. Conceptual system architecture
Source: Dave, B., Buda, A., Nurminen, A., Främling, K., A framework for integrating BIM and IoT through open standards, Automation in Construction, Volume 95, 2018, Pages 35-45. https://ars.els-cdn.com/content/image/1-s2.0-S0926580517305964-gr2_lrg.jpg

Contemporary architectural, engineering and construction projects are based on international BIM standards, which provide a unique and efficient approach to building development, design and management. These standards cover several essential elements, each addressing specific needs and ensuring that the project is executed accurately and collaboratively.

The international BIM ISO standard for information management through the BIM standard primarily serves to define the procedure by which information is circulated, created and communicated in a team. It involves sharing, editing, recording and organizing information, which plays a key role in ensuring that organizations in many countries can collaborate effectively, reducing the possibility of miscommunication and improving the security of project results in BIM projects. National BIM standards offer specific requirements of the AEC industry within the country's regulatory framework. The UK's BIM Level 2 is one of the best examples of this, which mandates the use of BIM in all government construction projects in the UK. It promotes a culture of collaboration, which requires detailed documentation of all information, making it a key part of BIM and integrated practice.[16] .

[16] Wu, J., Sadraddin, H. L., Ren, R., Zhang, J., Shao, X. (2021) Invariant signatures of architecture, engineering, and construction objects to support BIM interoperability between architectural design and structural analysis, Journal of construction engineering and management, 147(1), 04020148.



Picture 2. Relevance of quality control target and criteria
Source: Choi, J., Lee, S., & Kim, I. (2020). Development of Quality Control Requirements for Improving the Quality of Architectural Design Based on BIM. Applied Sciences, 10(20), 7074. https://doi.org/10.3390/app10207074. https://www.mdpi.com/applsci/applsci-10-07074/article_deploy/html/images/applsci-10-07074-g001.png

4. CONCUSION

Standards are deeply rooted in the history of planning and design, arising primarily from the need to improve hygienic conditions, and later to improve the quality of life. Although often criticized for their restrictiveness, standards are matters of logic, analysis, very conscientious research, and always determined on the basis of a well-defined problem.[17] Understood in this way, standards are not solely a matter of aesthetics, but also part of the public good.[18]

Eastern European countries are adopting BIM technology as the mainstream of building design and management at a slower pace.[19] Managerially, issues such as unclear information requirements, absence of data commissioning, and resistance to change continue to hinder adoption. Strategically, quantifying ROI remains difficult, and the lack of lifecycle-based policy incentives limits broader implementation.[20] The national governance and institutional frameworks influence BIM adoption, hence, we recommend that the governments in the countries where BIM is becoming established should consider proliferation of national standards and compliance for a wider spread of BIM adoption.[21] Standards help with aesthetics, form and function in the built environment. In order to create a high-quality urban life, we need rules that will help us overcome the problems of today's enormous urbanization, investment urbanism, rapid and low-quality construction, the use of non-

[17] Le Corbusier (1923) Ka pravoj arhitekturi, Građevinska knjiga, Beograd, 1977.
[18] Đorđević, A., op. cit.
[19] Leśniak, A., Górka, M., Skrzypczak, I. (2021) Barriers to BIM implementation in architecture, construction, and engineering projects—The polish study, Energies, 14(8), 2090.
[20] Chatsuwan, M., Moriwaki, A., Ichinose, M., Alkhalaf, H. (2025) BIM–FM Interoperability Through Open Standards: A Critical Literature Review, Architecture, 5(3), 74.
[21] Edirisinghe, R., London, K. (2015) Comparative analysis of international and national level BIM standardization efforts and BIM adoption, In Proceedings of the 32nd CIB W78 Conference (pp. 149-158).

ecological materials, but cheaper and therefore more profitable for investors, to the detriment of health, quality and durability.

LITERATURE:

[1] Aydın, M. (2025) Evaluating ISO 45001: 2018 and OHSAS 18001: 2007 with Insights for occupational health and safety (OHS) standards in the construction industry, Journal of Architectural Sciences and Applications, 10(1), 55-71.

[2] Dave, B., Buda, A., Nurminen, A., Främling, K., A framework for integrating BIM and IoT through open standards, Automation in Construction, Volume 95, 2018, Pages 35-45.

[3] Đorđević, A., (2014) Standardi u planiranju i projektovanju stambenih objekata u Srbiji – domen energetske efikasnosti, Beograd, Arhitektonski fakultet.

[4] Edirisinghe, R., London, K. (2015) Comparative analysis of international and national level BIM standardization efforts and BIM adoption, In Proceedings of the 32nd CIB W78 Conference (pp. 149-158).

[5] Ganah, A., Lea, G. (2021) A global analysis of BIM standards across the globe: A critical review, Journal Of Project Management Practice (JPMP), 1(1), 52-60.

[6] Heras-Saizarbitoria, I., Boiral, O. (2013) ISO 9001 and ISO 14001: towards a research agenda on management system standards, International journal of management reviews, 15(1), 47-65.

[7] Horry, R., Booth, C. A., Mahamadu, A. M. (2022) Towards a consensus of expert opinions on implementing ISO 14001 in the architecture, engineering and construction sectors of the UK, WIT Transactions on Ecology and the Environment, 258(2022), 329-341.

[8] Chatsuwan, M., Moriwaki, A., Ichinose, M., Alkhalaf, H. (2025) BIM–FM Interoperability Through Open Standards: A Critical Literature Review. Architecture, 5(3), 74.

[9] Choi, J., Lee, S., Kim, I. (2020) Development of Quality Control Requirements for Improving the Quality of Architectural Design Based on BIM. Applied Sciences, 10(20), 7074. https://doi.org/10.3390/app10207074.

[10] Kühner, T. (2023) Development of Indicator Set for Implementation of International Urban Agendas in Cities of the Global South, Doctoral thesis University of Brasilia, Faculty of Architecture and Urbanism.

[11] Le Corbusier (1923) Ka pravoj arhitekturi, Građevinska knjiga, Beograd, 1977.

[12] Leśniak, A., Górka, M., Skrzypczak, I. (2021) Barriers to BIM implementation in architecture, construction, and engineering projects—The polish study, Energies, 14(8), 2090.

[13] Nacionalna strategija održivog razvoja, (2005) Službeni glasnik RS, br. 55/05, 71/05-ispravka i 101/07 Pravilnik o uslovima, sadržini i načinu izdavanja sertifikata o energetskim svojstvima zgrada (2011), Službeni glasnik RS br. 61/11.

[14] Raad, L., Maya, R., Dlask, P. (2023) Incorporating BIM into the academic curricula of faculties of architecture within the framework of standards for engineering education., International Journal of BIM and Engineering Science, 6(2), 45-62.

[15] Wu, J., Sadraddin, H. L., Ren, R., Zhang, J., Shao, X. (2021) Invariant signatures of architecture, engineering, and construction objects to support BIM interoperability between architectural design and structural analysis, Journal of construction engineering and management, 147(1), 04020148.

[16] Zdraveski, V., Mishev, K., Trajanov, D., Kocarev, L. (2017) ISO-standardized smart city platform architecture and dashboard, IEEE Pervasive Computing, 16(2), 35-43.

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DEMING'S QUALITY MANAGEMENT PRINCIPLES AS A RESPONSE TO CONTEMPORARY SOCIETY CHALLENGES

Vladimir Pejanović, MSc [1]
Goran Zarić, PhD [2]
Gordana Radović, PhD [3]

Abstract: *This paper explores the applicability of Deming's 14 points for management transformation to addressing contemporary global challenges in the context of an unstable world marked by economic crises, conflicts, and climate change. The methodological approach of the paper is based on systemic analysis and comparative research of Deming's principles in relation to current global problems. The research analyzes Deming's 14 points, particularly emphasizing key elements such as defining purpose and focusing on continuous improvement (point 1), adopting a new philosophy (point 2), institutionalizing leadership (point 7), and continuous process improvement (point 5). The paper evaluates the potential contribution of these points in four critical areas: climate change, economic instability, resource scarcity, and global conflicts. The key methodological contribution of the paper is the identification of the PDCA cycle (Plan-Do-Check-Act) as a practical framework for iterative adjustment of strategies and policies in addressing global challenges. Through quantitative-qualitative analysis, the paper identifies two critical implementation challenges: the complexity of coordination at the global level and the tension between long-term planning and short-term profit goals. A methodological framework is proposed for overcoming these challenges through the integration of qualitative aspects of leadership with quantitative approaches to measuring progress, relying on Deming's points about eliminating fear (point 8) and institutionalizing education (point 13). The results of the analysis indicate the necessity of revitalizing Deming's entire quality management system as a response to pressing issues of contemporary society, including climate change, inequality, and global conflicts. The proposed model of applying Deming's principles to the broader social context offers a systematic approach to building a sustainable, balanced, and quality system, based on awareness, knowledge, and lifelong learning. It is concluded that Deming's philosophy of quality represents a valuable legacy which, when adequately*

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[3] Gordana Radović, Institute for Economics of Agriculture, Belgrade, R. Serbia, gordana.radovic09@gmail.com

implemented and adapted to contemporary challenges, can serve as a guide towards establishing a higher quality system both at the organizational and global societal levels.

Keywords: *Deming, quality principles, defining purpose, continuous improvement, leadership, social challenges, sustainable development, climate change*

JEL Classification*: A20*

1. INTRODUCTION

In today's world of instability, economic-financial crises, deep structural recessions, wars and conflicts worldwide, as well as multipolarity and globalization as political realities, Deming's ideas represent a guide toward establishing a better system of management, organization, business, and life in general in contemporary society. With the dynamic acceleration of information flow, the wide availability of knowledge via the Internet, the automation of processes in industry as well as in everyday life, society, and science in general, we witness that the need for quality, both in business and everyday life, becomes essential. With climate changes, numerous wars, conflicts, and hotspots around the world, supply chain disruptions, and global connectivity affecting the unequal distribution of both income and food, as well as the reduction in quality of life, it is necessary to return to the principles of great thinkers in the fields of economics, management, engineering management, production, such as Peter Drucker and his principles of "Management by Objectives," Michael Porter and his five forces of competitive system comparison as well as Porter's diamond, Juran, Ishikawa, Taiichi Ohno, and last but not least, Deming should be highlighted as a genius who created concepts for systems and orientations, guidelines, so-called signposts, signs along the way for achieving excellent organizations, harmonious systems, coherent elements, optimization of resource use, continuous production and improvement, and, above all, supreme quality of products, systems, and the functioning of society as a whole. To understand the importance of Deming and his teachings and philosophy in today's world, a world seeking a way out of various seemingly hopeless situations, such as climate change, global warming, war conflicts, and increasingly deeper, more frequent recessions of liberal capitalism spreading across the world in the era of globalization like waves on water after throwing a pebble. To understand how to exit these hopeless situations, we need to return to the basic concepts of great thinkers in economics and management, people who established and laid the foundations of the economy and society of the 20th century and predicted how society would be in the 21st century, that is, what it should be – a society of knowledge and information, as well as a society of lifelong learning.

2. THEORETICAL FRAMEWORK: DEMING'S 14 POINTS OF TRANSFORMATION

Deming's approach to quality management is based on the idea that quality is not just the responsibility of the quality department but of all employees within the organization. Through 14 key management principles, Deming laid the foundations for continuous improvement of processes and products. These principles emerged in the mid-20th century but show exceptional relevance to contemporary challenges.

2.1.Defining Purpose and Continuous Improvement

Deming's first point relates to creating constancy of purpose for improving products and services. This point emphasizes the need for a long-term vision and focusing on continuous improvement rather than short-term goals. Organizations should not just meet current standard requirements but must continuously work to improve their products, services, and processes. Improvement should be a constant process that never ends. In the context of contemporary global challenges, this point has special significance. For example, in the fight against climate change, long-term commitment and focus on continuously improving strategies to reduce greenhouse gas emissions are needed, rather than short-term solutions that can bring immediate political points.

2.2.Adopting a New Philosophy

The second point calls for adopting a new philosophy that puts quality first. Deming's argument here is that managers must learn to manage in accordance with the requirements of the modern economy. They must first learn and acquire the missing knowledge, they must accept new management concepts, and they must do so in the context of managing the entire system. In the contemporary context, this point can be interpreted as a call for a fundamental change in how we think about economic development, social responsibility, and sustainability. Instead of focusing exclusively on GDP growth, the new philosophy could place the well-being of people and the planet at the center of economic decision-making.

2.3.Institutionalizing Leadership

The seventh point relates to establishing leadership. Deming argued that leaders cannot achieve constancy of purpose if they do not create and effectively manage the entire system. They must primarily understand variations and what prevents their organization and employees from implementing improvement activities and achieving desired results. Then they must develop goals and establish a structure and key enabling factors so that the system is well managed. They must create complete alignment ensuring that everyone works within the system and that there are common goals and shared objectives. They must also spend time understanding each element of the work system, empathizing with employees, mentor and teach them, and enabling people to work and achieve results. They must develop others and initiate legacy leadership. In a global context, this point emphasizes the need for transformative leadership that can mobilize resources and will to solve complex challenges. Leaders at all levels, from local communities to international organizations, must create a vision of a sustainable future and inspire others to work toward achieving that vision.

2.4.Continuous Process Improvement

The fifth point calls for continuously improving the system of production and services. Using the PDCA cycle (Plan-Do-Check-Act), a culture of continuous improvement must be created to constantly eliminate problems and seek better alternatives. This must be based on the complete involvement and participation of employees. The PDCA cycle provides a practical framework for iterative improvement and adaptation to changes. This approach allows organizations and societies to continuously adapt to new challenges through testing, learning, and adapting strategies.

2.5.Eliminating Fear and Institutionalizing Education

The eighth point calls for eliminating fear from the organization. Fear is a major obstacle in many organizations. It gives upper management leverage for control and suppression. Fear manifests in many different ways. It can be fear of reprimand, fear of failure, fear of the unknown. The thirteenth point calls for establishing a strong program of education and self-improvement. In the twenty-first century, power is truly intellectual capital and the residual knowledge that organizations possess. Employees should be encouraged to embrace lifelong learning as a goal, to educate themselves, and be supported in their quest for advancement and improving their future.

3. APPLICATION OF DEMING'S PRINCIPLES TO CONTEMPORARY CHALLENGES

Deming's principles can be applied not only to product quality but also to systematic and process management of both products and the entire state system, the entire society. In this section, we analyze how Deming's principles can be applied to address four key challenges of contemporary society.

3.1.Climate Change and Global Warming

Climate change requires the application of new technologies, innovation and knowledge. Because of this, Deming emphasizes the necessity of creating a knowledge society in the 21st century in which humans would be the central point, their capacity for acquiring knowledge and lifelong learning, and thus the potential for creative and innovative solutions, exits from crises about which Deming wrote in his books. Deming’s systemic approach allows for understanding the interconnectedness of

different factors instead of fragmented solution of symptoms, which is crucial for sustainable solutions. This interdependence, both of elements and aspects of the current situation in the world, especially in today's era of global connectivity, but also the interconnectedness of key problems represents an advantage in implementing Deming's system, which is precisely founded on the idea of interconnectedness of all elements as well as the need for applying a comprehensive system, emphasizing interdependence as the main aspect. Deming's position was that partial solutions would not have a long-term and sustainable effect.

3.2.Economic Instability and Recessions

In a world of excessive consumption and resource depletion, Deming's focus on quality instead of quantity can help redirect the economy toward more sustainable models of production and consumption. Casino economy, as Nobel laureate George Akerlof would say, was one of the causes of numerous economic-financial crises and recessions that spilled over to the entire world. After all the experienced crises and recessions, including the current one, casino economy is still present, only with regulation and oversight. Deming's approach emphasizes long-term planning as opposed to short-term goals. In a world where the focus on quarterly results dominates, Deming's insistence on long-term planning represents a significant benefit for solving problems that require long-term commitment, such as climate change or social inequalities. A change in perspective is needed, a paradigm shift in the form of transitioning from quarterly results to long-term results, sustainability, long-term quality, primarily because we have come to the problem of climate change precisely due to short-sighted and irresponsible exploitation of resources.

3.3.Resource Scarcity and Unequal Distribution

Deming's advocacy for removing barriers between departments can be extended to breaking down barriers between sectors and countries in solving global challenges, encouraging multidisciplinary and international collaborations. As Deming points out in his ninth point: "There is no place for silos in this modern age and no more possibilities for prima donnas. Process-oriented organizations (PCOs) are those that understand and appreciate the importance of leverage, building synergy, and optimization through common goals and shared resources." This logic can be applied to global resource management, where collaboration between countries and sectors can lead to more efficient and fair distribution of resources.

3.4.Global Conflicts and Instability

Deming's eighth point about eliminating fear is particularly relevant for reducing global tensions and conflicts. Fear often lies at the foundation of international conflicts, whether it's fear of economic insecurity, cultural differences, or loss of power. By creating an environment based on trust and cooperation instead of fear and competition, we can lay the foundations for more peaceful international relations. Deming's fourteenth point calls for engaging everyone in transformation. In the context of global conflicts, this can be interpreted as a call for inclusive peace processes that include all relevant stakeholders, from civil society and local communities to national governments and international organizations. As Deming states: "Harnessing all the knowledge and expertise available through inclusion, participation, positive engagement of all employees; ensuring that there is two-way communication and complete alignment; using innovation and learning as powerful tools for achieving the desired transformation."

4. IMPLEMENTATION CHALLENGES AND PROPOSED MODEL

Implementing Deming's principles at the global level faces significant challenges that must be adequately addressed.

4.1.Key Implementation Challenges

Deming's principles were originally developed for production systems in the mid-20th century, which may limit their direct applicability to today's global challenges such as climate change or digital transformation. The complete transformation of an organization or system that Deming advocates is

extremely difficult to achieve at the global level with diverse actors and interests. Global problems often require coordination of hundreds of countries with different priorities. There is an inherent tension between quality and short-term profit goals in many organizations, especially in publicly traded companies under pressure for quarterly results. This tension can hinder the implementation of Deming's principles. Some critical global problems have outcomes that are difficult to measure precisely, which complicates the application of Deming's data-based approach. For example, it is difficult to quantify social progress or cultural changes.

4.2.Proposed Implementation Model

We propose a model that integrates Deming's principles into a broader social context, focusing on four key elements:

Systemic approach to social challenges: The model proposes applying a systemic approach to social challenges, recognizing the interconnectedness of different problems and their solutions. As stated: "The systemic approach allows for understanding the interconnectedness of different factors instead of fragmented solution of symptoms, which is crucial for sustainable solutions."

PDCA cycle for iterative improvement of policies: The model proposes applying the PDCA cycle for iterative improvement of policies and strategies. This approach allows continuous learning and adaptation based on feedback, which is crucial in the context of complex global challenges.

Transformative leadership with a focus on long-term goals: The model emphasizes the role of transformative leadership in mobilizing resources and will to solve complex global challenges. Leaders must create a vision of a sustainable future and inspire others to work toward achieving that vision.

Continuous learning and knowledge development: The model emphasizes the importance of continuous learning and knowledge development for solving complex global challenges. This includes investing in education, research and development, as well as encouraging a culture of lifelong learning.

5. CONCLUSION

In a world faced with complex and interconnected challenges, Deming's quality management principles provide a valuable framework for a systematic approach to solving these challenges. Through the analysis of Deming's 14 points for management transformation, this paper has identified key principles that have the greatest potential for addressing contemporary social problems.Principles such as creating constancy of purpose and focusing on continuous improvement (point 1), adopting a new philosophy (point 2), institutionalizing leadership (point 7), and continuously improving the system (point 5) are particularly relevant for addressing challenges such as climate change, economic instability, resource scarcity, and global conflicts.The results of the analysis indicate the necessity of revitalizing Deming's entire quality management system as a response to the burning issues of contemporary society, including climate change, inequality, and global conflicts. The proposed model of applying Deming's principles to the broader social context offers a systematic approach to building a sustainable, balanced, and quality system, based on awareness, knowledge, and lifelong learning.It is concluded that Deming's quality philosophy represents a valuable legacy that, when adequately implemented and adapted to contemporary challenges, can serve as a guide toward establishing a higher quality system both at the organizational and global societal level.

LITERATURE

[1] Rinehart, G. (1993) Quality education: Applying the philosophy of Dr. W. Edwards Deming to transform the educational system. Irwin Professional Publishing.
[2] Scherkenbach, W.W. (1986) The Deming route to quality and productivity: Road maps and roadblocks. Washington, DC, CEEP Press Books.
[3] Deming, W.E. (2012) The essential Deming: Leadership principles from the father of quality. McGraw Hill Professional.

[4] Deming, W.E. (2018) Out of the crisis, reissue. Cambridge, MIT Press.
[5] Ohno, T. (1988) Toyota production system: Beyond large-scale production. CRC Press.
[6] Pejanović, R. (2019) Izazovi ekonomskog obrazovanja, monografija. Akademska knjiga, Novi Sad.
[7] Obara, S. and Wilburn, D. (2012) Toyota by Toyota: Reflections from the Inside Leaders on the Techniques That Revolutionized the Industry. CRC Press.

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MACHINE VISION IN QUALITY CONTROL OF MECHANICAL PRODUCTS

MAŠINSKA VIZIJA U KONTROLI KVALITETA MAŠINSKIH PROIZVODA

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Abstract: *The concept of machine vision involves that the machine itself recognizes an object and takes further action in the production process. Machine vision is one of the concepts that enables automatic control and identification of quality deficiencies, dimensional faults, product defects, product manufacturing faults, ... The concept of machine vision enables precise and rapid analysis of visual information, thus reducing human error, increasing productivity and ensuring product quality. This paper presents the basic principles of machine vision systems, as well as an analysis of some of the solutions and equipment used in this concept. Special emphasis is placed on the application of machine vision in quality control, where this technology is used to detect microscopic defects, measure dimensions and check the correctness of components. The advantages of implementing such a system, such as reducing costs and increasing competitiveness, were also analyzed, as well as the challenges posed by using machine vision in the industrial process (level of spatial illumination, shape variation, ...). In addition to the theoretical foundations, practical examples were also presented.*

Keywords: *Machine vision, mechatronics, industry, mechanical engineering.*

JEL Classification*: 69*

1. INTRODUCTION

Modern technologies are increasingly innovative in terms of application. One of the innovative systems that is widely used in various branches of mechanical engineering is machine vision. It is a technology that allows a computer to use cameras to recognize objects or specific features on objects

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in order to carry out an activity or task. Machine vision today has wide application in various fields, but one of the areas is product quality control. When it comes to the application of machine vision in quality control, it is possible to sort products using machine vision, control various dimensions of a new product, or on the other hand, it is possible, for example, to control specific features on a product such as the quality of surface treatment, label sticking, analysis of correct position, etc[4]. In its simplest terms, machine vision allows for the recognition of certain product characteristics through images and the subsequent execution of a specific process based on what the camera has captured. Applications include presence/absence detection, spot/flaw detection, shape/color recognition, number verification, and advanced optical character recognition (OCR)[5].

Depending on the operation or the next process, machine vision can be used on different devices to perform an activity. Machine vision can be used on robots, different production lines, etc. Thus, based on machine vision, the control unit can control robots, i.e. robotic arms or, for example, the operation of production lines. Since machine vision can be used for quality control, it can often be used to sort products that meet or do not meet production quality standards[6]. The application of machine vision can be a complicated process for the calibration process itself or learning based on what the camera can see, but on the other hand it allows for such control where there is no machine fatigue or oversight in control that can occur in the case of a human. Also, in addition to human fatigue, there are other advantages, such as the fact that on the production line there may be various anomalies in the product that a human may not be able to recognize, while the application of machine vision allows for easy recognition. The speed of detection is also one of the important characteristics, in the case of a human it takes time to control a product, while in the case of machine vision it takes much less time.[7] In addition to image recognition and analysis, there are other technologies that enable counting or analyzing certain phenomena, based on which conclusions and warnings related to a specific process are drawn.

The aim of this paper is to introduce the application and concept of mechanical quality control. The aim of this paper is achieved through the use of various images and explanations related to the application in different areas of industry and in different processes. The advantages of the application in relation to a specific problem that is analyzed in a specific case are also analyzed.

2. MACHINE VISION TECHNOLOGY AND WORKING PRINCIPLE

Quality control today is performed manually or using some simple control systems. Such control can lead to certain challenges that can affect the control process itself. Manual inspection relies on human labor. Thus, experts with many years of experience can make decisions influenced by mood and environment, are prone to errors and have a limited attention span at certain moments[8]. On the other hand, machine vision, or the overall principle of operation, enables constant work where conclusions are drawn about product parameters, most often based on certain images obtained via cameras.

When it comes to the working principle of the machine vision system, a simplified diagram is shown in Figure 1a. Based on the working principle described in the IVS[9], where the basic components of a system or machine vision technology are presented. Although each of these components serves its

[4] Silva, L. R., et. al., Machine Vision Systems for Industrial Quality Control Inspections. 15th IFIP International Conference on Product Lifecycle Management (PLM), 2018, pp.631-641,

[5] Keyence Canada machine vision system improves quality control inspection. Available at: https://www.canadianmetalworking.com/canadianmetalworking/product/measurement/keyence-canada-machine-vision-system-improves-quality-control-inspection (Accessed 22.07.2025)

[6] Tzampazaki, M., et. al. Machine Vision—Moving from Industry 4.0 to Industry 5.0. Applied Sciences, Vol. 14, 2024, pp. 1471.

[7] Zhou, H. A., et. al. Generative AI in Industrial Machine Vision: A Review. Journal of Intelligent Manufacturing, 2025, https://doi.org/10.1007/s10845-025-02604-6.

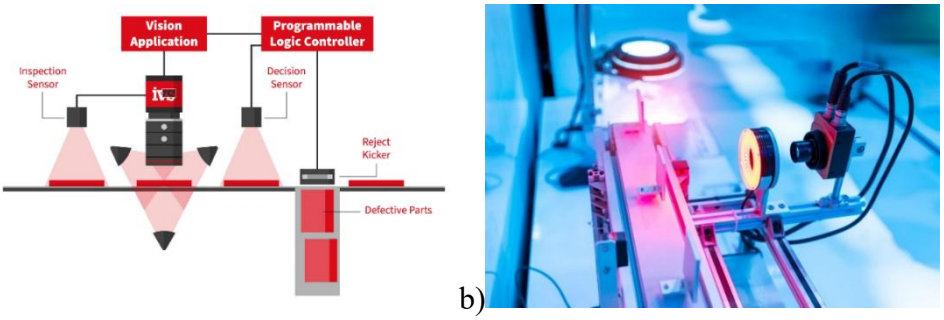
[8] Quality Inspection with AI Vision. Available at: https://www.automate.org/industry-insights/quality-inspection-ai-vision-synthetic-data-testing-training (Accessed 25.07.2025)

[9] The 7 elements of a machine vision system. Available at: https://www.industrialvision.co.uk/news/the-7-elements-of-a-machine-vision-system (Accessed 25.07.2025)

own individual function and can be found in many other systems, when they work together, each of them has a specific role. In order to function reliably and generate repeatable results, it is important that these critical components interact effectively with each other.

The machine vision process begins with the part or product being inspected. When the part is in the correct location, the sensor will initiate the capture of a digital image. Structured illumination is used to ensure that the captured image is of optimal quality. An optical lens focuses the image onto the camera sensor. Depending on the capabilities, this digitizing sensor may perform some pre-processing to ensure that the correct image features are highlighted. The image is then sent to a processor for analysis against a set of pre-programmed rules. Communication devices are then used to report and trigger automatic events such as accepting or rejecting the part. It all starts with the part or product being inspected. This is because the size of the part, certain tolerances, and other parameters will help determine the required machine vision solution. To achieve the desired results, the system will need to be designed so that the placement and orientation of the parts are consistent and repeatable.

The sensors used are optical or magnetic, used to detect the part and operate a light source to highlight key features and a camera to capture the image. This part of the process can also include what is often called "scene setting". Scene setting is often mechanical and requires ensuring that the correct surface of the part is facing the camera. This may require rotation if several surfaces need to be inspected, holding the part still while the camera or lens captures the image, and consistently placing the part in the same place within the overall "scene" image so that the processor can easily analyze it. Lighting is crucial because it allows the camera to see the necessary details. Poor lighting can be one of the main causes of poor product inspection. An example of a camera through which an image is generated in the system itself is shown in Figure 1b, which shows the camera and the lighting of the product being observed or inspected. If the product is found to be of poor quality or has deficiencies in the parameters being analyzed, rejection or sorting occurs.

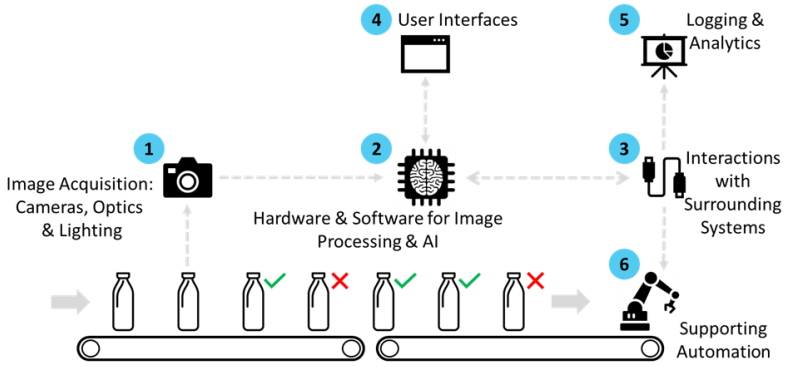


a) b)

Picture 1. The working principle and components of machine vision, where: a) diagram of elements, b) camera through which the products being controlled are recorded
Source: https://www.industrialvision.co.uk/news/the-7-elements-of-a-machine-vision-system, 25.07.2025
https://vicoimaging.com/the-four-basic-functions-of-machine-vision, 25.07.2025

In addition to a simpler machine vision diagram, Figure 2 shows a more detailed example of a machine vision system. Today, machine vision systems are already being developed in terms of the application of artificial intelligence (AI), which allows for a greater range of analysis and data processing, as well as control itself. In contrast, vision systems that use artificial intelligence (AI) can process and visualize information more like a human would. Deep learning is truly a fundamental breakthrough in AI that has enabled the creation of visual perception systems that can cope with very messy, unstructured, and complicated real-world environments.[8] If you look at Figure 2, it is noticeable that the images are sent to the control unit via cameras and the entire image generation system. The control unit analyzes the image itself and the parameters in the image. The process of programming a large number of parameters or complex parts can be very complicated in order for the system to learn to recognize errors or defects. The machine vision system is connected to several other elements. First of all, it is connected to the user interface that allows the user, or rather workers in the industrial plant, to have insight into what is seen and what is controlled, what are the possible

deviations, whether the product is assessed as having acceptable quality or is rejected. Secondly, the machine vision system is additionally connected to the data analysis and collection system, where, based on all controlled products and even if there are multiple connected machine vision systems, an analysis of all the data that users need can be generated related to all products or systems. The third element and perhaps the most important element is the additional automation itself or the connection with other systems in the industrial process. Depending on the case where a particular machine vision system is applied. Based on the data obtained through the machine vision system, other automation systems (robots, automated sorting systems, production lines, ...) can further perform operations with a specific product. Thus, if a product is not of satisfactory quality or has certain defects, it may be separated or rejected. If the product is evaluated as positive by other systems, it can be transferred to the next operation. Figure 2 also shows examples of products that have been evaluated positively or negatively based on the machine vision system.



Picture 2. Machine vision working principle and components
Source: https://www.automate.org/industry-insights/quality-inspection-ai-vision-synthetic-data-testing-training, 25.07.2025.

When it comes to the user interface and the data that can be checked, examples are shown in Figure 3. As can be seen, these are examples related to products such as bottles and electronic components. In the case of a bottle, a check of dimensions, data on the bottle, etc. was performed using machine vision. In this case, it is noticeable that multiple parameters were checked and that the overall score for the product itself is assigned based on this. On the other hand, an example is given where an electronic component was checked, where in addition to component markings, dimensional parameters but also markings on the product itself were checked.

Picture 3. Machine vision working principle and components
Source: https://usautocorp.com/product/autovision-machine-vision-software, 25.07.2025.

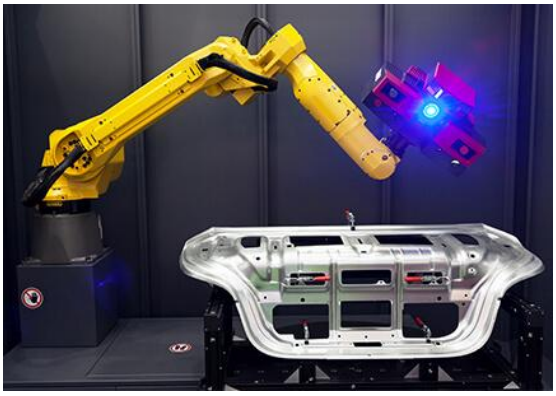
In addition to the application of machine vision on production lines, machine vision systems and cameras are often used directly in robot workspaces. Specifically, Figure 4 shows two specific cases where machine vision is shown as an example of controlling a robot directly and monitoring parts within the robot's working area. There are two variants, namely when the camera records the space in which the robot is maneuvering and is located separately from the robot arm (Figure 4a), while in

the second case the camera through which the workspace is recorded is directly placed on the robot arm (Figure 4b). In both cases, the robot arm is controlled via machine vision and in this way the robot arm directly recognizes certain parts that it can separate or take from the space in which it is maneuvering.

a) b)

Picture 4. Machine vision camera in two different positions: where: a) the camera is outside the robotic arm, b) the camera is on the robotic
Source: https://www.kuka.com/en-de/products/robot-systems/software/application-software/kuka_visiontech, 27.07.2025.
https://www.roboticstomorrow.com/article/2019/12/what-is-machine-vision/14548 27.07.2025.

In addition to robots that use machine vision directly for separating, sorting, adding different elements, there are systems and robotic arms that are directly used only for quality control. Figure 5 shows an example of a robotic arm that is directly equipped only for quality control. Thus, the analysis of the entire part is performed using a robotic arm. Quality control systems in industries rely heavily on visual inspection. Automation of visual inspection provides better accuracy, repeatability and actually better quality control. Cameras have long been part of this automation of quality control. Magnification and digitization (record keeping) were the primary requirements in the past. Today, with computer vision and artificial intelligence, the complete automation of quality control systems is rapidly developing. Vision algorithms and artificial intelligence can analyze images in more detail and faster, making these automated control systems invaluable in the production plant[10].



Picture 5. Robotic arm with machine vision camera
Source: https://www.e-consystems.com/markets/industrial-cameras/quality-control-inspection.asp, 27.07.2025.

Thus, machine vision and its application can be very important in quality control, but not only that, but also has a positive impact on the application in industrial plants and the company itself. Such advantages can be reflected in the efficiency of the system itself, cost reduction, but also in the reputation of the manufacturing company. Every defective product that slips through the cracks can

[10] Instantly detect machine defects with powerful quality control inspection camera. Available at: https://www.e-consystems.com/markets/industrial-cameras/quality-control-inspection.asp (Accessed 27.07.2025)

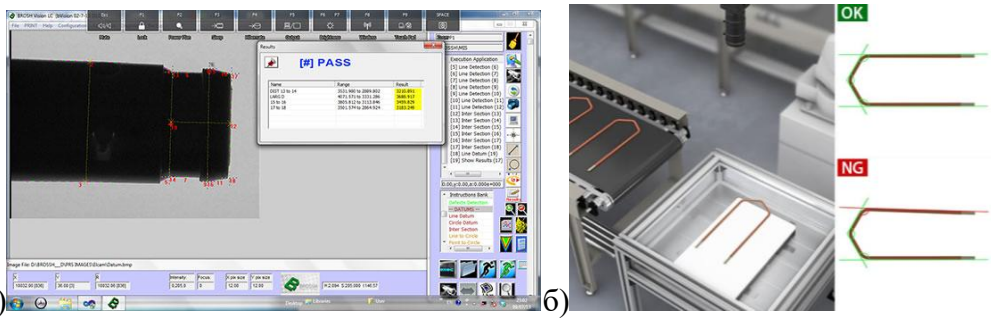
mean waste of materials, labor and operating time, which increases production costs. Defects or poor quality products can cause bottlenecks in production, reducing the overall efficiency of the production process. In addition to all of the above, reputation is very important and, above all, in today's digital age, one defective product can lead to negative reviews and reactions on social networks, affecting brand reputation and customer loyalty[11].

3. EXAMPLES OF MACHINE VISION APPLICATION IN QUALITY CONTROL

The application of machine vision in quality control can be used for various purposes, starting from dimensional control and product measurement, positioning accuracy, control of defects or deformations in the product, verification, etc.

Product dimensional inspection is a type of inspection of the parameters or appearance of a product. Dimensional inspection is important when it comes to assessing whether parts or products are machined, manufactured, or assembled according to specifications. Product dimensional inspection can involve measuring maximum/minimum dimensions of parts or products, measuring maximum/minimum/average inside or outside diameters or center coordinates of O-rings, measuring the roundness or angle of the tips of metal parts, measuring the position of edges and labels, measuring the width of sheet metal products[12].

The advantages of machine vision measurement, compared with traditional methods, are high precision, high throughput, and measurement of complex morphology. For example, some high-precision products were previously only sampled due to the difficulty of measuring with the human eye, but machine vision can achieve complete control[9]. Through machine vision, it is possible to measure the dimensions of various cross-sections of parts and products based on this data and assess whether they are within tolerances, as shown in Figure 6a[13]. Another advantage is that you can simultaneously measure angles or the roundness of a circle with different section lengths and save them as numerical data, as shown in Figure 6b.



а) б)

Picture 6. Control of dimensions using machine vision, where: a) control of dimensions, b) control of angles and shapes

Source: https://brossh.com/en/machine-vision-measurement-concept, 01.08.2025. https://www.keyence.com/products/vision/vision-sys/applications/vision-measurement-for-dimension-inspection.jsp, 01.08.2025

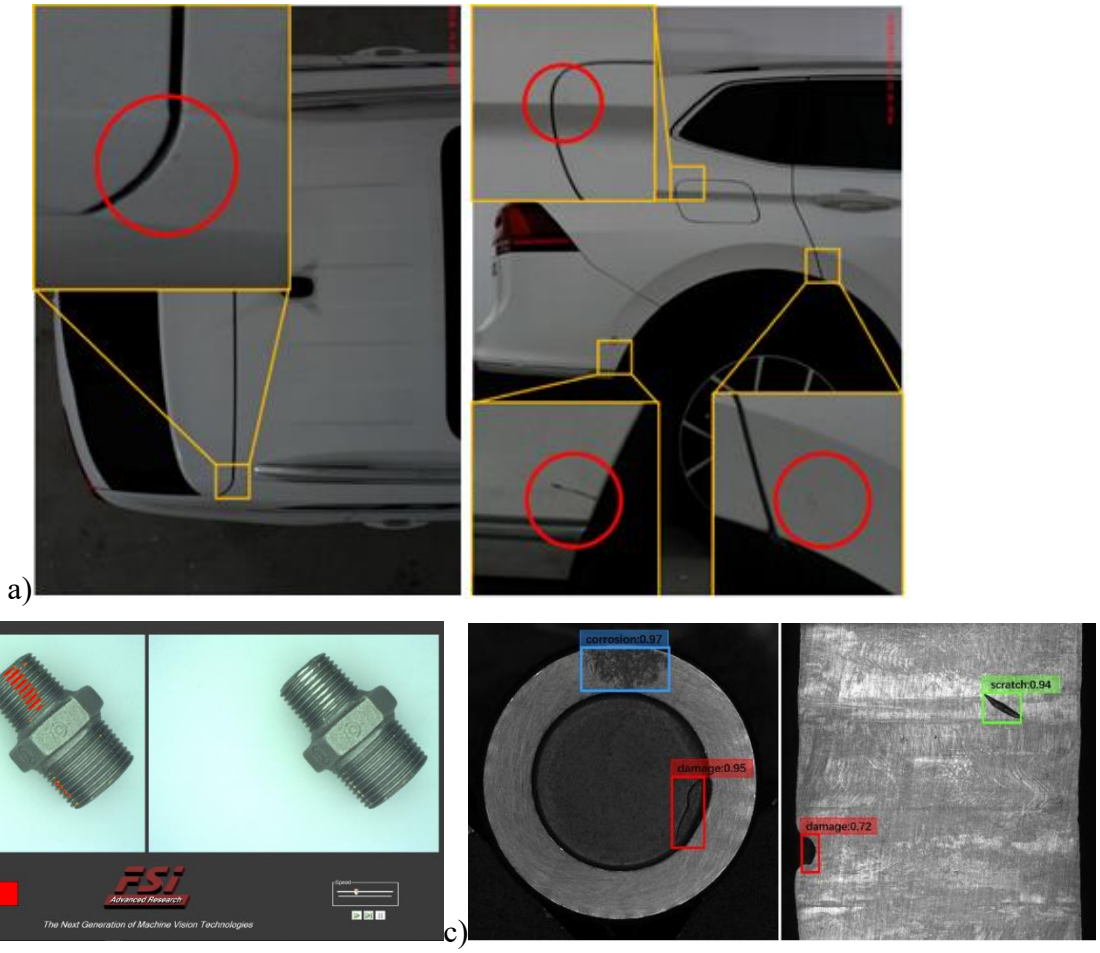
Product or part appearance inspection is mainly concerned with the inspection of product appearance defects, the most common of which include surface assembly defects (such as lack of assembly, mixing, misalignment, etc.), surface printing defects, and surface shape defects (such as broken edges, bumps, dents, etc.). Since product appearance defects are usually very diverse, inspection can therefore be difficult in practice. By combining advanced image processing with machine learning,

[11] The Future of Quality Control in Manufacturing with Computer Vision & AI. Available at: https://www.kibsi.com/manufacturing/revolutionizing-quality-control-manufacturing-computer-vision (Accessed 01.08.2025)

[12] 2D Measurement Inspection. Available at: https://www.keyence.com/products/vision/vision-sys/applications/vision-measurement-for-dimension-inspection.jsp (Accessed 01.08.2025)

[13] Machine vision measurement concept. Available at: https://brossh.com/en/machine-vision-measurement-concept (Accessed 01.08.2025)

computer vision systems can identify small defects and irregularities before they become significant problems. With high-speed cameras and complex algorithms, computer vision can inspect millions of parts with accuracy and speed that surpasses large teams of highly skilled workers[14]. Thus, Figure 5a shows errors in vehicle assembly, Figure 7b also shows an example of identifying a defect in a product, as well as Figure 7c, where machine vision, in addition to evaluating the product, also identifies the defect, but at the same time, the user is shown exactly what the identified defect is.



Picture 7. Control of defects and defects in the product, a) Defects in assembly, b) defects in the product, c) defects in the product

Source: Zhou, Q., et al. An Automatic Surface Defect Inspection System for Automobiles Using Machine Vision Methods, Sensors, Vol. 19, No. 3, 2019, pp. 644.

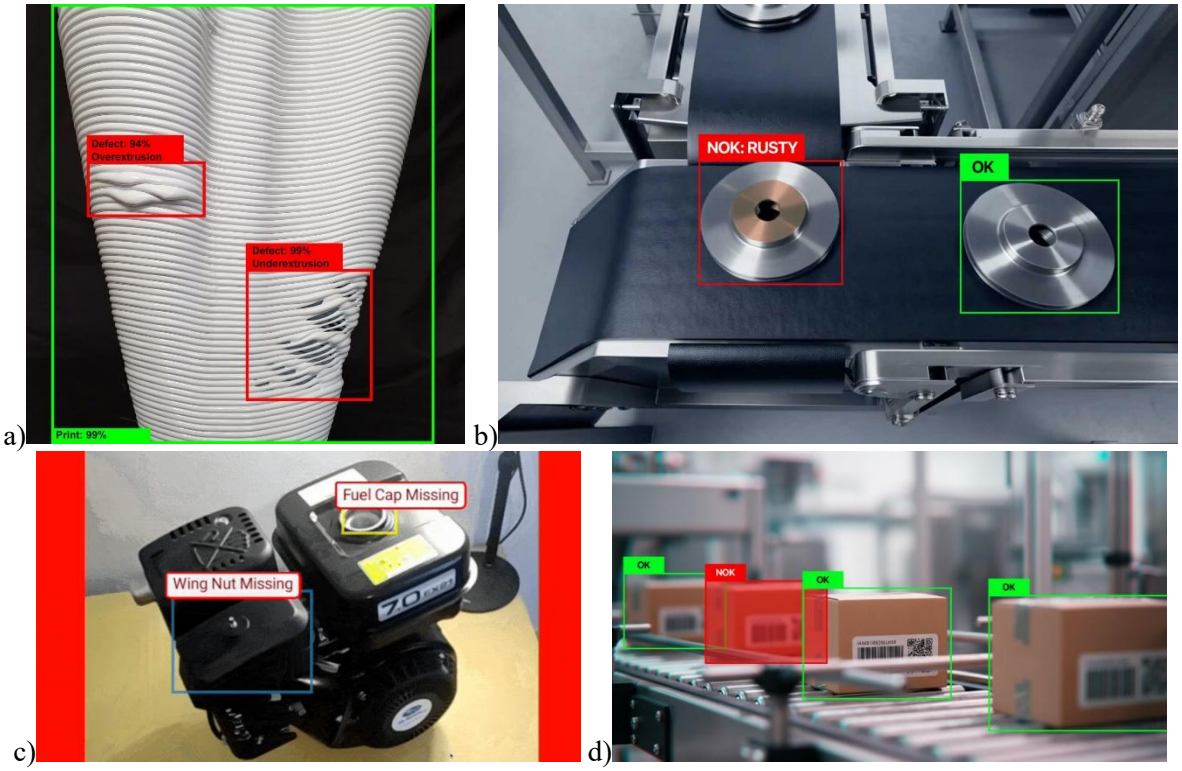
https://fsiar.com/deep-learning, 05.08.2025

Wen, S., et al. Vision-Based Surface Inspection System for Bearing Rollers Using Convolutional Neural Networks. Applied Sciences, Vol. 8, No. 12, 2018, pp. 2565.

The application of machine vision is also shown in Figure 8. The example in Figure 8a shows an example of analyzing the quality of a product made using a 3D printer; this application is also possible in cases where the products are made by casting or some long extrusion technique. The example in Figure 8b is an example that can be related to the analysis of the product from the perspective of the model surface. In this case, it was identified that one part of the surface was corroded. In addition to analyzing all finished products or individual products, it is very important to perform assembly control during assembly. Thus, Figure 8c shows an example of analyzing one assembly, where it can be seen that an example of engine assembly has been analyzed. In this example, it can be seen that using machine vision, an example of the lack of two parts in the assembly is observed. Finally, when

[14] Revolutionizing Quality Control in Transportation Manufacturing with AI-Powered Computer Vision. Available at: https://www.matroid.com/revolutionizing-quality-control-in-transportation-manufacturing (Accessed 05.08.2025)

it comes to packaging analysis, an example is given in Figure 8d, where it can be seen that using machine vision, only the packaging of the product is analyzed, often using machine vision, not only the quality of the packaging can be controlled, as well as information.



Picture 8. Product control, a) Model printing defects, b) product surface control, c) assembly part defects, d) packaging control

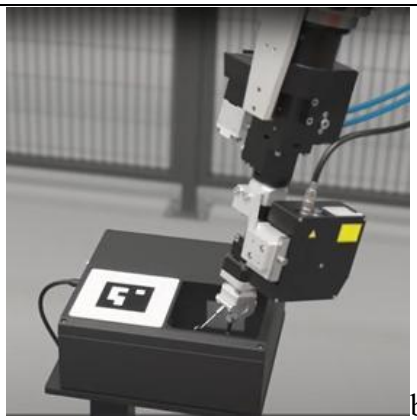
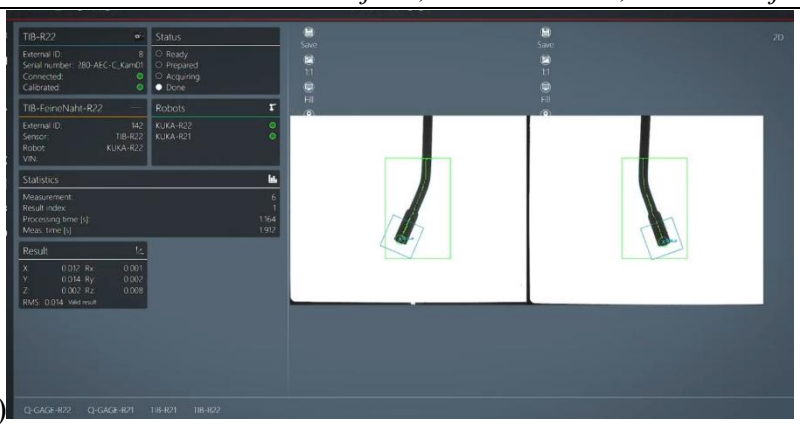
Source: https://3dprintingindustry.com/news/ai-build-introduces-computer-vision-for-3d-printing-quality-control-156704, 10.08.2025

https://journeyapps.com/platform/blog/computer-vision-use-cases-in-manufacturing, 10.08.2025.

https://tupl.com/solutions/ai-computer-vision/ai-computer-vision-quality-inspection, 10.08.2025.

In addition to all the advantages offered by machine vision, it can also be used in various complex processes that can be complicated for human control. An example of such control is the application within paint shops. Using machine vision, it is possible to control the applied paint or varnish on certain parts or the entire assembly, such as the body of a vehicle. Using machine vision and robots, it is also possible to apply various materials such as sealants so that there is no excess or incorrect application of such materials, e.g. materials such as silicone. In a large number of processes, various tools are also applied, so using machine vision it is possible to perform tool control. An example of tool control for applying sealants or adhesives is shown in Figure 9, which is performed using machine vision. Figure 9a shows the positioning of the tools in a device intended for controlling the correctness of the tools. On the other hand, Figure 9b shows the result of the control of the tool itself. Based on the data, the tool itself is analyzed and can be calibrated if necessary. Of course, if a certain limit is reached in the tool's tolerances that are not acceptable, it can be replaced. In this way, machine vision also minimizes errors that would occur due to malfunctions in the tool itself[15].

[15] Inspection solutions for the paint shop. Available at: https://www.isravision.com/en-en/industries/automotive/paint-shop (Accessed 10.08.2025)

a)  b) 

Picture 9. Tool control, a) Tool positioning, b) Tool integrity control
Source: https://www.isravision.com/en-en/industries/automotive/paint-shop, 10.08.2025

4. CONCLUSION

Quality control today represents one of the key factors for successful business in the modern era. Quality control using traditional methods can lead to certain errors that are often associated with unintentional errors but can lead to an incorrect assessment of the quality of a product. Today, various modern concepts of quality control systems are increasingly being applied, which are based on computer-supported systems, which lead to precise control.

One such quality control system used today is the machine vision system. Machine vision is a system that allows a computer to draw conclusions about a product based on images and algorithms formed by a human. The conclusions mainly refer to the fact that the computer can recognize a product characteristic based on images. Product characteristics are those characteristics that a human himself sets, or teaches the control unit to check. The control of these characteristics depends on the product itself and the industry in which it is applied. In the mechanical industry, product characteristics can refer to product dimensions, product surface, specific joints, etc. Product evaluation based on product characteristics is important because the next operation is performed on the basis of the evaluation with a certain product, whether it is further assembly or packaging of the product up to separation and reprocessing of the part if it is evaluated as negative.

The application of machine vision speeds up the inspection process, especially in the case of complex parts. It is also important to note that the use of such systems can reduce errors, and the machine itself cannot become tired, which is the case with humans. Certainly, one of the disadvantages of the application of machine vision is certainly the complexity of programming such a system in order to achieve proper operation without errors. There is no doubt that in the future there will be an increasing development of machine vision systems in quality control. Certainly, machine vision is widely used today in other areas also in the mechanical industry, e.g. in the process of controlling the implementation of safety measures at work or analyzing the work of workers or certain machines such as robots, which will be one of the future research areas.

LITERATURE

[1] Silva, L. R., Rudek M., Szejka, L.A., Canciglieri, J. O., (2018), Machine Vision Systems for Industrial Quality Control Inspections. 15th IFIP International Conference on Product Lifecycle Management (PLM), pp.631-641,
[2] Zhang, C., Xu, X., Fan, C., Wang, G., (2021), Literature Review of Machine Vision in Application Field,
[3] Keyence Canada machine vision system improves quality control inspection. E3S Web of Conferences, Vol. 236, pp. 04027.
[4] Keyence Canada machine vision system improves quality control inspection. Available at: https://www.canadianmetalworking.com/canadianmetalworking/product/measurement/keye

nce-canada-machine-vision-system-improves-quality-control-inspection (Accessed 22.07.2025)
[5] Tzampazaki, M., Zografos, C., Vrochidou, E., Papakostas, G.A., (2024), Machine Vision—Moving from Industry 4.0 to Industry 5.0. Applied Sciences, Vol. 14, pp. 1471.
[6] Zhou, H. A., Wolfschläger, D., Florides, C., Werheid, J., Behnen, H., Woltersmann, J.-H., Pinto, T. C., Kemmerling, M., Abdelrazeq, Schmitt, R. H., (2025), Generative AI in Industrial Machine Vision: A Review. Journal of Intelligent Manufacturing, https://doi.org/10.1007/s10845-025-02604-6.
[7] Quality Inspection with AI Vision. Available at: https://www.automate.org/industry-insights/quality-inspection-ai-vision-synthetic-data-testing-training (Accessed 25.07.2025)
[8] The 7 elements of a machine vision system. Available at: https://www.industrialvision.co.uk/news/the-7-elements-of-a-machine-vision-system (Accessed 25.07.2025)
[9] The Four Basic Functions of Machine Vision. Available at: https://vicoimaging.com/the-four-basic-functions-of-machine-vision (Accessed 25.07.2025)
[10] AutoVISION Machine Vision Software. Available at: https://usautocorp.com/product/autovision-machine-vision-software (Accessed 27.07.2025)
[11] Overview of KUKA.VisionTech. Avable at: https://www.kuka.com/en-de/products/robot-systems/software/application-software/kuka_visiontech (Accessed 27.07.2025)
[12] What is Machine Vision. Available at: https://www.kuka.com/en-de/products/robot-systems/software/application-software/kuka_visiontech (Accessed 27.07.2025)
[13] Instantly detect machine defects with powerful quality control inspection camera. Available at: https://www.e-consystems.com/markets/industrial-cameras/quality-control-inspection.asp (Accessed 27.07.2025)
[14] The Future of Quality Control in Manufacturing with Computer Vision & AI. Available at: https://www.kibsi.com/manufacturing/revolutionizing-quality-control-manufacturing-computer-vision (Accessed 01.08.2025)
[15] 2D Measurement Inspection. Available at: https://www.keyence.com/products/vision/vision-sys/applications/vision-measurement-for-dimension-inspection.jsp (Accessed 01.08.2025)
[16] Machine vision measurement concept. Available at: https://brossh.com/en/machine-vision-measurement-concept (Accessed 01.08.2025)
[17] Zhou, Q., Chen, R., Huang, B., Liu, C., Yu, J.,Yu, X., (2019), An Automatic Surface Defect Inspection System for Automobiles Using Machine Vision Methods, Sensors, Vol. 19, No. 3, pp. 644.
[18] Revolutionizing Quality Control in Transportation Manufacturing with AI-Powered Computer Vision. Available at: https://www.matroid.com/revolutionizing-quality-control-in-transportation-manufacturing (Accessed 05.08.2025)
[19] What is deep learning for machine vision. Available at: https://fsiar.com/deep-learning (Accessed 05.08.2025)
[20] Wen, S., Chen, Z., Li, C., (2018), Vision-Based Surface Inspection System for Bearing Rollers Using Convolutional Neural Networks. Applied Sciences, Vol. 8, No. 12, pp. 2565.
[21] Ai Build introduces computer vision for 3D printing quality control. Available at: https://3dprintingindustry.com/news/ai-build-introduces-computer-vision-for-3d-printing-quality-control-156704 (Accessed 10.08.2025)
[22] Computer Vision Impact on Key Quality Dimensions. Available at: https://tupl.com/solutions/ai-computer-vision/ai-computer-vision-quality-inspection (Accessed 10.08.2025)
[23] Computer Vision Use Cases in Manufacturing. Available at: https://journeyapps.com/platform/blog/computer-vision-use-cases-in-manufacturing, (Accessed 10.08.2025)
Inspection solutions for the paint shop. Available at: https://www.isravision.com/en-en/industries/automotive/paint-shop (Accessed 10.08.2025)

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THE ROLE OF CSR STANDARDS IN ORGANIZATIONAL PRACTICE AND STRATEGIC COMMUNICATION

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Abstract: *Corporate Social Responsibility (CSR) has become a key component of modern management strategy, as it shapes the way organizations create value, manage risks, and maintain legitimacy in the marketplace. This paper explores ideas and presents solutions on the practical implementation of standards related to CSR, as well as standards based on communicating the results of CSR activities. Special focus is placed on ISO 26000, ISO 14001, Global Reporting Initiative (GRI), and Report verification (AA1000), as frameworks for integrating responsibility into organizational structures and economic decision-making. The analysis highlights how effective implementation of these standards can improve operational efficiency, stakeholder trust, and long-term competitiveness by linking ethical behavior to measurable business results. The central role of strategic communication is to ensure transparency towards the public, as well as to shape the perception and expectations of stakeholders, thereby transforming CSR from a normative obligation into a source of economic and reputational value. Examining the interrelationships between CSR frameworks, communication practices, and performance indicators, the paper demonstrates that integrating multiple CSR standards enables companies to achieve social legitimacy without compromising market success. Finally, CSR is presented as a communication and economic system that transforms the principles of sustainability into concrete strategic advantages and reinforces the role of responsible communication as the foundation of sustainable economic growth.*

Keywords: *Corporate Social Responsibility (CSR), CSR standards, Organizational practice, Strategic communication, Stakeholder trust*

JEL Classification*: M14, M21, Q56*

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1. INTRODUCTION

Corporate Social Responsibility (CSR) has evolved from a predominantly voluntary ethical practice into a strategic component of contemporary organizational governance. Companies now rightfully recognize that effective CSR implementation was never intended to be a matter of legal or regulatory compliance, but rather a source of competitive advantage, reputational legitimacy, and long-term value creation. International standards, such as ISO 26000 for social responsibility guidance, ISO 14001 for environmental management, the Global Reporting Initiative (GRI) for sustainability reporting, and the AA1000 Accountability Principles for stakeholder assurance, have provided organizations with structured frameworks to implement CSR in a consistent, measurable, and verifiable manner. The aforementioned standards serve dual purposes. Firstly, they ensure that companies meet both internal and external expectations regarding ethical, environmental, and social responsibilities. Secondly, they enable organizations to translate CSR practices into quantifiable outcomes that enhance operational efficiency, foster stakeholder trust, and improve market positioning. Effective CSR requires not only the adoption of these standards but also the strategic communication of already implemented CSR activities, which aligns internal processes with stakeholder perceptions and promotes transparency and legitimacy—a task that is exceptionally well accomplished by utilizing internal and external public relations (PR) principles. By examining the integration of CSR standards into organizational practice and the mechanisms through which CSR communication enhances economic and reputational value, this paper contributes to the understanding of CSR as both a compliance instrument and a driver of organizational and market performance.

2. CSR STANDARDS AS FRAMEWORKS FOR ORGANIZATIONAL PRACTICE

After finding a theoretical foundation from several approaches to corporate social responsibility, what was missing was a practical approach that could be standardized.

The existence facilitates the timely and proper development and implementation of social responsibility, or rather, the possible application of standards available to companies. The most widely represented and applied standards for introducing and improving social responsibility in business are ISO 26000, ISO 14001, GRI, and AA1000.

2.1.ISO 26000: Integrating Social Responsibility Principles

The Social Responsibility Guidance Standard (SRGS) is a voluntary standard that, although it does not provide a certification option, aims to consolidate in one place the fundamental principles of social responsibility practices that companies should be aware of.[4] The standard has gained popularity over the last ten years, in proportion to stakeholder demands for a more serious approach to social responsibility practices by companies.

As befits any standard, ISO 26000 aims to clarify and clearly define terms, especially when they are misused and are often used interchangeably in everyday and business speech. This applies in particular to terms such as social responsibility, sustainable development, and sustainability. According to ISO 26000, the general objective of social responsibility is to contribute to sustainable development, as sustainable development encompasses economic, social, and environmental goals that are of equal importance to the whole of society.[5] The three factors of responsibility mentioned are entirely consistent with the four factors of social responsibility of Carroll's pyramid, which are: economic responsibility, legal responsibility, ethical responsibility, and philanthropic responsibility.

Key external motivators for implementing ISO 26000 are: competitive advantage, risk reduction, and compliance with the law; while key internal motivators are: improving the work environment,

[4] Bernhart, S., Maher, F. (2011) ISO 26000 in Practice: A User Guide, Milwaukee, ASQ - American Society for Quality, p. 1.
[5] Ibid, p. 11.

attracting better staff, and harmonization with other standards (e.g., ISO 14001 – Environmental Management Standard).[6]

The general principles and guidelines defined by the ISO 26000 standard are:[7]

- human rights (analysis of business from a human perspective, avoiding complicity, resolving complaints, promoting civil and political rights, advocating against discrimination, providing assistance to vulnerable groups, promoting and respecting economic and socio-cultural rights, respecting the fundamental principles of the right to work);
- work practice (employment and interpersonal relations, working conditions and social protection, social dialogue, health and safety of employees, staff development and training);
- environment (pollution prevention, sustainable use of resources, adaptation of production and sales processes to mitigate climate change, maintenance of biodiversity and natural habitats);
- business practices (anti-corruption, responsible political interference, fair competition, promotion of CSR in the supply chain, respect for property rights);
- consumer rights (fair marketing, consumer protection, sustainable consumption, sales and after-sales services for consumers, consumer data protection, availability of services, consumer training);
- community and development (community engagement, education and culture, job and skills creation, technology development, wealth creation, health).

Picture 1. Seven core subjects of ISO 26000
Source: ISO, 2019, Switzerland

Multinational companies adopt ISO 26000 to enhance their legitimacy and reputation for their internal CSR policies, thereby gaining broader access to the international market.[8] Large multinational companies have consistently been pioneers in adopting ISO 26000, as is the case with other social responsibility standards, such as ISO 14001, AA1000, and GRI standards.

[6] Idowu, S., Sitnikov, C., Moratis, L. (2019) ISO 26000 - A Standardized View on Corporate Social Responsibility, Heidelberg, Springer, p. 213.
[7] CSR za sve (2016) Priručnik za Poslodavačke Organizacije o Izveštavanju Održivosti, Projekat: Društveno Odgovorno Poslovanje za Sve, Belgrade, CSR for All, p. 29.
[8] Idowu, S., Sitnikov, C., Moratis, L., op. cit., p. 213.

2.2.ISO 14001: Environmental Management as a CSR Component

The Environmental Management System Standard (EMS) ISO 14001 contains principles and guidelines that help companies to:[9]

- reduced their negative impact on the environment through a proactive approach to protection (instead of exclusively applying a reactive approach like most companies);
- comply with all relevant laws and regulations imposed by the state for environmental protection (to fulfill the legal responsibility factors desired by internal and external stakeholders);
- encourage continuous operational improvements in the field of environmental protection (acting internally to achieve external results that attract the attention of the external public to the greatest extent).

ISO 14001 is a process, not a performance standard. This means that its principles do not concern the level of environmental performance of a company, but instead offer precise guidelines for improving operational processes. Initially, the standard allows companies to create their own policies and business objectives, taking into account existing legal regulations.[10] The standard certainly inspires companies to work on improving environmental protection, even in areas where there is no state-backed regulation. The primary factors influencing the introduction of standards into a company's processes are often governmental and non-governmental institutions, as well as internal and external stakeholders.[11]

The practice of most companies suggests that the quality of social responsibility is enhanced by implementing the ISO 14001 standard, primarily due to progress in employee education about the environmental impacts of the company and the adoption of more environmentally friendly production procedures.[12] In this way, the awareness of the internal public, i.e., the company's staff, is highly effective when the education mentioned above is paired with everyday practice. Compliance with the standard can bring benefits to businesses that apply it, such as improving the environmental performance of their facilities through more efficient resource use. In addition to the previous, it is also possible to minimize external impacts on the environment. In addition, such a standard, or rather its implementation, can create a synergistic effect that also improves the business's financial performance. This is remarkably achievable through cost reduction and improved financial performance, resulting from more efficient resource use and better waste management.[13]

2.3.GRI: Communication Through Structured Reporting

To provide an annual framework for companies to report on their social responsibility, the Global Reporting Initiative (GRI) was introduced in 2002. This international initiative aimed to create a common platform through which companies could focus on standards of practice in reporting on social responsibility.[14] GRI represents a standard for assessing the social performance of companies. The standard recognizes four categories of social performance indicators:[15,16]

[9] Camilleri, A.M. (2022) The Rationale for ISO 14001 Certification: A Systematic Review and a Cost–Benefit Analysis, Corporate Social Responsibility and Environmental Management, 29(4), p. 1075.
[10] Chen, C., Torstensson, P. (2015) Environmental Management System's Impact on Corporate Social Responsibility - A Case of a Multinational Company Operating in China, Sweden, Karlstad University, p. 10.
[11] Camilleri, A.M., op. cit., p. 1098.
[12] Ikram, M., Zhou, P., Shah, S., Liu, G. (2019) Do Environmental Management Systems Help Improve Corporate Sustainable Development? Evidence from Manufacturing Companies in Pakistan, Journal of Cleaner Production, 226, p. 636.
[13] Camilleri, A.M., op. cit., p. 1098.
[14] Bartlett, J., Tywoniak, S., Hatcher, C. (2007) Public Relations Professional Practice and the Institutionalisation of CSR, Journal of Communication Management, 11(4), p. 10.
[15] Carroll, A., Shabana, K. (2010) The Business Case for Corporate Social Responsibility: A Review of Concepts, Research and Practice, International Journal of Management Reviews, 12(1), p. 96.
[16] CSR za sve, op. cit., p. 60.

- work practices and dignity (employment, employee relations, occupational safety and health, training and education, diversity and equal opportunities);
- human rights (non-discrimination, freedom of association and collective bargaining, absence of child labor, insurance practices, absence of forced labor, rights of indigenous national minorities);
- society (contribution to the local community, anti-corruption, competitive behavior, participation in public policy, complaint mechanisms regarding possible negative environmental impacts);
- product responsibility (consumer health and safety, harmonized product and service labels, marketing communications in the service of consumers and the public, preserving consumer privacy).

The GRI standard relies on its own index of responsibilities, which is included in the World Bank's lending and analytical services, in its reporting. This so-called GRI Index was prepared in accordance with the previously mentioned indicator categories.[17]

In practical terms, the GRI standards can be used by businesses of all sizes, as well as non-profit and government organizations. They aim to make reporting as transparent as possible in the areas they define as relevant.[18] The level of transparency targeted is similar to that already available in financial reporting, which is accessible to stakeholders and the public for most businesses. GRI provides a common reporting framework that businesses can use to communicate their sustainability performance. The framework for the Global Reporting Initiative is shown in Picture 2 below.[19]

Picture 2. GRI Reporting Framework
Source: Medel-González et al., 2011, Germany

In order to make the level of success of the implementation of GRI standards by companies more easily recognizable and measurable, the reports received from them are classified into three different levels:[20]

- Level C – requires reporting on at least ten performance indicators, with at least one indicator each for the economic, social, and environmental responsibility of the companies;
- Level B – requires the acquired conditions for the previous level (C), with reporting on ten more performance indicators, with at least one indicator related to work, society, and production;

[17] World Bank (2018) The World Bank Global Reporting Index 2018, Washington, DC, World Bank Group, p. 1.
[18] Wilburn, K., Wilburn, R. (2013) Using Global Reporting Initiative Indicators for CSR Programs, Journal of Global Responsibility, 4(1), p. 65.
[19] Medel-González, F., Garcia, L., Enriquez, S., Anido, M. (2011) Reporting Models for Corporate Sustainability in SMEs, In: Information Technologies in Environmental Engineering, Heidelberg, Springer, p. 19.
[20] Wilburn, K., Wilburn, R., op. cit., p. 65.

- Level A – requires the acquired conditions from the previous two levels (C and B), along with the measurement of each performance indicator from the special guidelines section of GRI Plus.

2.4.AA1000: Assurance, Verification, and Stakeholder Engagement

The AccountAbility Assurance 1000 Standard (AA1000) is a set of principles and standards that contribute to the implementation of sustainability in business. The AA1000 standard encompasses three dimensions: AccountAbility Principles (APS), Assurance Standards (AS), and Stakeholder Engagement Standard (SES). Fundamentally, the AA1000 standard is based on the following principles:[21]

- Involvement – indicated responsibility by a company for its own actions and operations;
- Materiality – the degree of importance of individual items in the eyes of stakeholders and the company;
- Responsiveness – communicating stakeholder dialogue regarding issues of economic, social, and environmental performance of a company.

The previously mentioned principles are the carriers of all variations of the AA1000 standard and directly influence the process of measuring the success of its implementation and application in business. The success of the application of the AA1000 standard depends on the self-understanding of the company, that is, on the fact that its management is aware of why it is acting (purpose), what it is acting on (scope), and who the participants in the action are (ownership, mandate, stakeholders).[22] The relationship between these three issues, their connection to organizational goals, and the final impact on the company's performance improvement resulting from applying the AA1000 standard is defined by the model itself. The standard model is illustrated in Picture 3 below.

Picture 3. Purpose, scope, and stakeholders
Source: AccountAbility, 2015, USA

The basis of the AA1000 standard is the Deming cycle, which consists of the cyclical succession of elements: plan, do, check, act (PDCA). More modern versions of the cycle replace the "check" element with "study", but the principle of careful planning that begins with secondary research and ends (one) cycle with the concrete implementation of the planned remains the same. Along with the implementation of the plan, a final analysis of what has been done is also implied as the final step in controlling the completed process. Based on the final analysis, it is possible to conduct primary research from which conclusions are drawn that contribute to the following business cycles, i.e., projects within the company.

[21] Ioana-Maria, D. (2013) Encyclopedia of Corporate Social Responsibility - AA 1000, Heidelberg, Springer, p. 1.
[22] AccountAbility (2015) AA1000 Stakeholder Engagement Standard, New York, NY, AccountAbility, p. 15.

The transition from applying social responsibility standards to communicating them is the point at which the difference between substantive and declarative responsibility is most clearly revealed. Although frameworks like ISO 26000, ISO 14001, GRI, and AA1000 provide a methodological foundation for orderly impact management, their real value only emerges when organizations go beyond mere procedural alignment and turn internal practices into verifiable, transparent narratives. This is precisely where the tension arises: companies often introduce standards for the sake of legitimization, while contemporary societal demands condition legitimacy on dialogue, openness, and evidence. Mere possession of certificates or published indicators cannot replace credible communication. The effectiveness of CSR today depends on companies' willingness to expose their processes to public scrutiny, accept critical feedback, and abandon symbolic approaches. Therefore, the implementation of standards and the communication of results are not separate phases, but mutually conditioned dimensions of building organizational responsibility.

3. COMMUNICATION OF CSR ACTIVITIES

When communicating social responsibility, three factors must be met: adopting third-party approval when communicating accountability; messages that convey social responsibility must be tailored to the audience, i.e., directly involve stakeholders; and ensuring the appropriate intensity and tone of the communication of social responsibility.[23] In addition to the three factors mentioned, the three main tools for communicating social responsibility by the company are classified into four categories:[24]

- Instrumental communication tools for publishing one-way CSR communication with a strategic perspective of the company, targeting external stakeholders (reports and brochures);
- An instrumental unpublished communication that includes internal codes of conduct or strategic documents on the CSR perspective of a company.
- Advisory communication channels for publication and a focus on open discourse composed of multiple participants (blogs and social networks);
- An advisory unpublished communication that includes internally maintained communication materials that facilitate open discourse (investor presentations and stakeholder roundtables).

Finally, as a potential solution to the problems raised above, there is the companion standard ISO 26000, which was previously mentioned, consisting of five basic levels that every company should consider when communicating socially responsible activities. The basic levels (factors) and questions that the company must answer are presented in Table 1.

[23] Kim, S. (2019) The Process Model of Corporate Social Responsibility (CSR) Communication: CSR Communication and its Relationship with Consumers' CSR Knowledge, Trust, and Corporate Reputation Perception, Journal of Business Ethics, 154(4), p. 2.

[24] Ibid, p. 3.

Table 1 - Creating key messages for communicating and engaging in Corporate Social Responsibility (CSR)

Factors:	Questions:
Stakeholder perspective	• Who are the key stakeholders or publics? • What do they need to know about social responsibility? • What are their most likely questions? • How much knowledge and attitude do they have about social responsibility? • What is their opinion of the business organization or the sender of the message? • What motivates them? • What are their concerns and objections? • What cultural/geographical/demographic differences should be taken into account? • What is the known input from internal and external stakeholders? • What needs to be done with this information? Change behavior? Get feedback? Create a sense of pride in the business organization? Purchase the business organization's products and services? Donate? Media attention?
Alignment	• How does the information align with the vision, mission, values, policies, and strategies? • What are the existing key messages?
Coverage	• Can the same messages related to social responsibility be used for every external public? • Can the same messages related to social responsibility be used for the internal public? • What are the similarities and differences between messages intended for external and internal publics? • Is it necessary to use different messages for management compared to employees?
Creation	• Deleting messages that are too specific or inconsistent with the needs of the business organization and stakeholders? • Reducing messages to three or four? • Expert coaching?
Review	• Show messages to the core team and other reviewers? • Finalize message for use? • Ensure that all employees – especially communicators (marketers, sales, and customer service) – are aware of the key messages?

Source: Bernhart, 2011, USA

The reputation of a company can be considered the outcome of implementing CSR activities and their internal and external communication, in which identification occurs between consumers and the company.

4. CONCLUSION

Corporate social responsibility (CSR) management is now viewed as an integral component of corporate strategy and organizational culture, rather than a stand-alone or voluntary endeavor. In addition to guaranteeing a systematic approach to ethical, environmental, and social action, the application of international standards, such as ISO 26000, ISO 14001, GRI, and AA1000, also establishes the groundwork for generating long-term value and enhancing confidence between the business and its stakeholders. By connecting internal performance with external legitimacy, these standards turn abstract notions of accountability into quantifiable, verifiable, and effectively communicated procedures.

Effective implementation of CSR standards, however, does not end at the technical level of implementation. It requires strategic thinking about the way socially responsible activities are communicated to the public. This is precisely where the key role of public relations (PR) becomes apparent, as it bridges the gap between organizational intentions and stakeholder perceptions. The communication of CSR activities must be authentic, two-way, and contextually adapted, thereby avoiding formalism and fostering a genuine dialogue between the company and society. The use of combined communication tools—ranging from institutional reports and standardized indicators to

digital platforms and interactive channels—enables transparency and continuity in conveying messages about responsible business practices.

The solutions resulting from the integration of standards and strategic communication contribute not only to reputational differentiation but also to the internal cohesion of the organization. When employees identify with the values that the organization represents and when those values are clearly communicated to external audiences, CSR becomes a source of motivation, trust, and market competitiveness. This achieves a double benefit: the organization gains a more stable market position, while society benefits through more sustainable and fairer economic practices.

The ability of management to link standardization with strategy and ethics with business economics is ultimately what determines the successful implementation and communication of socially conscious business practices. A business that successfully strikes a balance between social expectations, market forces, and regulatory frameworks affirms its position as both a financial player and an active contributor to sustainable development. The shift from declarative to transformative practice, where standards and communication collaborate to shape the future of sustainable business, is the essence of contemporary social responsibility.

LITERATURE:

[1] AccountAbility (2015) AA1000 Stakeholder Engagement Standard, New York, NY, AccountAbility.
[2] Bartlett, J., Tywoniak, S., Hatcher, C. (2007) Public Relations Professional Practice and the Institutionalisation of CSR, Journal of Communication Management, 11(4), pp. 281-299.
[3] Bernhart, S., Maher, F. (2011) ISO 26000 in Practice: A User Guide, Milwaukee, ASQ - American Society for Quality.
[4] Camilleri, A.M. (2022) The Rationale for ISO 14001 Certification: A Systematic Review and a Cost–Benefit Analysis, Corporate Social Responsibility and Environmental Management, 29(4), pp. 1067-1083.
[5] Carroll, A., Shabana, K. (2010) The Business Case for Corporate Social Responsibility: A Review of Concepts, Research and Practice, International Journal of Management Reviews, 12(1), pp. 85-105.
[6] Chen, C., Torstensson, P. (2015) Environmental Management System's Impact on Corporate Social Responsibility - A Case of a Multinational Company Operating in China, Sweden, Karlstad University.
[7] CSR za sve (2016) Priručnik za Poslodavačke Organizacije o Izveštavanju Održivosti, Projekat: Društveno Odgovorno Poslovanje za Sve, Belgrade, CSR for All.
[8] Idowu, S., Sitnikov, C., Moratis, L. (2019) ISO 26000 - A Standardized View on Corporate Social Responsibility, Heidelberg, Springer.
[9] Ikram, M., Zhou, P., Shah, S., Liu, G. (2019) Do Environmental Management Systems Help Improve Corporate Sustainable Development? Evidence from Manufacturing Companies in Pakistan, Journal of Cleaner Production, 226, pp. 628-641.
[10] International Organization for Standardization [ISO] (2019) Social Responsibility and Sustainable Development - Guidance on Using ISO 26000:2010 in the Food Chain ISO/TS 26030:2019, Geneva, ISO.
[11] Ioana-Maria, D. (2013) Encyclopedia of Corporate Social Responsibility - AA 1000, Heidelberg, Springer.
[12] Kim, S. (2019) The Process Model of Corporate Social Responsibility (CSR) Communication: CSR Communication and its Relationship with Consumers' CSR Knowledge, Trust, and Corporate Reputation Perception, Journal of Business Ethics, 154(4), pp. 1143-1159.
[13] Medel-González, F., Garcia, L., Enriquez, S., Anido, M. (2011) Reporting Models for Corporate Sustainability in SMEs, In: Information Technologies in Environmental Engineering, Heidelberg, Springer.
[14] Wilburn, K., Wilburn, R. (2013) Using Global Reporting Initiative Indicators for CSR Programs, Journal of Global Responsibility, 4(1), pp. 62-75.
[15] World Bank (2018) The World Bank Global Reporting Index 2018, Washington, DC, World Bank Group.

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MODELS OF IMPROVING THE QUALITY OF TOURIST PRODUCTS IN THE REPUBLIC OF SRPSKA

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Abstract: *There are many challenges the solution of which can open up opportunities to attract a higher percentage of tourists in Republika Srpska who spend more and to improve the overall efficiency of the tourism sector. This implies the positioning of the destination as a function of tourist values in relation to the volume of tourism, which depends on factors such as increasing the number of different products, improving quality, more content and the application of destination marketing.*

Rapid product development should enable Republika Srpska to focus on tourists who spend more. By diversifying the product base, the attractiveness of Republika Srpska can be increased and investments can be accelerated, and sustainable growth can be stimulated in all parts of the economy of Republika Srpska. In order to achieve the desired characteristic and uniqueness, the so-called "experiential" type of tourism products should enable a comprehensive approach to product development, which will be achieved by carefully designing experiences.

In order to raise the quality of tourist products in Republika Srpska to a higher level, it is necessary to implement a three-part model that includes the determination of clusters for the development of tourism, connecting through primary and secondary centers as well as developing and promoting recognizable experiences.

Keywords: *quality, tourism, products, models*

JEL Classification*: L83, L15*

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1. INTRODUCTION

An improved tourism product implies the creation of recognizable, unique products in the form of experiences based on authenticity and diversity. Despite the extremely negative impact of the pandemic since 2020, the activities within the strategic objectives of the development of tourism in the Republic of Srpska from 2021 to 2027 were based on the activities started during the period of the implementation of the tourism development strategy from 2010 to 2020.

Republic of Srpska has set ambitious goals for the development of the tourism industry on a sustainable basis for the period of implementation of the new tourism development strategy from 2021 to 2027, through increasing the number of arrivals and diversifying into markets with higher returns that attract more responsible and demanding tourists.

In order to harmonize the previously mentioned supply-oriented strategies with demand-oriented strategies, a rapid and sophisticated development of various products based on local cultural heritage is required. It is planned that in the period between 2021 and 2027, the following goals will be achieved in the area of tourism product development:

- air traffic capacity increased by 20% compared to 2020,
- the offer of accommodation units increased by at least 20% compared to 2020,
- 20 new tourist infrastructure projects based on market needs implemented compared to 2020,
- existing hotel capacities categorized by new standards,
- existing spa facilities categorized according to new standards,
- introduced quality standards for rural accommodation service providers and the number of registered rural service providers increased from 100 to 500,
- designed and promoted 50 new experiences for tourists in local communities,
- at least 15 local agricultural/culinary/gastronomic/rural tourism events improved and promoted, - local tourism clusters established and established in the largest surface protected areas (national parks - Sutjeska, Kozara, Drina and nature parks - Orjen, Una, Praca, Cicelj, Tara) and individual, surface-smaller, protected areas used for tourist purposes (tourist caves Orlovaca, Vaganska, Rastusa, Pavlova, Sane spring, forest park), and for the purpose of managing the design, monitoring and promotion of at least 15 new eco-tourism products,
- created at least 10 themed trails, at least five heritage sites converted into visitor centers or similar tourist services and improved or established at least five existing or new festivals that attract foreign tourists.

In order to achieve these goals, the following priorities have been established in relation to the development of tourism products that will be implemented through dedicated measures and activities:

- improve accessibility and transportation options, - expand the offer of accommodation facilities, - use the main resources (authentic culture and heritage, diverse nature and opportunities for sports and recreational activities),
- diversify tourist experiences and activities based on nature, sports and recreational facilities, culture and heritage,
- improve visitor services,
- include authentic gastronomic offers, including wines and handicrafts, in the value chain of tourism,
- improve the offer of entertainment and recreational content, events and festivals to attract tourists, increase their stay and consumption.

Table 1: Value chain of tourism products in the Republic of Srpska

Accessibility and transportation	Airports, buses, car rental agency, information, traffic signs and road signs and tourist signage
Accommodation	Hotels, motels, guesthouses, rural accommodation, camps and others
Resources, experiences and activities	Nature and sports and recreational facilities, culture and heritage, spas, spas, culture, history, archeology and religion
Tourist services	Information centers and tourist guides
Gastronomy and wine	Restaurants, authentic food and wine tourism
Crafts	Metal, wooden and other traditional crafts
Events and festivals	Cultural, sports and musicaleventsand festivals
Entertainment and recreation	Cafes, bars, clubs, shops, water parks, yoga, organizations and meditation centers

Source: Tourism Development Strategy in the Republic of Srpska 2021-2027, Banja Luka, 2021.

The value chain implies a set of all information, activities, goods, services and experiences that tourists have the opportunity to consume.

1.1.A three-part approach to the development of tourist products in the Republic of Srpska

Solving the previously mentioned challenges should enable a significantly higher percentage of tourists to be realized in the Republic of Srpska, who would also achieve higher consumption. The goal is to raise the overall efficiency and effectiveness of the tourism sector to a higher level.

In this respect, it is very important to clearly set the destination as a function of tourist values. It depends on a number of factors such as the increase in the number of different products, the improvement of product quality and the development of destination marketing.

The effective development of tourist products should enable the Republic of Srpska to focus on those tourists who spend more. For that, a suitable diversification of the base of tourist products is needed. In this way, the tourist attraction of the Republic of Srpska increases and investments accelerate and stimulate sustainable economic growth within the Republic of Srpska.

In order to achieve the appropriate characteristic and specificity within the tourism sector, a comprehensive approach to the development of the tourism product is needed, which would be achieved by inventively designing potential experiences in the field of tourism.

A three-part approach to the development of tourism in the Republic of Srpska includes:

a) cluster planning for tourism development;
b) connection through primary and secondary centers;
c) developing and promoting recognizable experiences.

2. PLANNING TOURIST DESTINATION CLUSTERS

Determining tourist destination clusters in Republic of Srpska allows to determine geographical areas for tourism development. Within each cluster, reliance is placed on existing, characteristic and unique resources, experiences and offers to attract tourists[4].There is also a need for master plans for tourism development clusters.

[4]Golob M., Sirotic T., Golob M., Research on the quality and level of satisfaction of tourists with the tourist offer, Rijeka, Proceedings of the University of Rijeka, Vol. 2, No. 1., 2020, page 21.

Currently, there are no mentioned master plans for each of the administrative clusters of Republic of Srpska or cities, except for individual development plans aimed at their own development that does not go beyond their borders.

In order to avoid the emergence of "uncoordinated development areas", future projects should be connected and integrated with the rest of the destination. The benefits of planned clusters of a tourist destination should be:

- help to create critical mass - so that the provision of different types of content and services within a given area is sustainable;
- create value by creating a whole that is greater than the sum of its parts;
- help to diversify the product offer in a way that they can be promoted in different market segments, thus facilitating product branding;
- enable the symbiosis of different forms of tourism development - designating areas intended exclusively for adventure tourism or nature tourism, but also other areas for more intensive use;
- provide the opportunity to create an environment that ensures coordinated and complementary land use;

Table 2:Potential clusters of tourist destinations in the RepublikaSrpska

Cluster – tourist zone	*The values they offer*	*Attractions*
Banja Luka-Prijedor tourist zone	*A rich nightlife offering, a connection between the urban area and nature.*	*Kastel fortress, Krupa on the Vrbas river monastery, health resortSlatina, health resortKulaši, Balkana lake, Vrbasriver canyon*
Doboj tourist zone	*Thermal mineral waters, spa tourism, wellness and spa offer.*	*Health resortVrucica, ''TermeOzren'', Doboj's fortress,Liplje monastery*
Bijeljina-Zvornik tourist zone	*Cultural and historical heritage and archaeological sites.*	*Ethno-villageStanisici, Tavnamonastery,''Fivelakes'' monastery, Papraca monastery, Lovnica monastery, Zvornik'scultural summer, Drina's regatta*
Sarajevo tourist zone	*Top destinations for winter sports*	*Jahorina, Trebevic, FlatMountain, Romanija, Treskavica*
Foca-Visegrad tourist zone	*Literary and architectural heritage*	*The bridge''Na DriniCuprija'' (Unesco), Andric-towninVisegrad, Dobrun monastery, Lim river canyon, Stari Brod memorial complex*
Trebinje tourist zone	*Kvalitetnahrana, izvrsnavina, srednjovekovnimanastiri, autentičnaselaizstarihvremena,*	*''Old town'', Tvrdos monastery, Lastva'slake, ''Popovofiled'', Herzegocina'sGracanica, ''The sun town'' , Nevesinje'solimpic game*

Source:Data obtained through the author's research for the purposes of this paper

3. CONNECTING THROUGH PRIMARY AND SECONDARY CENTERS

When connecting through primary and secondary centers, the emphasis is on the integration of routes between attractions within the same or between different clusters. A primary center is a larger location

with larger accommodation capacities connected to the nearest location of secondary centers. Secondary centers are attractions or secondary destinations – smaller towns and villages. These can then be combined into thematic package arrangements, i.e. itineraries and routes that include not only a visit to a single location but a visit lasting half or a whole day, including multiple locations within onecluster[5].

Table 3: Priorities and measures in the function of connecting primary and secondary centers

Priorities	*Measures*
Improve accessibility and transport options	*- Increase the capacity of international airports* *- Improve the border crossing regime* *- Enable more efficient transport throughout the Republic of Srpska* *– Provide adequate bus transport and a sufficient number of car rental agencies*
Expand the offer of accommodation capacities	*- Implement an adequate system of accommodation capacity categorization* *- Support the construction of overnight stays, camps and rural facilities* *- Encourage the construction of hotels, motels and boarding houses of various categories*
Utilize the main resources of RepublikaSrpska (authentic culture and heritage)	*- Ensure the sustainability and well-being of cultural and natural resources* *- Place cultural heritage in the tourism offer of the Republic of Srpska*
Diversify tourist experiences and activities	*- Develop adventure products and experiences* *- Create adventure products with an emphasis on priority activities* *- Create an adequate offer of spa and health tourism* *- Create new products within rural tourism* *- Determine an adequate offer within religious tourism* *- Transform and improve the promotion of museums and archaeological sites*
Improve the service offering to visitors	*- Improve the quality of innovative tourist centers*
Authentic gastronomic offer	*- Implement national and mandatory standards of good practices*

Source:Data obtained through the author's research for the purposes of this paper

In order to achieve efficient and effective connectivity through primary and secondary centers, it is necessary to clearly define priorities and measures within those priorities. It is crucial to clearly define priorities and measures in the function of connecting primary and secondary centers because this is a condition for efficient and effective use of all tourism resources.

[5]Grzinić J., Bevanda V., Modern trends in tourism, Pula,UniversityJurja'sDobrile u Puli, 2022..page 34.

4. DEVELOPING AND PROMOTING DISTINCTIVE EXPERIENCES

Within the framework of distinctive experiences, outstanding tourist products and experiences characteristic of a given destination are combined into package arrangements and promoted with the aim of adding value to local experiences and experiences and attracting tourists who achieve higher spending[6].

Republic of Srpska should encourage entrepreneurs to develop distinctive and unique experiences and experiences that can be promoted locally, regionally and internationally as different experiences that promise quality and uniqueness.

Potential themes for distinctive experiences in Republic of Srpska are:

1. ''Magnificentnature'' (Sutjeska, Kozara);
2. ''Living heritage" (making brandy, cheese production, watermills, ''opanak production'', traditional crafts);
3. Adventures (kayaking in Banja Luka, rafting on the Vrbas and Tara rivers, adrenaline and adventure tightrope walking and climbing, etc.)
4. ''Spiritual discoveries''(Gomionica, Mostanica, Komusina)
5. Cities (Banja Luka and Trebinje)
6. Foodandwine (enjoying the consumption of traditionally prepared food from local resources, Trebinje Slow Food, "Wine Road'')
7. Trail "Following UNESCO Heritage in Republic of Srpska".

5. CONCLUSION

The tourism sector in Republic of Srpska can be raised to a higher level through targeted studies and more focused public campaigns. It is necessary to determine more precisely which categories of tourists it wants to attract and why. The new approach to be implemented in the period up to 2027 implies that the tourism product will be developed and promoted in the future based on whom RepublikaSrpska wants to attract to visit it.

The pandemic caused by the coronavirus (COVID-19) has provided a unique opportunity to strategically focus our activities depending on the current needs of the tourism industry in Republic of Srpska.

Global trends are increasingly turning to outdoor activities and, more specifically, unique outdoor experiences, which gives Republic of Srpska a clear comparative advantage and the key is to now focus on those who are looking for something that Republic of Srpska can realistically offer.

With the recovery from the losses caused by the pandemic, international tourism brands and businesses are revising their offers to respond to the changes in the behavior and habits of their clientele.

Everyone working on destination marketing is adjusting their strategies and tactics to the new reality, and there is a need for this in the Republicof Srpska tourism sector as well.

Converting the interests of targeted tourists into bookings will also require innovative approaches to achieve the highest number of visits at the lowest possible cost. Expanding product offerings on global sales platforms such as TripAdvisor, Booking.com, collaborating with receptive tour operators from the region, and joint marketing activities of supranational institutions are just some of the important tactics that the Republic of Srpska can use to increase the number of bookings.

[6]Pike S., Destination Marketing: An Integrated Marketing Communication Approach, Oxford, Butterworth heinemann, 2021., page 54.

Strategic focus on specific source markets based on past performance indicators for the Republic of Srpska, developing air transport capacities, and identifying future trends based on appropriate studies and analyses, are key to achieving strategic goals in the field of tourism.

LITERATURE

[1] Golob M., Sirotic T., Golob M., Research on the quality and level of satisfaction of tourists with the tourist offer, Rijeka,Proceedings of the University of Rijeka, Vol. 2, No. 1., 2020.
[2] Grzinić J., Bevanda V., Modern trendsin tourism, Pula, UniversityJurja'sDobrileinPula, 2022.
[3] Pike S., Destination Marketing: An Integrated Marketing Communication Approach, Oxford, Butterworth heinemann, 2021.
[4] Ministry of Trade and Tourism, Tourism Development Strategy in the RepublikaSrpska 2021-2027, Banja Luka, Government of the RepublikaSrpska, 2021.
[5] Ubavic P., Tourism policy and possible directions of tourism developmentin Serbia, Nis, Economy: theoryand practice, 8.
[6] UNWTO, Handbook of Tourism Product Development, Madrid, WTO iETC,Madrid2021.
[7] UNWTO, Tourism product development, https://www.unwto.org/tourism- development products, (pristup 04. februara 2025.)

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THE IMPACT OF EFFICIENCY AND THE IMPORTANCE OF CLEARANCE AND TRIBOLOGICAL CHARACTERISTICS ON THE QUALITY OF HYDRAULIC SYSTEMS WITH CYCLOIDAL GEARS

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dr Nevena Banković[3]

Abstract: *Cycloidal gears in gerotor pumps, which belong to the group of planetary rotary pumps, have numerous advantages over other rotary pumps. The main advantages are: simple construction, versatile application and compact design with smaller dimensions, leading to material savings and reduced processing costs, as well as lower product prices and reduced noise levels. The application of cycloidal gears in hydraulic systems has created a need to analyze key factors that result in increases volumetric and mechanical efficiency. This paper gives an analysis of the impact of the clearances between tooth profiles on the design of cycloidal gears noise levels, the value of the normal contact force, the oil film pressure and thickness between the teeth. The tribological characteristics—friction, and wear—in gerotor pumps have also been analyzed, as well as the posibilities of reducing contact stresses, by altering the geometric parameters of the cycloidal gear profiles.*

Keywords*: gerotor pumps, cycloidal gears, efficiency, clearances, friction, wear*

JEL Classification*: L00*

1. INTRODUCTION

Rotary machines with internal cycloidal gearing are used as pumps in various industries, especially in the automotive, where they are used for engine oil lubrication and in transmission systems. Their main advantages are design simplicity, wide range of applications, and design compactness in smaller dimensions, which contributes to material savings, reduced machining cost, lower product price, and decreased noise levels. These machines consist of a cylindrical housing and two rotors that spin at different speeds, with a fixed gear ratio. The inner rotor transmits motion to the outer rotor via contact points. The working chambers are limited by these contact points, which causes change in their volume during rotation, making the machine suitable to function as a pump. Inlet and outlet ports are usually located on one of the housing plates [1], [2].

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The cycloidal geometry of the rotor and the performance of these machines have been investigated by scientists using various methods. Many researchers have broadened the analysis of the profile taking into account other aspects of hydraulic machines, especially contact characteristics, and have proposed variations in common profiles to improve flow characteristics or work efficiency.

One of the main goals of developing cycloidal gears in hydraulic machines is to ensure an increase of volumetric and mechanical efficiency, that is, to reduce losses caused by clearances and friction, which would increase the quality of these systems. In this review paper, groups of papers have been selected in which the following impact on the quality of hydraulic machines have been analyzed:

- efficiency level: volumetric and mechanical,
- clearances in cycloidal gears and
- tribological characteristics: friction and wear.

2. EFFICIENCY LEVEL

2.1 Volumetric efficiency level

This section includes an overview of various methods for determining the impact of geometric and kinematic parameters of cycloidal gearing on the level of volumetric efficiency.

In the paper, [1] *L. Ivanović et al*. applied a method to examine the influence of factors on the flow and volumetric efficiency level of a gerotor pump. The factors considered are the trochoid radius coefficient, the number of revolutions of the pump drive shaft, and operating pressure, the first factor being a geometric parameter, and the others being operating parameters.

By analyzing the data for volumetric efficiency, it was concluded that the pressure of the gerotor pump has the greatest impact. The volumetric efficiency of the gerotor pump increases with the number of revolutions, while the pressure decreases. A mathematical model was developed to predict the flow and level of volumetric efficiency related to the above-mentioned parameters.

In the paper [2], *A. Panchenko et al.* developed a kinematic diagram of the motion of the rotors of an orbital hydraulic motor, which provided basis for the kinematics of the motion of its rotors and analysis of the change in output characteristics. The high value (0.92) and the constancy of the volumetric efficiency of the orbital hydraulic motor is explained by the characteristic of its rotors to "self-seal" in the process of motion, thus eliminating overflow.

M. Pellegri and A. Vacca in their study [3] emphasized the importance of accurate modeling of the lateral clearance to correctly predict the current pressure in each displacement chamber. This approach can be considered a valuable tool for designing Gerotor units and quantifying the impact of geometric clearances on the level of volumetric efficiency.

D. Roy et al. conducted an analysis to predict the inter-chamber leakage flows through two transition active contacts, which separate the high-pressure chambers from the adjacent low-pressure chambers,

in the ORBIT engine [4]. Creation of gaps at the transition contacts occurs at certain stages, due to deformations of the closed contacts, during the transmission of torque. Such gaps are estimated using FEM techniques. In the study, FEM analysis was used in the Ansys environment. Such gaps are difficult to measure, as the contact positions are inaccessible to any conventional measuring instrument. The results of the FEM analysis agree very well with the results predicted by the previous test method. The estimated amount of such leakage flow indicates a relatively low volumetric efficiency as shown in the product catalogs.

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[1] Ivanović L., Veličković S., Stojanović B., Kandeva M., Jakimovska K., The Selection of Optimal Parameters of Gerotor Pump by Application of Factorial Experimental Design, FME Transactions, Vol. 45, No. 1, 2017, p. 159

[2] Panchenko A., Voloshina A., Luzan P., Panchenko I., Volkov S., Kinematics of motion of rotors of an orbital hydraulic machine, International Scientific Conference Energy Efficiency in Transport, Vol. 1021, 012045, 2020, p. 1

[3] Pellegri M., Vacca A., A simulation approach for the evaluation of power losses in the axial gap of gerotor units, The 10th JFPS International Symposium on Fluid Power 2017, p. 1

In the paper [5], *R. Zhenxing et al.* analyzed the calculation of the flow of a cycloid rotary pump and explained the phenomenon of trapped oil. The results of their analysis showed that the flow characteristics of a cycloid rotary pump were better than those of an external gear pump. They concluded that in practice, it is theoretically feasible to increase volumetric efficiency by increasing the chamber included angle at the minimum volume position and decreasing the oil chamber included angle at the maximum volume position (Figure 1).

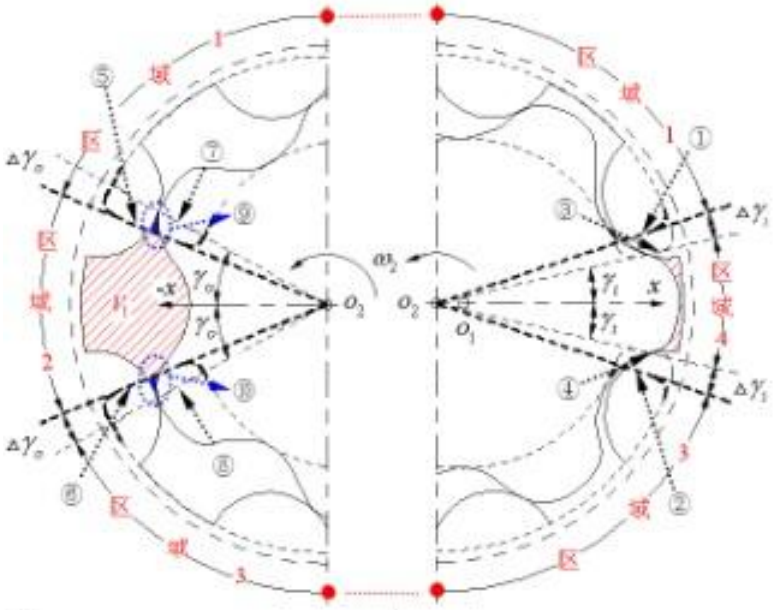

Figure 1. Theoretical and actual contour in the position of maximum and minimum volume [5]

2.2 Mechanical efficiency level

In this section, an overview of papers gives new approaches in generating cycloidal gear profiles in pumps in order to increase their mechanical efficiency.

In the paper [6] *K. Yoshida et al.* begins with market demands for developing energy-efficient and environmentally friendly cars, equipped with rotary pumps that can maintain a sufficient amount of oil discharge, but with reduced pump dimensions. To meet these demands, they developed a highly efficient rotary oil pump with a new "Geocloid" tooth profile. The "Geocloid" tooth height is designed to be higher than that of conventional rotors to provide a higher mechanical efficiency, while allowing the rotor size to be reduced without reducing volumetric characteristics. In 2011, "Geocloid" rotors began to be used in oil pumps for transmissions in hybrid vehicles.

G. Bonandrini et al. have shown that their work [7] can be used as a basis for creating the original type of rotary pump with internal gearing. This type of machine has shown potential fundamental advantages compared to classical epitrochoid pumps, in particular better wear characteristics, higher specific flow and higher mechanical efficiency. This paper considers the original profile of rotary pumps with internal gearing, which shows many potential advantages compared to the usual epitrochoid profile.

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[4] Roy D., Maiti R., Das P. K., Inter Chamber Leakages in Orbit Motors- Estimation by Modeling and Simulation in FEM and Fluent Environment, Journal of Physics, Conferense Series 1060, 012081, 2018, p. 1

[5] Zhenxing R., Chunyan L., Yulong L., Flow Characteristic and Trapping Characteristics of Cycloid Rotor Pump, The Open Mechanical Engineering Journal, Vol. 9, 2015, p. 4

[6] Yoshida K., Uozumi M., Shimada Y. Kosuge T., Development of High Efficiency Internal Gear Pump Rotor "Geocloid Rotor", Sei Technical Review, Vol. 74, 2012, p. 43

J Stryczek et al. [8] give a review of contemporary research focusing on improving the performance of gerotor pumps. The *IAFARG* & *LABSON* research group from *Terrassa* considers a gerotor pump as a hydraulic machine whose pumping is performed by a gear with a trochoidal sleeve. The research group combines several approaches to characterize the performance index of either an existing gerotor pump or a new concept of a gerotor unit GeroMAG (Figure 2). These approaches are mainly dynamic simulation using bond graph techniques, numerical simulation of computational fluid dynamics and experimental work. A gerotor pump design that achieves a balance between volumetric efficiency, productivity and mechanical efficiency is proposed.

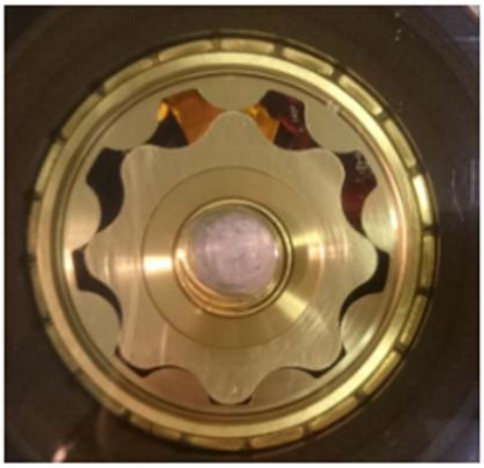

Figure 2. GeroMAG prototype [8]

3. CLEARANCES

This section gives the results of an analysis of the impact of the geometry and size of the gear tooth clearance on the performance of a cycloid pump.

In the paper [9] *L. Ivanović et al*. presented a mathematical model of a gear with gaps based on the principle of ideal profile development. The minimum height of the gap between the tooth profiles is determined in relation to the current gear ratio. The results obtained can be used for the design of a trochoidal gear where accurate and quiet operation is required.

In the paper [10] *D. Roy et al.* analyzed the occurrence of gaps at the transition active contact, i.e. the contact separating two adjacent chambers with one at high and the other at low pressure in the ORBIT engine. This occurs during a significant period of the power cycle. Interchamber leakage through these gaps is partly responsible for the reduction in volumetric efficiency.

B. Paffoni et al. in their study [11] aimed to examine the influence of the tooth clearance on the operating characteristics of a hydrostatic pump: the rotation speed of the internal gear, the normal contact forces, the pressure and the film thickness between the teeth. Both the clearance and the deformations of the teeth in contact are taken into account. A detailed procedure for determining the normal contact force between the teeth is described. Then the contact pressure and the film thickness are calculated. Comparisons are made with the result obtained with a pump without clearance (Figure 3). The number of contact points increases when the outlet pressure increases and/or the clearance decreases. Compared to a pump without clearance and under identical operating conditions, the maximum normal force of the gear and the internal gear is calculated taking into account the clearance and can be multiplied by two. The result is a significant increase in the contact pressure. It increases from 80 to 120 MPs and causes a decrease in oil film thickness.

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[7] Bonandrini G., Mimmi G., Rottenbacher C., Design and simulation of meshing of a particular internal rotary pump, Mechanism and Machine Theory, Vol. 49, 2012, p. 104

[8] Stryczek J., Bednarczyk S., Codina E., Gamez-Montero P. J., Ivanović L., Matejić M., Gears or rotors - three approaches to design of working units of hydraulic machines, IRMES 2019, Vol. 659, 012006, 2019, p. 8

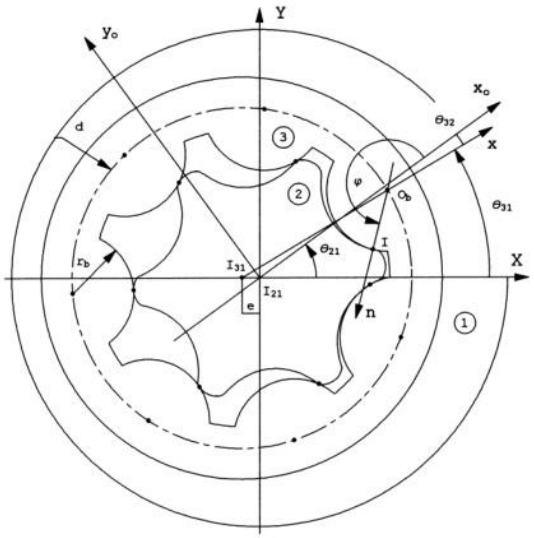

Figure 3. The diagram of examining a pump without clearance [11]

4. TRIBOLOGICAL CHARACTERISTICS – FRICTION AND WEAR

This section gives an overview of various approaches and methods for reducing friction and wear in cycloidal gears in order to increase their efficiency.

S. M. Kwon et al. [12] analyzed the contact stress in a gerotor pump, because the gerotor pump cannot adapt to wear. In the first part of their paper, simple and accurate equations for the rotor profile of a gerotor pump are presented. The second part of the paper proposes an explicit formula for avoiding undercutting on the internal gear of a gerotor pump by examining the minimum radius of curvature of the internal gear tooth profile on a convex cross-section. It was found that undercutting does not occur as long as the minimum radius of curvature on the convex cross-section is not less than zero. Based on the results obtained, the wear characteristics expressed by the pHVs factor, proportional to the wear rate, between the rotors of a gerotor pump under quasi-static and dry contact conditions are presented.

M. R. Karamooz Ravari in his work [13] derived mathematical equations for the elliptical shape of the rotor profile and the curvature of the profile and then formulated the specific flow and proportional wear factor (*WRPF*). In order to achieve minimal wear of the rotor teeth, the ellipse shape factor is changed for each value of the number of teeth of the external rotor gearing in the feasible range, thus obtaining the proportional wear factor. The results obtained are compared with pumps with a circular rotor profile shape, with similar geometric parameters and show a significant improvement in rotor wear with negligible changes in the specific flow.

S. M. Kwon et al. analyzed the wear rate between the rotors of a hypotrochoidal gear pump [14]. Using the knowledge of the design shape of the rotors, the contact stresses without hydrodynamic effect between the rotor teeth were calculated by calculating the Hertzian contact stress. A genetic algorithm (GA) was used as an optimization technique to minimize the wear rate proportional factor (WRPF). The result shows that the wear rate or WRPF can be significantly reduced, e.g. approximately 12.8%, during optimization using GA.

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[9] Ivanović L., Devedžić G., Ćuković S., Mirić N., Modeling of the Meshing of Trochoidal Profiles with Clearances, Journal of Mechanical Design, Vol. 134, 2015, p. 041003-1

[10] Roy D., Maiti R., Das P. K., Mechanics and FEM estimation of gaps generated in starring active contacts of ORBIT motor during operation, Springer Nature B.V., 2019, p. 1

[11] Paffoni B., Progri R., Gras R., Teeth clearance effects upon pressure and film thickness in a trochoidal hydrostatic gear pump, Proc. Instn Mech. Engrs., Vol. 218, Part G., 2004, p. 248

[12] Kwon S. M., Kim M. S., Shin J. H., *Analytical Wear Model of a Gerotor Pump without Hydrodynamic Effect*, Journal of Advanced Mechanical Design, Systems, and Manufacturing, Vol. 2, No. 2, 2008, p. 230

G. Ranganathan et al. [15] presented the factors that significantly characterize wear in pumps. They investigated the relations between microstructure, microhardness, surface roughness, tip clearance of new and worn parts. In addition to conventional wear testing practices in industry, the concept of accelerated wear test (AWT) is used to simulate equivalent wear of rotors and bearings, and the results obtained are compared to real samples (Figure 4). Empirical data on wear behavior come from experimental studies that can be used for simulated durability testing of these parts.

Figure 4. Worn rotor assembly, 90433 km of work [15]

J. Furustig et al. analyzed the wear of the main parts of a gerotor motor – a gear set consisting of an internal gear that rotates and meshes with an external gear [16]. The wear of these contacts is investigated experimentally and numerically using a wear model based on the Archard model in combination with the load sharing concept. The global model calculates the contact forces, relative velocities and profile radii in the contact between the internal and external gears. In the wear model, wear occurs only as a direct consequence of the contact between the mating surfaces. Low feed rates and high contact forces tend to shift the contact situation to boundary lubrication in the contacts of the orbital gears of the motor under certain operating conditions.

The contact problem is so severe that it leads to wear depths of several microns. The experimental results are compared with the model predictions for equivalent coupling conditions. The wear predicted by the model agrees with the experimental results. For this reason, it is concluded that the wear of the gerotor motor is dominated by the wear mechanisms considered in the tribological model.

In the paper [17], *L. Ivanović et al.* analyzed the influence of geometric and kinematic parameters of the gear profile on the instantaneous friction coefficient of a trochoidal gear in a gear pump. The friction coefficient is not a constant value and varies during tooth engagement as a result of a constant change in the lubrication regime. There are many empirical expressions for calculating the instantaneous friction coefficient, but due to numerous limitations, many of these expressions can only be applied to certain operating conditions and loads. The analysis of the friction coefficient was performed through two contact periods defined by the change in direction of the rolling velocity of the contact point. The obtained results allow the identification of dominant factors that affect the instantaneous friction coefficient and show the possibilities for further development of analytical models of mechanical losses in a motor pump.

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[13] Karamooz Ravari M. R., Elliptical lobe shape gerotor pump design to minimize wear, Front. Mech. Eng., Vol. 6, No. 4, 2011, p. 429

[14] Kwon S. M., Kim C. H., Shin J. H., Optimal rotor wear design in hypotrochoidal gear pump using genetic algorithm, Springer, Vol. 18, 2011, p. 718

[15] Ranganathan G., Hillson T., Raj S., Mohan Ram P. V.: Wear characterisation of small PM rotors and oil pump bearings, Tribology International, Vol. 37, 2004, p. 3

[16] Furustig J., Larsson R., Almqvist A., Bates C. A., Ennemark P., A wear model for EHL contacts in gerotor type hydraulic motors, Journal of Mechanical Engineering Science, Vol. 229, No. 2, 2015, p. 254

In the paper [18], the author *L. Ivanović* presented as the primary goal of the analysis the definition of conditions that would allow reduction the maximum contact pressure by changing the geometric parameters of the trochoidal gear profiles. One of the main problems in designing a trochoidal gear with internal gearing is the impossibility of compensating wear resulting from high contact pressures in some phases of engagement. In order to define the maximum contact stresses, forces and moments were analyzed by analytical and numerical methods, taking into account pressure variations in the pump chambers due to fluid flow. It was shown that gear pairs can be generated based on minimizing the equivalent curvature of the tooth profiles in contact, when the condition is met that the specific slips of the engaged profiles are equal. This procedure was applied to a commercial pump, and the result was proposed as a better solution for the given conditions. The results of the analysis showed that for the same operating conditions, significant reductions in maximum contact stress can be achieved. The results obtained in this work have wide and practical application, especially in the design of gerotor pumps with better performance.

5. CONCLUSION

The mentioned papers analyze different parameter influences on volumetric efficiency and the results show that the pressure of the gerotor pump has the greatest impact. As presented, with the reduction of the pressure and increase in the number of revolutions, the volumetric efficiency increases. Pratically speaking, it is theoretically possible to increase the level of efficiency by increasing the included angle of the chamber at the minimum volume position, as well as by reducing the included angle of the oil chamber at the maximum volume position.

Additionally, the original tooth profiles of rotary pumps with cycloidal internal gearing were considered, which showed significant advantages over conventional rotors. A pump design that provides a balance between the volumetric efficiency level, productivity and mechanical efficiency level was proposed.

Research has shown that rational design of distribution system elements reduces leakage in the contact zone, which increases the productivity of the distribution system due to the better volumetric efficiency of the planetary hydraulic motor. One of the main problems in designing internal cycloidal gearing is the inability to compensate for wear that happens in certain phases of engagement as a result of high contact stresses.
Conditions have been established that will reduce the maximum contact stress by changing the geometric parameters of the tooth profile. Using a genetic algorithm in optimization, a reduction in the proportional wear rate factor (*WRPF*) by 12.8% was achieved.

The results of this research can serve as a basis for developing innovative designs of cycloidal pumps, which would lead to improved volumetric and mechanical efficiency levels.

BIBLIOGRAPHY:

[1] Ivanović L., Veličković S., Stojanović B., Kandeva M., Jakimovska K., The Selection of Optimal Parameters of Gerotor Pump by Application of Factorial Experimental Design, FME Transactions, Vol. 45, No. 1, pp. 159-164, 2017
[2] Panchenko A., Voloshina A., Luzan P., Panchenko I., Volkov S., Kinematics of motion of rotors of an orbital hydraulic machine, International Scientific Conference Energy Efficiency in Transport, Vol. 1021, 012045, 2020
[3] Pellegri M., Vacca A., A simulation approach for the evaluation of power losses in the axial gap of gerotor units, The 10th JFPS International Symposium on Fluid Power 2017

[17] Ivanović L., Mačkić T., Stojanović B., Analysis of the instantaneous friction coefficient of the trochoidal gear pair, The Journal of the Balkan Tribological Association, Vol. 22, No. 1, 2016, p. 281
[18] Ivanović L., Reduction of the maximum contact stresses by changing geometric parameters of the trochoidal gearing teeth profile, Meccanica, ISSN 0025-6455, Vol. 51, No. 9, 2016, p. 2243

[4] Roy D., Maiti R., Das P. K., Inter Chamber Leakages in Orbit Motors- Estimation by Modeling and Simulation in FEM and Fluent Environment, Journal of Physics, Conferense Series 1060, 012081, 2018

[5] Zhenxing R., Chunyan L., Yulong L., Flow Characteristic and Trapping Characteristics of Cycloid Rotor Pump, The Open Mechanical Engineering Journal, Vol. 9, 2015

[6] Yoshida K., Uozumi M., Shimada Y. Kosuge T., Development of High Efficiency Internal Gear Pump Rotor "Geocloid Rotor", Sei Technical Review, Vol. 74, pp. 43-47, 2012

[7] Bonandrini G., Mimmi G., Rottenbacher C., Design and simulation of meshing of a particular internal rotary pump, Mechanism and Machine Theory, Vol. 49, pp. 104-116, 2012

[8] Stryczek J., Bednarczyk S., Codina E., Gamez-Montero P. J., Ivanović L., Matejić M., Gears or rotors - three approaches to design of working units of hydraulic machines, IRMES 2019, Vol. 659, 012006, 2019

[9] Ivanović L., Devedžić G., Ćuković S., Mirić N., Modeling of the Meshing of Trochoidal Profiles with Clearances, Journal of Mechanical Design, Vol. 134, 041003 (pages 9), 2015

[10] Roy D., Maiti R., Das P. K., Mechanics and FEM estimation of gaps generated in starring active contacts of ORBIT motors during operation, Springer Nature B.V., 2019

[11] Paffoni B., Progri R., Gras R., Teeth clearance effects upon pressure and film thickness in a trochoidal hydrostatic gear pump, Proc. Instn Mech. Engrs., Vol. 218, Part G. pp. 247-255, 2004.

[12] Kwon S. M., Kim M. S., Shin J. H., Analytical Wear Model of a Gerotor Pump without Hydrodynamic Effect, Journal of Advanced Mechanical Design, Systems, and Manufacturing, Vol. 2, No. 2, pp. 230-237, 2008

[13] Karamooz Ravari M. R., Elliptical lobe shape gerotor pump design to minimize wear, Front. Mech. Eng., Vol. 6, No. 4 pp. 429-434, 2011

[14] Kwon S. M., Kim C. H., Shin J. H., Optimal rotor wear design in hypotrochoidal gear pump using genetic algorithm, Springer, Vol. 18, pp. 718-725, 2011

[15] Ranganathan G., Hillson T., Raj S., Mohan Ram P. V.: Wear characterisation of small PM rotors and oil pump bearings, Tribology International, Vol. 37, pp. 1-9, 2004.

[16] Furustig J., Larsson R., Almqvist A., Bates C. A., Ennemark P., A wear model for EHL contacts in gerotor type hydraulic motors, Journal of Mechanical Engineering Science, Vol. 229, No. 2, pp. 254-264, 2015

[17] Ivanović L., Mačkić T., Stojanović B., Analysis of the instantaneous friction coefficient of the trochoidal gear pair, The Journal of the Balkan Tribological Association, Vol. 22, No. 1 pp. 281-293, 2016

[18] Ivanović L., Reduction of the maximum contact stresses by changing geometric parameters of the trochoidal gearing teeth profile, Meccanica, ISSN 0025-6455, Vol. 51, No. 9, pp. 2243-2257, 2016

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KNOWLEDGE-DRIVEN QUALITY: THE ROLE OF KNOWLEDGE MANAGEMENT (KM) AS THE STRATEGIC PREREQUISITE FOR TOTAL QUALITY MANAGEMENT (TQM)

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Abstract: *This review paper explores the fundamental role of knowledge as a vital organizational resource and analyzes the indispensable synergy between Knowledge Management (KM) and Total Quality Management (TQM) in achieving and sustaining competitive advantage and performance excellence in the modern, knowledge-based economy. The paper employs a systematic literature review approach to synthesize and establish the conceptual relationship between Total Quality Management (TQM) and Knowledge Management (KM). The methodology involved identifying and analyzing relevant theoretical and conceptual frameworks, with a specific focus on the core principles of KM and foundational quality models, such as W. Edwards Deming's 14 Points for Management. The findings confirm that KM is a strategic prerequisite for continuous improvement (the central goal of modern TQM). Deming's principles — such as the mandate for a new philosophy committed to learning (Point 2), building quality through expertise rather than inspection (Point 3), investment in research and education (Points 1 & 5), systematic training (Point 6), and breaking down inter-departmental barriers (Point 9) – explicitly demand the effective transfer, creation, and sharing of knowledge to build quality into processes from the start. This paper underscores that the successful integration of KM into Quality Management Systems (QMS) is not merely beneficial but a necessary precondition for survival in a dynamic market. It provides a structured conceptual foundation, supported by quality theory, arguing that quality is inherently knowledge-driven.*

Keywords: *Knowledge Management (KM), Total Quality Management (TQM), Tacit Knowledge, Competitive Advantage, Deming's 14 Points*

JEL Classification*: M11, D83*

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1. INTRODUCTION

Despite the recorded rise in research addressing the correlation between Total Quality Management (TQM) and Knowledge Management (KM), a unified agreement still lacks among scientists regarding how their mutual relationship should be best theoretically explained.[3] Some scientific papers emphasize that a positive link exists between knowledge management, total quality management, and organizational performance.[4,5,6] Also, it is emphasized that Total Quality Management and Knowledge Management contribute to process and product innovations.[7] However, the theoretical and empirical research connecting these two areas is still insufficiently represented in the scientific and professional literature.[8] Knowledge management and total quality management are considered equally important for all service and manufacturing companies.[9] While Total Quality Management (TQM) primarily focuses on constant process improvement and fact analysis, Knowledge Management (KM) introduces a key distinction by placing emphasis on a culture that encourages the creation and sharing of knowledge.[10] The shared characteristics of both approaches, such as results orientation and people-focused leadership, enable their easy combination. Consequently, KM effectively enhances TQM's capacity for continuous learning. Instead of being viewed as separate practices, TQM and KM should be strategically integrated to achieve maximum business excellence. The latest research results confirm the key role of Knowledge Management (KM), which serves as a mediating mechanism that significantly explains how Total Quality Management (TQM) directly and indirectly helps companies achieve better sustainable performance, thereby substantially filling gaps in the existing literature.[11] Research results show that genuine competitive advantage does not stem from the formal methods of Total Quality Management (TQM), such as standardized training or benchmarking.[12] Instead, the essential drivers of success are intangible, behavioral elements—specifically a culture of openness and executive commitment. From this, it follows that TQM's effectiveness depends on possessing these tacit, unique resources that are difficult to imitate.[13] Organizations that develop them can outperform rivals, even without strict adherence to all prescribed TQM techniques.[14] The essence of Total Quality Management (TQM) success lies in tacit resources—such as open culture and leadership commitment—rather than in formal tools. These intangible elements form the core of Knowledge Management (KM), which is the only strategic framework capable of nurturing and transferring this unarticulated knowledge.[15] Successful KM, which relies on leadership support and a culture of free knowledge exchange, directly enables the efficient application of knowledge in processes. In this way, KM improves both operational

[3] Honarpour A., Jusoh A., & Md Nor K., Knowledge management, total quality management and innovation: A new look. Journal of technology management & innovation, Vol. 7, No. 3, 2012, pp. 22-31. http://dx.doi.org/10.4067/S0718-27242012000300003.

[4] Mohsin M., Shamsudin M. N., Jaffri N. R., Idrees M., Jamil K., Unveiling the contextual effects of total quality management to enhance sustainable performance. The TQM Journal, Vol. 37, No. 3, 2025, pp. 680–708. https://doi.org/10.1108/TQM-05-2023-0124.

[5] Abbas J., & Kumari K, op. cit.

[6] Honarpour A., Jusoh A., & Md Nor K., Total quality management, knowledge management, and innovation: an empirical study in R&D units. Total Quality Management & Business Excellence, Vol. 29, No. 7–8, 2018, pp. 798–816. https://doi.org/10.1080/14783363.2016.1238760.

[7] Honarpour A., Jusoh A., & Md Nor K., op. cit.

[8] Abbas J., & Kumari K, op. cit.

[9] Abbas J., & Kumari K, op. cit.

[10] Hsu S.-h., & Shen H.-p., Knowledge management and its relationship with TQM. Total Quality Management & Business Excellence, Vol. 16, No. 3, 2005, pp. 351–361. https://doi.org/10.1080/14783360500054111.

[11] Mohsin M., Shamsudin M. N., Jaffri N. R., Idrees M., Jamil K., op. cit.

[12] Powell T. C., Total quality management as competitive advantage: a review and empirical study. Strategic management journal, Vol. 16, No. 1, 1995, pp. 15-37. https://doi.org/10.1002/smj.4250160105.

[13] Powell T. C., op. cit.

[14] Powell T. C., op. cit.

[15] Polanyi M., Tacit knowing: Its bearing on some problems of philosophy. Reviews of modern physics, Vol. 34, No. 4, 1962, 601. https://doi.org/10.1103/RevModPhys.34.601.

performance (quality and efficiency) and financial results of the organization, thereby ensuring a lasting competitive advantage.

The connection between knowledge management and quality management is very important. Thanks to knowledge management, continuous improvement also occurs within the organization, which represents the fundamental goal of modern quality management.

2. LITERATURE REVIEW - KNOWLEDGE MANAGEMENT

Knowledge, as a key resource for the functioning of organizations[16,17,18], is divided into two main types: tacit (implicit) and clear (explicit). [19] Tacit knowledge is informal, personal, and emotional knowledge that is challenging to transfer or precisely describe, as it encompasses individual skills, feeling, and personal experience.[20] Conversely, explicit knowledge consists of facts and data that are easily accessible, recorded, or documented, and which can be efficiently managed and shared, including manuals, records, and operating procedures.[21]

Knowledge Management (KM) is defined as an organized approach to creating, storing, sharing, and utilizing knowledge within a company.[22] It encompasses several distinct phases:

- Knowledge Creation: This phase involves generating new understandings, concepts, and discoveries through research, development activities, and internal team collaboration.
- Knowledge Storage: Refers to establishing frameworks and systems for systematizing and archiving available knowledge, utilizing written documentation, databases, and specialized KM software tools for this purpose.
- Knowledge Sharing: Promoting an environment for continuous learning within the organization, which entails fostering communication, collaborative work, and the transfer of information among employees.
- Knowledge Application: Focusing on the practical use of acquired knowledge in ongoing operations and business processes, thereby achieving better results, innovativeness, and a higher quality of products or services.[23]

Although information management (IM) and knowledge management (KM) overlap in some areas, KM surpasses the boundaries of IM because it covers a significantly more extensive scope.[24] Specifically, KM includes elements of procedure development and the acquisition of insights (learning), which are not central priorities of the traditional approach to information management. Therefore, it is emphasized that KM operates in a fundamentally different way from IM, requiring leadership to grasp the concept of "knowledge" far more comprehensively than simple storage and retrieval of textual records.

[16] Prusak L., Knowledge in organisations. Routledge, 2009.
[17] Davenport T. H., & Prusak L., Working knowledge: How organizations manage what they know. Harvard Business Press, 1998.
[18] Blackler F., Knowledge, Knowledge Work and Organizations: An Overview and Interpretation. In C. W. Choo, & N. Bontis (Eds.), The Strategic Management of Intellectual Capital and Organizational Knowledge (pp. 47-64). Oxford Unitersity Press, 2002.
[19] Polanyi M., op. cit.
[20] Polanyi M., op. cit.
[21] Polanyi M., op. cit.
[22] Nonaka I., & Takeuchi H., The Knowledge creating company: How Japanese Companies create the dynamics of innovation, Oxford University Press, Oxford, 1995.
[23] Nonaka I., & Takeuchi H., op. cit.
[24] Gustav Johannsen C., Total quality management in a knowledge management perspective. Journal of Documentation, Vol. 56, No. 1, 2000, pp. 42–54. https://doi.org/10.1108/EUM0000000007108.

Many scientific papers emphasize the role of knowledge management in contributing to the development and maintenance of companies' competitive advantage[25,26,27,28,29,30,31, 32,33,34,35,36] in the modern knowledge-based economy.

3. THE SYNERGY BETWEEN KNOWLEDGE MANAGEMENT AND QUALITY MANAGEMENT

One of the fundamental scientific papers titled "Integrating Total Quality Management and Knowledge Management," which established the connection between knowledge management and total quality management, was written by Vincent M. Ribière and Reza Khorramshahgol[37]. The conclusion was that KM and TQM constitute a reciprocal path of collaboration, where both disciplines can mutually enhance each other and extract benefits.[38]

The synergy of knowledge management and quality management is essential for creating successful and flexible organizations. Akdere[39] asserts that knowledge management is a vital component of quality management[40], as it significantly increases the creation and utilization of knowledge within organizations[41]. Incorporating knowledge management practices into quality systems enables organizations to enhance their work processes and ensure continuous learning, evolution, and the

[25] Arsawan I. W. E., Koval V., Rajiani I., Rustiarini N. W., Supartha W. G., Suryantini N. P. S., Leveraging knowledge sharing and innovation culture into SMEs sustainable competitive advantage. International Journal of Productivity and Performance Management, Vol. 71, No. 2, 2022, pp. 405–428. https://doi.org/10.1108/IJPPM-04-2020-0192.

[26] Meihami B., & Meihami H., Knowledge Management a way to gain a competitive advantage in firms (evidence of manufacturing companies). International letters of social and humanistic sciences, Vol. 14, 2014, pp. 80-91. https://doi.org/10.18052/www.scipress.com/ILSHS.14.80.

[27] Nguyen Q. T. N., Neck P. A., & Nguyen T. H., The critical role of knowledge management in achieving and sustaining organisational competitive advantage. International Business Research, Vol. 2, No. 3, 2009, pp. 3-16.

[28] Shehabat I., The role of knowledge management in organizational performance and gaining sustainable competitive advantage. In Proceedings of the 2020 Asia Service Sciences and Software Engineering Conference (pp. 133-139), 2020. https://doi.org/10.1145/3399871.3399878.

[29] Shannak R., Masa'deh R. E., Al-Zu'bi Z., Obeidat B., Alshurideh M., & Altamony H., A theoretical perspective on the relationship between knowledge management systems, customer knowledge management, and firm competitive advantage. European Journal of Social Sciences, Vol. 32, No. 4, 2012, pp. 520-532.

[30] Yu H., Shang Y., Wang N., & Ma Z., The Mediating Effect of Decision Quality on Knowledge Management and Firm Performance for Chinese Entrepreneurs: An Empirical Study. Sustainability, Vol. 11, No. 13, 2019, 3660. https://doi.org/10.3390/su11133660.

[31] Omerzel D. G., & Gulev R. E., Knowledge Resources and Competitive Advantage. Managing Global Transitions: International Research Journal, Vol. 9, No. 4, 2011, pp. 335-354.

[32] Sharkie R., Knowledge creation and its place in the development of sustainable competitive advantage. Journal of Knowledge Management, Vol. 7, No. 1, 2003, pp. 20–31. https://doi.org/10.1108/13673270310463590.

[33] Mahdi O. R., Almsafir M. K., & Yao L., The role of knowledge and knowledge management in sustaining competitive advantage within organizations: A review. African Journal of Business Management, Vol. 5, No. 23, 2011, pp. 9912-9931. doi: 10.5897/AJBM11.1118.

[34] Rahimli A., Knowledge management and competitive advantage. In Information and Knowledge Management, Vol. 2, No. 7, 2012, pp. 37-43.

[35] Ndlela L. T., & Du Toit A. S., Establishing a knowledge management programme for competitive advantage in an enterprise. International journal of information management, Vol. 21, No. 2, 2001, pp. 151-165. https://doi.org/10.1016/S0268-4012(01)00007-X.

[36] Civi E., Knowledge management as a competitive asset: a review. Marketing Intelligence & Planning, Vol. 18, No. 4, 2000, pp. 166–174. https://doi.org/10.1108/02634500010333280.

[37] Ribière V. M., & Khorramshahgol R., Integrating total quality management and knowledge management. Journal of Management Systems, Vol. 16, No. 1, 2004, pp. 39-54.

[38] Ribière V. M., & Khorramshahgol R., op. cit.

[39] Akdere M., The Role of Knowledge Management in Quality Management Practices: Achieving Performance Excellence in Organizations. Advances in Developing Human Resources, Vol. 11, No. 3, 2009, pp. 349-361. https://doi.org/10.1177/1523422309338575.

[40] Stewart D., & Waddell D., Knowledge Management: The fundamental component for delivery of quality. Total Quality Management & Business Excellence, Vol. 19, No. 9, 2008, pp. 987–996. https://doi.org/10.1080/14783360802227803.

[41] Grant R., Knowledge and organization. In I. Nonaka, D. J. Teece (Eds.) Knowledge and organization (pp. 145-169). SAGE Publications Ltd, 2001. https://doi.org/10.4135/9781446217573.n8.

raising of performance levels.[42] This integration lays the foundation for generating new ideas and long-term development, thereby making knowledge management a vital part of modern quality management. This approach is necessary for enhancing organizational capacity and achieving performance excellence.[43]

Research shows that TQM practices influence employee performance through the mediation of the knowledge sharing process, which represents an integral and mandatory part of the broader concept of knowledge management.[44] It can be concluded that TQM is not sufficient on its own; effective knowledge sharing is an essential mechanism that allows TQM practices to truly improve employee performance, thereby establishing a specific strategy for achieving better results and strengthening employee performance.

Previous research[45], emphasizes that manufacturing and service companies can ensure sustainability through the implementation of TQM and KM concepts.

W. Edwards Deming's book 'Out of the Crisis,'[46] particularly through its framework of 14 Points for Management, establishes a direct link between Quality Management (QMS) and Knowledge Management (KM).

Deming emphasizes that knowledge is a critical resource for achieving quality, which is reflected in the following aspects:

- Continuous Education and Training (Point 6): Deming insists on systematic on-the-job training, directly underlining the importance of knowledge transfer (KM). This ensures that employees possess the necessary competencies for efficient work, treating learning as an ongoing process rather than a one-time activity.
- Commitment to Learning and Innovation (Points 1 and 5): Constancy of purpose in improving products and services requires investment in research and education. These activities are the foundation of new knowledge creation (KM), which is essential for achieving continual improvement (QMS).
- Management Transformation through Knowledge (Point 2): Management must adopt a new philosophy that entails a long-term commitment to new knowledge and learning. This clearly positions knowledge management as a strategic prerequisite for organization-wide change.
- Interdisciplinary Cooperation and Knowledge Sharing (Point 9): To improve quality, it is necessary to break down barriers between functional units. Workers from design, production, and sales must function as an integrated team, actively sharing knowledge (KM) to preventively solve problems and establish an integrated quality system.
- Prevention Based on Expertise (Point 3): The demand to cease dependence on mass inspection implies that quality must be built into the production process from the very beginning. This is only possible if management and employees possess deep technical knowledge of production processes and utilize statistical control methods.

Deming argues that the fundamental path toward overcoming a crisis is a management transformation that requires continuous acquisition of and investment in knowledge (using his Points 1, 2, and 6).[47] In this way, he positions knowledge management as the central element of modern quality management, emphasizing that excellence is not achieved by simple purchase, but must be guided by

[42] Akdere M., op. cit.
[43] Akdere M., op. cit.
[44] Al-Saffar N. G., & Obeidat A. M., The effect of total quality management practices on employee performance: The moderating role of knowledge sharing. Management Science Letters, Vol. 10, 2020, pp. 77-90. https://doi.org/10.5267/j.msl.2019.8.014.
[45] Abbas J., Impact of total quality management on corporate sustainability through the mediating effect of knowledge management. Journal of Cleaner Production, Vol. 244, 2020, 118806. https://doi.org/10.1016/j.jclepro.2019.118806.
[46] Deming W. E., Out of the Crisis. MIT Center for Advanced Educational Services, 1986.
[47] Deming W. E., op. cit.

expertise. This expertise is developed through education, research activities, and inter-sectoral team exchange (Point 9).[48]

4. CONCLUSION

Knowledge management represents a fundamental element in the development, maintenance, and improvement of quality systems. Through effective knowledge management, organizations can facilitate work processes, improve production capacities, and simultaneously satisfy consumer needs. Therefore, the integration of KM into quality systems is not just a benefit, but also a necessary precondition for competitiveness in a dynamic market. Participation in KM initiatives improves efficiency, quality, and fosters creativity and innovation, which is crucial for the success of any company under conditions of intensive competition and in the development of the modern knowledge-based economy. TQM techniques are merely tools, but Knowledge Management (KM) is the process that introduces and nurtures tacit resources (culture and leadership). These resources ensure that the TQM tools are used effectively, resulting in lasting excellence and outperforming competitors.

Considering the limitations and defining future research directions has the potential to yield more precise and applicable results regarding the methods of integrating Knowledge Management (KM) into Quality Management Systems (QMS). If future research focuses on gathering empirical evidence, the impact of culture, and supporting innovation, it can significantly advance existing quality management strategies, as well as the optimization of the quality of goods and services.

LITERATURE:

[1] Abbas, J. (2020). Impact of total quality management on corporate sustainability through the mediating effect of knowledge management. Journal of Cleaner Production, 244, 118806. https://doi.org/10.1016/j.jclepro.2019.118806.

[2] Abbas, J., & Kumari, K. (2023). Examining the relationship between total quality management and knowledge management and their impact on organizational performance: a dimensional analysis. Journal of Economic and Administrative Sciences, 39(2), 426–451. https://doi.org/10.1108/JEAS-03-2021-0046.

[3] Akdere, M. (2009). The Role of Knowledge Management in Quality Management Practices: Achieving Performance Excellence in Organizations. Advances in Developing Human Resources, 11(3), 349-361. https://doi.org/10.1177/1523422309338575.

[4] Al-Saffar, N. G., & Obeidat, A. M. (2020). The effect of total quality management practices on employee performance: The moderating role of knowledge sharing. Management Science Letters, 77-90. https://doi.org/10.5267/j.msl.2019.8.014.

[5] Arsawan, I. W. E., Koval, V., Rajiani, I., Rustiarini, N. W., Supartha, W. G., & Suryantini, N. P. S. (2022). Leveraging knowledge sharing and innovation culture into SMEs sustainable competitive advantage. International Journal of Productivity and Performance Management, 71(2), 405–428. https://doi.org/10.1108/IJPPM-04-2020-0192.

[6] Blackler, F. (2002). Knowledge, Knowledge Work and Organizations: An Overview and Interpretation. In C. W. Choo, & N. Bontis (Eds.), The Strategic Management of Intellectual Capital and Organizational Knowledge (pp. 47-64). Oxford Unitersity Press.

[7] Civi, E. (2000). Knowledge management as a competitive asset: a review. Marketing Intelligence & Planning, 18(4), 166–174. https://doi.org/10.1108/02634500010333280.

[8] Davenport, T. H., & Prusak, L. (1998). Working knowledge: How organizations manage what they know. Harvard Business Press.

[9] Deming, W. E. (1986). Out of the Crisis. MIT Center for Advanced Educational Services.

[10] Grant, R. (2001). Knowledge and organization. In I. Nonaka, D. J. Teece (Eds.) Knowledge and organization (pp. 145-169). SAGE Publications Ltd. https://doi.org/10.4135/9781446217573.n8.

[48] Deming W. E., op. cit.

[11] Gustav Johannsen, C. (2000). Total quality management in a knowledge management perspective. Journal of Documentation, 56(1), 2000, 42–54. https://doi.org/10.1108/EUM0000000007108.
[12] Honarpour, A., Jusoh, A., & Md Nor, K. (2012). Knowledge management, total quality management and innovation: A new look. Journal of technology management & innovation, 7(3), 22-31. http://dx.doi.org/10.4067/S0718-27242012000300003.
[13] Honarpour, A., Jusoh, A., & Md Nor, K. (2018). Total quality management, knowledge management, and innovation: an empirical study in R&D units. Total Quality Management & Business Excellence, 29(7-8), 798–816. https://doi.org/10.1080/14783363.2016.1238760.
[14] Hsu, S.-h., & Shen, H.-p. (2005). Knowledge management and its relationship with TQM. Total Quality Management & Business Excellence, 16(3), 351–361. https://doi.org/10.1080/14783360500054111.
[15] Mahdi, O. R., Almsafir, M. K., & Yao, L. (2011). The role of knowledge and knowledge management in sustaining competitive advantage within organizations: A review. African Journal of Business Management, 5(23), 9912-9931. doi: 10.5897/AJBM11.1118.
[16] Meihami, B., & Meihami, H. (2014). Knowledge Management a way to gain a competitive advantage in firms (evidence of manufacturing companies). International letters of social and humanistic sciences, 14, 80-91. https://doi.org/10.18052/www.scipress.com/ILSHS.14.80.
[17] Mohsin, M., Shamsudin, M. N., Jaffri, N. R., Idrees, M., Jamil, K. (2025). Unveiling the contextual effects of total quality management to enhance sustainable performance. The TQM Journal, 37(3), 680–708. https://doi.org/10.1108/TQM-05-2023-0124.
[18] Ndlela, L. T., & Du Toit, A. S. (2001). Establishing a knowledge management programme for competitive advantage in an enterprise. International journal of information management, 21(2), 151-165. https://doi.org/10.1016/S0268-4012(01)00007-X.
[19] Nguyen, Q. T. N., Neck, P. A., & Nguyen, T. H. (2009). The critical role of knowledge management in achieving and sustaining organisational competitive advantage. International Business Research, 2(3), 3-16.
[20] Nonaka, I., & Takeuchi, H. (1995). The Knowledge creating company: How Japanese Companies create the dynamics of innovation, Oxford University Press, Oxford.
[21] Omerzel, D. G., & Gulev, R. E. (2011). Knowledge Resources and Competitive Advantage. Managing Global Transitions: International Research Journal, 9(4), 335-354.
[22] Polanyi, M. (1962). Tacit knowing: Its bearing on some problems of philosophy. Reviews of modern physics, 34(4), 601. https://doi.org/10.1103/RevModPhys.34.601.
[23] Powell, T. C. (1995). Total quality management as competitive advantage: a review and empirical study. Strategic management journal, 16(1), 15-37. https://doi.org/10.1002/smj.4250160105.
[24] Prusak, L. (2009). Knowledge in organisations. Routledge.
[25] Rahimli, A. (2012). Knowledge management and competitive advantage. In Information and Knowledge Management, 2(7), 37-43.
[26] Ribière, V. M., & Khorramshahgol, R. (2004). Integrating total quality management and knowledge management. Journal of Management Systems, 16(1), 39-54.
[27] Shannak, R., Masa'deh, R. E., Al-Zu'bi, Z., Obeidat, B., Alshurideh, M., & Altamony, H. (2012). A theoretical perspective on the relationship between knowledge management systems, customer knowledge management, and firm competitive advantage. European Journal of Social Sciences, 32(4), 520-532.
[28] Sharkie, R. (2003). Knowledge creation and its place in the development of sustainable competitive advantage. Journal of Knowledge Management, 7(1), 20–31, https://doi.org/10.1108/13673270310463590.
[29] Shehabat, I. (2020). The role of knowledge management in organizational performance and gaining sustainable competitive advantage. In Proceedings of the 2020 Asia Service Sciences and Software Engineering Conference (pp. 133-139). https://doi.org/10.1145/3399871.3399878.

[30] Stewart, D., & Waddell, D. (2008). Knowledge Management: The fundamental component for delivery of quality. Total Quality Management & Business Excellence, 19(9), 987–996. https://doi.org/10.1080/14783360802227803.

[31] Yu, H., Shang, Y., Wang, N., & Ma, Z. (2019). The Mediating Effect of Decision Quality on Knowledge Management and Firm Performance for Chinese Entrepreneurs: An Empirical Study. Sustainability, 11(13), 3660. https://doi.org/10.3390/su11133660.

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THE ROLE OF ENGINEERING MANAGEMENT AND SAFETY CULTURE IN PROACTIVELY MITIGATING OPERATIONAL AND ENVIRONMENTAL RISKS IN HIGH-HAZARD INDUSTRIES

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Abstract: *In high-hazard industries, such as chemical and petrochemical operations, systemic risks occur where minor deviations can cause catastrophic failures with catastrophic human and environmental consequences. Occupational safety has been traditionally reactive, often spurred by major industrial accidents. This paper posits that the transition from a reactive to a proactive paradigm of risk mitigation requires the synergistic integration of three critical domains: a mature safety culture (SC), a systemic OSH Management Framework (OSHMS), and robust Engineering Management (EM) capabilities. The analysis shows that a mature safety culture (that evolves from a pathological to a generative state) and a structured OSHMS (like ISO 45001) provide the foundation for continuous improvement, activated by visible leadership commitment as a cultural catalyst that shifts accountability from individual error to systemic design faults, coupled with employee engagement and proactive reporting to create organizational vigilance, and EM as the technical engine that translates cultural values into physical controls through practices such as Inherently Safer Design (ISD) and predictive technologies. Effective risk mitigation is not achieved by addressing these domains in isolation but by treating them as an integrated socio-technical system, placing the engineering manager both as a technical architect of safer systems and as a cultural catalyst of long-term organizational resilience.*

Keywords: *Safety Culture, Engineering Management, Safety Management Systems (SMS), Risk Management, High-Hazard Industries*

JEL Classification*: M54, L65, J81*

1. INTRODUCTION

Complex processes and hazardous materials used in high-hazard industries like chemical and petrochemical operations amplify systemic vulnerability by magnifying the impact of even minor

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deviations[3]. The consequences of operational failures go far beyond financial loss to catastrophic casualties and environmental destruction. Occupational accidents impose significant costs on national social health systems and compromise the quality and image of the company[4]. All of these results highlight that safety lapses are not technical issues that can be addressed in isolation, but rather sustained socio-economic burdens.

The systematic development of safety approaches was largely reactive and prompted by accidents in the 1970s and 1980s such as the Flixborough accident (1974), the Seveso incident (1976), and the Piper Alpha disaster (1987)[5]. The recurrence of such deficiency's points to an enduring organizational tendency to underestimate systemic risks until catastrophic failures drive recognition, and a reality that progress in safety has often been fueled by tragedy rather than foresight. In-depth examinations of these incidents showed shortcomings in traditional Occupational Safety and Health (OSH) management[6], and widespread failures illustrated the need for systemic reform. Reform must be planned to address both technical modifications, or engineering action, and organizational preparedness, or educational action[7]. The two dimensions of compliance and resilience must be balanced to move from compliance to resilience. Organizations that move safety from compliance to integration distinguish themselves from those that merely pass a regulatory audit by embedding safety deep into the heart of their operations.

In order to proactively mitigate operational and environmental risk, three critical domains must work together in a functionally integrated manner: Engineering Management (EM) capabilities, Systemic OSH Management Framework (OSHMS), and mature Safety Culture (SC)[8]. They are interdependent domains that must evolve in tandem rather than as independent efforts. Effective risk mitigation treats these three components as inseparable socio-technical partners, and moves organizational performance beyond the reactive paradigm of the past to anticipate rather than react to risk, thereby ensuring the future of safety.

2. FOUNDATIONAL FRAMEWORKS: SAFETY CULTURE AND OSH MANAGEMENT SYSTEMS

Safety practices in high-hazard settings are underpinned by creating systematic foundations for safety, which include defining organizational safety maturity and implementing auditable management systems; the latter are not administrative requirements, but the structural foundation upon which the difference between reactive and proactive safety practices depends.

2.1. Defining safety culture and its principles

Safety culture (SC) is the term used to describe the psychological and behavioral climate of an organization with respect to safety, which is defined formally as the shared attitudes, beliefs, perceptions, and practices of employees and management with respect to safety[9]. whereas in practice, it refers to what actually drives the decision to prioritize safety strategically as opposed to treating it as an afterthought. A key, measurable component of this culture is the safety climate, a concept introduced by Zohar[10], which he defined as a shared perception among employees about the

[3] Dasgupta, A., et al., "Engineering Management Perspectives on Safety Culture in Chemical and Petrochemical Plants: A Systematic Review," *Academic Journal on Science, Technology, Engineering & Mathematics Education*, Vol. 1, No. 1, 2024, pp. 36–52, https://doi.org/10.69593/ajieet.v1i01.121.

[4] Marhavilas, P. K., et al., "International Management System Standards Related to Occupational Safety and Health: An Updated Literature Survey," *Sustainability*, Vol. 14, No. 20, 2022, Article 13282, https://doi.org/10.3390/su142013282.

[5] Ibid.

[6] Ibid.

[7] Ibid.

[8] Dasgupta, A., et al., op. cit.

[9] Ibid.

[10] Zohar, D., "Safety Climate in Industrial Organizations: Theoretical and Applied Implications," *Journal of Applied Psychology*, Vol. 65, No. 1, 1980, pp. 96–102, https://doi.org/10.1037/0021-9010.65.1.96.

importance of safety in their daily work, which is a major contribution because it redirects focus from written policies to the perception of the workforce about the true priorities of management. Zohar's study indicated that the two most influential factors in determining the level of safety climate were (1) how workers perceived the attitude of management about safety, and (2) how they perceived safety relative to other production processes[11]. This is validated by empirical evidence that organizations with higher inherent risk levels often have stronger safety climates[12] as a foundational study of 20 industrial plants showed that chemical plants had the highest safety climate scores (mean score of 186.6) while food processing plants had the lowest (120.8). Safety climate is also perceived as an individual trait that represents leadership prioritization of safety and employee involvement in protective practices[13], As such, climate serves as both a diagnostic instrument and a performance indicator, revealing whether organizational discourse about safety aligns with actual operational conduct.

Safety culture is a preventive mechanism that influences personal behavior and organizational practice to reduce the risk of accidents[14]. This barrier is not inert; it conditions decision-making such that safety considerations are not treated as an afterthought to operational choices. In this way, SC can be seen as a kind of invisible infrastructure: when strong, it directs decisions toward resilience; when weak, it exposes organizations to predictable failure.

A more appropriate way to understand the evolution of safety culture maturity is to think of it as a developmental process in which the approach to safety within an organization moves through a sequence of stages along a continuum of recognizable stages, with movement through the stages driven by greater awareness and trust[15]. The lowest level of this developmental ladder is the *Pathological*, in which safety is considered a problem that is created by workers and the primary driver of the organization is to avoid regulatory fines and penalties, which represents a defensive mentality where the organization seeks to avoid accountability[16]. The *Reactive* stage is an improvement, but the organization does not take safety seriously until something happens, reflecting a short-term, event-driven mindset[17]. With increasing maturity, a *Calculative* culture develops, which is characterized by a high degree of formal safety management systems and extensive data collection, but safety is still largely top-down imposed by management rather than adopted by the workforce, showing the limits of bureaucracy with systems in place but no cultural ownership for resilience[18]. With the *Proactive* stage, the organization begins to be able to predict problems and workforce involvement starts to take the initiative beyond a strictly top-down approach, showing that the organization has shifted from a reactive mode of safety to one that is anticipatory, and employees have become contributors rather than just recipients[19]. The final stage, *Generative*, is the point where safety is viewed as part of the business[20], and in this state, the dedicated safety department can become obsolete as the responsibility for safety becomes so ingrained that it is shared by everyone in the organization[21].

[11] Ibid.
[12] Ibid.
[13] Milijić, N., et al., "Multicriteria Analysis of Safety Climate Measurements at Workplaces in Production Industries in Serbia," *International Journal of Industrial Ergonomics*, Vol. 44, No. 4, 2014, pp. 510–19, https://doi.org/10.1016/j.ergon.2014.03.004.
[14] Tetzlaff, E. J., et al., "Safety Culture: A Retrospective Analysis of Occupational Health and Safety Mining Reports," *Safety and Health at Work*, Vol. 12, No. 2, 2021, pp. 201–8, https://doi.org/10.1016/j.shaw.2020.12.001.
[15] P. Hudson, P., "Applying the Lessons of High Risk Industries to Health Care," *BMJ Quality & Safety*, Vol. 12, Suppl. 1, 2003, pp. i7–12, https://doi.org/10.1136/qhc.12.suppl_1.i7.
[16] Ibid.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Ibid.
[21] Goncalves Filho, A. P., et al., "A Safety Culture Maturity Model for Petrochemical Companies in Brazil," *Safety Science*, Vol. 48, No. 5, 2010, pp. 615–24, https://doi.org/10.1016/j.ssci.2010.01.012.

This continuum shows that cultural maturity is developmental, not static, and that it takes sustained leadership commitment and reinforcement at all organizational levels to maintain a total system of safety that integrates intangible attitudes with tangible behaviors, and that safety excellence is built not just on compliance but on the purposeful development of trust, shared responsibility, and continuous learning.

2.2. OSHMS and systemic integration

OSHMS standards offer a structured approach to OSH management at the worksite and serve as a planning, review, and organizational arrangements system that is designed to prevent work-related injuries and enhance health and safety performance[22]. This definition also highlights that OSHMS is not a static checklist but a dynamic framework that necessitates interaction between planning and practice. These systems allow organizations to develop flexible policies that reflect legal requirements while directing efforts to prevent work-related injuries[23]. The strength of these systems lies in the ability to move the organizational mindset from reactive compliance responses to preventive strategies.

While the most common standard has been Occupational Health and Safety Assessment Series 18001 (OHSAS 18001), the newer ISO 45001:2018 standard, which has already become widespread in the literature, supersedes it[24]. The swift adoption of ISO 45001 reflects a worldwide acknowledgment that safety management must be integrated into overall organizational governance rather than operate as a parallel or secondary system. The purpose of ISO 45001 is to develop a structured system to improve employees' OSH and reduce risks at worksites[25]. In essence, it repositions OSH from a compliance obligation to a strategic enabler of operational resiliency. An effective OSHMS cannot operate in a vacuum; a truly effective IMS OSHMS integrates several disciplines: Occupational Safety and Health (OSH), Quality Management Systems (QMS), and Environmental Management Systems (EMS)[26]. The integration of OSHMS with other disciplines is an operational reality that safety, quality, and environmental performance are intertwined, and that deficiencies in one area will adversely impact others[27]. This integration creates benefits, such as improved coordination and reduced costs[28]. It also improves organizational credibility by showing that safety is not an operational afterthought, but rather a strategic value.

Nonetheless, the challenge of integrating multiple standards is a significant implementation barrier, and other barriers include the high cost of implementation and employee understanding of the OSHMS's significance[29]. These barriers reinforce that integration is more cultural and organizational change than technical alignment, which is best achieved with continued investment in communication, training, and leadership clarity, yet the challenge of alignment of different standards indicates that integration is as much an organizational change process as it is a technical exercise, and therefore, it requires clarity from Engineering Management. In the end, OSHMS integration is less a formal function of the standards themselves and more a reflection of the ability of the organization to internalize them as part of its operational identity.

2.3. The PDCA cycle for proactive prevention

OSHMS frameworks draw structural coherence from the principles of quality management, which use the Plan-Do-Check-Act (PDCA) method to ensure continuous improvement[30]. This cycle helps

[22] Kale, S. R., et al., "Review of Occupational Health and Safety Management System (OHSMS) of Process Industries with a Case-Based Study of a Fiber Industry," *International Journal of Engineering Research*, Vol. 2, No. 6, 2013, pp. 1650–1659.
[23] Marhavilas, P. K., et al., op. cit.
[24] Ibid.
[25] Ibid.
[26] Ibid.
[27] Ibid.
[28] Ibid.
[29] Ibid.
[30] Ibid.

the organization develop OSH policy, implement processes, monitor performance, and act to improve safety, but PDCA is more than a procedural tool, it institutionalizes learning, challenging organizations to identify weaknesses and build corrective action into the operational DNA. The strength of PDCA lies in its iterative nature, which prevents stagnation and compels organizations to treat safety as a dynamic objective rather than a fixed achievement[31]. In this way, PDCA transforms safety from a compliance exercise into a continuous pursuit of resilience.

Risk Analysis and Assessment (RAA) is a crucial component of proactive hazard prevention, and the quantified Risk Evaluation (QRE) component of the RAA provides the empirical foundation for decision making by defining risk in terms of the frequency (probability) and consequence of a particular harmful event[32]. Defining risk as the intersection of the frequency and consequence of a particular harmful event reinforces the understanding that risk is not a theoretical concept but a measurable intersection of likelihood and impact, meaning systematic evaluation is essential to credible prevention strategies. The aim of this controlled risk management is to achieve tolerable risk, which is the point of optimal balance between absolute safety and operational needs[33]. This is not a tradeoff but an equilibrium, where organizations must protect human and environmental health while maintaining operational viability, and this is the test of whether safety management is truly integrated into organizational strategy.

3. LEADERSHIP COMMITMENT AND SYSTEM ACCOUNTABILITY

The shift from reactive compliance to a generative safety culture depends entirely on visible, committed leadership[34]. Without this commitment, even the most sophisticated systems risk devolving into symbolic compliance rather than meaningful practice. Leadership must structure systemic accountability. This accountability is not a bureaucratic formality but the mechanism through which safety becomes embedded in organizational identity.

3.1. Leadership as the cultural catalyst

Leadership commitment to safety is the critical factor determining the resilience of the safety culture[35]. Leaders function as visible role models, and their active behavior directly influences employee attitudes[36]. The credibility of safety initiatives rises or falls with leadership behavior, as employees calibrate their own priorities against what leaders visibly reward and tolerate. The success of any OSHMS hinges on the demonstrated commitment of every level, particularly the uppermost management[37]. The recognition of OSH as a management function, with widespread participation, reframes safety as a strategic management responsibility rather than a delegated technical task.

Engineering managers meet this obligation through active measures such as setting expectations, ensuring resources, and confirming training[38], which sends a message to the workforce that safety is not up for debate but an operational value. The commitment is also reflected in organizational decisions such as granting high organizational status and executive authority to safety officers and committees, a key distinction of companies with effective safety programs[39]. As engineering management becomes more engaged, the organization experiences increased employee involvement

[31] Ibid.
[32] Ibid.
[33] Ibid.
[34] Dasgupta, A., et al., op. cit.
[35] Sutton, I. S., "Use Root Cause Analysis to Understand and Improve Process Safety Culture," *Process Safety Progress*, Vol. 27, No. 4, 2008, pp. 274–79, https://doi.org/10.1002/prs.10271.
[36] Shirali, Gh. A., et al., "Quantitative Assessment of Resilience Safety Culture Using Principal Components Analysis and Numerical Taxonomy: A Case Study in a Petrochemical Plant," *Journal of Loss Prevention in the Process Industries*, Vol. 40, 2016, pp. 277–84, https://doi.org/10.1016/j.jlp.2016.01.007.
[37] Marhavilas, P. K., et al., op. cit.
[38] Dasgupta, A., et al., op. cit.
[39] Zohar, D., op. cit.

and a stronger safety culture[40]. Research has shown this by example, such as in a comparison of two Algerian petrochemical plants, one with European management (Company A) that had a much more developed safety culture and lower accident rates than the other with strictly local management (Company B)[41]. This shows that leadership commitment is infectious: visible commitment at the top trickles down into ownership at the front line. This commitment must overcome the considerable financial cost barrier to the adoption of OSHMS[42], and leaders transform cost into investment, which builds long-term resilience and organizational reputation.

3.2. Moving beyond the blame-on-error fallacy

Accidents, incidents, and harm are manifestations of problems in the organizational and technical system, a concept established decades ago when accidents were viewed as "symptoms of design faults in that system"[43], and are not simply caused by human errors[44]. This systemic perspective, which has been found in historical analyses of mining accident reports that framed safety failures as a tension between the role of the individual and the role of the organization[45], moves the focus of analysis from accidents to organizational design and decision-making, and in doing so, moves the locus of accountability from the frontline operator to management design decisions and motivational influences. This way of reframing accountability recognizes that accidents are symptoms of structural weaknesses rather than personal failings and that active leadership must move the organizational focus from hazard management to proactively managing systemic organizational risks[46], which is the distinction between organizations that respond after the fact and those that anticipate, design against, and prevent incidents

4. EMPLOYEE ENGAGEMENT AND ORGANIZATIONAL VIGILANCE

Employee engagement is a critical, foundational element of effective OSHMS implementation. It facilitates continuous quality improvement. Engagement is not a peripheral add-on but the mechanism that converts safety systems from paper frameworks into lived organizational practice.

4.1. Fostering ownership and shared responsibility

The progression toward a mature safety culture relies heavily on employee involvement and effective training programs because employees are the frontline actors in daily safety, and their engagement in safety initiatives is essential[47]. Worker involvement is considered a crucial element of a successful safety climate, along with management commitment[48]. This duality highlights the fact that safety cannot be delivered by management, but must be co-produced by those who carry out the work and that a safety culture must be developed where safety is considered to be a shared responsibility in order to achieve measurably superior safety outcomes[49]. When employees take ownership of safety protocols, abstract safety procedures become personal and collective responsibility[50]. Ownership shifts compliance from a duty to a conviction, and safety becomes part of the professional identity of the workforce. Thus, true safety performance is rooted in intrinsic motivation and shared ownership[51], where workers see safety compliance as a shared obligation rather than an externally mandated obligation. This shift is critical: rules may control behavior, but ownership sustains it.

[40] Dasgupta, A., et al., op. cit.
[41] Boughaba, A., et al., "Safety Culture Assessment in Petrochemical Industry: A Comparative Study of Two Algerian Plants," *Safety and Health at Work*, Vol. 5, No. 2, 2014, pp. 60–65, https://doi.org/10.1016/j.shaw.2014.03.005.
[42] Marhavilas, P. K., et al., op. cit.
[43] Zohar, D., op. cit.
[44] Marhavilas, P. K., et al., op. cit.
[45] Tetzlaff, E. J., et al., op. cit.
[46] Dasgupta, A., et al., op. cit.
[47] Ibid.
[48] Milijić, N., et al., op. cit.
[49] Shirali, Gh. A., et al., op. cit.
[50] Dasgupta, A., et al., op. cit.
[51] Ibid.

4.2. Proactive reporting and continuous improvement

The ongoing improvement cycle (PDCA) that is a part of OSHMS relies on employee vigilance to provide the data that will feed the cycle, and research has shown that when managers give clear expectations and a trusting environment, employees are far more likely to report potential hazards[52]. This is not a soft culture aspect, but a measurable factor of the frequency and quality of reports, as they mature from reactive organizations that may only see reports of serious accidents, to organizations with formal systems of reporting all unusual events, including near-misses, because employees feel safe enough to inform managers[53]. Proactive reporting systems can transform near-misses from a hidden occurrence into a key element of risk assessment and system adjustment[54], essentially making vigilance a form of organizational intelligence that turns frontline observations into strategic foresight.

However, studies have shown that organizational learning has not been fully achieved in the occupational safety field, despite the structural existence of frameworks for continuous improvement such as PDCA[55]. A major structural deficiency is that the traditional audit approach is reactive, looking back at incidents after the fact, and not incorporating near-misses systematically for proactive measures[56], and their reliance on lagging indicators creates a hindsight rather than foresight loop. This gap between reporting systems and systematic organizational learning turns valuable leading indicators (near-misses) into chronic, unaddressed flaws in the OSHMS structure[57]. This failure is critical because near-misses function as precursors to more serious events and should be reframed as early warnings[58]. When these warnings are ignored, unsafe practices can become normalized, creating systemic vulnerability within the organization[59].

4.3. Educational action and training efficacy

The original systematic safety approaches required education action as well as engineering changes[60]. Safety training must be effective and involve employees in safety decision-making[61]. In reality, many incidents are caused by inadequate training and knowledge, leading to lack of awareness and unsafe behavior among the workforce[62]. which shows that technical safeguards cannot make up for cognitive blind spots, knowledge gaps directly translate into operational risks. The challenge of employees failing to understand the importance of OSH management can be addressed through high-quality training, perhaps using innovative tools such as virtual simulations, that bring abstract hazards to life and make risks tangible through immersive methods such as simulations to create experiential learning[63]. Thus, training must be carefully designed to make employees competent in responding to potential hazards and to make risks real and tangible, and training efficacy is directly linked to the competence of employees in responding to emergencies, so the modules of training must be carefully redesigned based on the analysis of past incidents and learning needs[64]. In this sense, training is not a one-time intervention but a continuously adaptive system, evolving in parallel with the organization's risk landscape.

[52] Ibid.
[53] Goncalves Filho, A. P., et al., op. cit.
[54] Kale, S. R., et al., op. cit.
[55] Marhavilas, P. K., et al., op. cit.
[56] Kale, S. R., et al., op. cit.
[57] Marhavilas, P. K., et al., op. cit.; Kale, S. R., et al., op. cit.
[58] Sutton, I. S., op. cit.
[59] Tetzlaff, E. J., et al., op. cit.
[60] Marhavilas, P. K., et al., op. cit.
[61] Dasgupta, A., et al., op. cit.
[62] Kale, S. R., et al., op. cit.
[63] Dasgupta, A., et al., op. cit.
[64] Kale, S. R., et al., op. cit.

5. ENGINEERING MANAGEMENT

The technical foundation of proactive risk mitigation is engineering management (EM), which converts cultural commitment and systemic frameworks into physical controls and safer design. In this sense, EM bridges the gap between organizational values and the physical systems that either prevent or enable catastrophic failure. Crucially, OHSMS planning falls short when managers rely on simple administrative checklists while overlooking the major engineering controls that must be prioritized in the planning process[65]. EM has the mandate to be the technical conscience that ensures engineering controls supersede reliance on purely administrative mandates; it is the difference between symbolic safety systems and operationally effective systems. EM is responsible for detailed risk assessment, inherently safer design, and the implementation of safety technologies[66]. By doing so, EM transforms safety from a compliance-driven exercise into a design philosophy embedded at the core of operations.

The challenge of high-hazard management is to move away from the qualitative guesswork and into the rigorous quantitative methods. In fact, risk is a measurable quantity expressed by a mathematical formula and therefore should be evaluated quantitatively, known as Quantified Risk Evaluation (QRE)[67]. The RAA process[68] is not just a procedural step, but an epistemological step, in which the organizations move from intuitive decision-making to evidence-based certainty. It is our firm belief that safety decisions must be consistently grounded in these verifiable metrics to systematically move management beyond subjective risk perception toward quantifiable, tolerable risk criteria. Only then can organizations credibly claim that their risk thresholds are defensible, transparent, and aligned with societal expectations.

The most effective prevention strategy is to address the root cause of risk at the design phase, rather than trying to manage the symptoms of systemic flaws, which is called Inherently Safer Design (ISD), a philosophy that corrects underlying design faults by eliminating or fundamentally reducing hazards before they are introduced into a process[69]. ISD is implemented through several core concepts, including the substitution of hazardous materials and the minimization of their quantities[70], moderating process conditions and simplifying complex systems to reduce the opportunity for error[71]. In other words, ISD collapses the chain of potential failure by eliminating the hazard itself, which is as close as engineering can get to "designing out" risk altogether.

Additionally, EM should continually utilize digital innovations to truly reach a predictive state of safety. Automation systems reduce the need for humans to perform critical operations, which reduces the possibility of human error, and more importantly, the use of Artificial Intelligence (AI) and Machine Learning (ML) is crucial[72], as predictive analytics based on real-time data enables organizations to foresee subtle risks before they become significant incidents[73]. This level of technology is what makes management move from regulatory compliance toward a predictive capability, where the Check and Act phases of the OSHMS cycle are optimized. Finally, EM must look to embrace resilience engineering and digital twin technologies, which will allow organizations to model failures and test interventions and optimize safety strategies before they are deployed, taking ISD to the digital world to eliminate or mitigate hazards in silico before they even occur in practice.

[65] Ibid.
[66] Dasgupta, A., et al., op. cit.
[67] Marhavilas, P. K., et al., op. cit.
[68] Ibid.
[69] Sutton, I. S., op. cit.; Dasgupta, A., et al., op. cit.
[70] Marhavilas, P. K., et al., op. cit.
[71] Dasgupta, A., et al., op. cit.
[72] Dasgupta, A., et al., op. cit.
[73] Ibid.

6. CONCLUSION

In this paper, we have argued that the proactive mitigation of operational and environmental risks in high-hazard industries relies on the synergistic integration of Engineering Management (EM), a systemic OSH Management Framework (OSHMS), and a mature Safety Culture (SC). This integrated approach is critical because the systemic failures that result in occupational accidents (e.g., weak safety culture or inadequate engineering controls) are often the same root causes of catastrophic environmental incidents. This means that mitigating operational and environmental risk are not a separate endeavor but two outcomes of the same foundational commitment to process safety and organizational excellence. Moving beyond the reactive paradigm requires a mature safety culture, operationalized through a structured OSHMS that institutionalizes continuous learning. This framework is brought to life by visible leadership commitment, which serves as the cultural catalyst to move organizations beyond blaming individuals toward addressing systemic design faults. This commitment is, in turn, activated by bottom-up employee engagement, where proactive reporting and shared ownership transform frontline vigilance into strategic foresight. Finally, Engineering Management acts as the technical engine that translates these cultural values into physical reality through quantitative risk evaluation, Inherently Safer Design (ISD), and predictive technologies. The analysis presented here demonstrates that for high-hazard industries to achieve a true state of resilience, engineering managers must act as both technical architects of safer systems and as cultural catalysts who create the systemic accountability that sustains them. Future research should therefore focus on developing empirical models to validate these interdependencies in practice and exploring how emerging digital innovations, such as resilience engineering and digital twin technologies, may accelerate this cultural and technical integration.

LITERATURE

[1] Boughaba, A., Hassane, C. and Roukia, O. (2014), "Safety culture assessment in petrochemical industry: A comparative study of two Algerian plants," *Safety and Health at Work*, 5/2, pp. 60–65. https://doi.org/10.1016/j.shaw.2014.03.005

[2] Dasgupta, A., Islam, M.M., et al. (2024), "Engineering management perspectives on safety culture in chemical and petrochemical plants: A systematic review," *Academic Journal on Science, Technology, Engineering & Mathematics Education*, 1/1, pp. 36–52. https://doi.org/10.69593/ajieet.v1i01.121

[3] Goncalves Filho, A.P., Andrade, J.C.S. and Marinho, M.M.O. (2010), "A safety culture maturity model for petrochemical companies in Brazil," *Safety Science*, 48/5, pp. 615–624. https://doi.org/10.1016/j.ssci.2010.01.012

[4] Hudson, P. (2003), "Applying the lessons of high risk industries to health care," *BMJ Quality & Safety*, 12/suppl 1, pp. i7–i12. https://doi.org/10.1136/qhc.12.suppl_1.i7

[5] Kale, S.R., Gujrathi, A.M. and Kale, L.S. (2013), "Review of occupational health and safety management system (OHSMS) of process industries with a case based study of a fiber industry," *International Journal of Engineering Research*, 2/6, pp. 1650–1659.

[6] Marhavilas, P.K., Pliaki, F. and Koulouriotis, D. (2022), "International management system standards related to occupational safety and health: An updated literature survey," *Sustainability*, 14/20, Article 13282. https://doi.org/10.3390/su142013282

[7] Milijić, N., Mihajlović, I., Nikolić, D. and Živković, Ž. (2014), "Multicriteria analysis of safety climate measurements at workplaces in production industries in Serbia," *International Journal of Industrial Ergonomics*, 44/4, pp. 510–519. https://doi.org/10.1016/j.ergon.2014.03.004

[8] Shirali, Gh.A., Shekari, M. and Angali, K.A. (2016), "Quantitative assessment of resilience safety culture using principal components analysis and numerical taxonomy: A case study in a petrochemical plant," *Journal of Loss Prevention in the Process Industries*, 40, pp. 277–284. https://doi.org/10.1016/j.jlp.2016.01.007

[9] Sutton, I.S. (2008), "Use root cause analysis to understand and improve process safety culture," *Process Safety Progress*, 27/4, pp. 274–279. https://doi.org/10.1002/prs.10271

[10] Tetzlaff, E.J., Goggins, K.A., Pegoraro, A.L., Dorman, S.C., Pakalnis, V. and Eger, T.R. (2021), "Safety culture: A retrospective analysis of occupational health and safety mining reports," *Safety and Health at Work*, 12/2, pp. 201–208. https://doi.org/10.1016/j.shaw.2020.12.001

[11] Zohar, D. (1980), "Safety climate in industrial organizations: Theoretical and applied implications," *Journal of Applied Psychology*, 65/1, pp. 96–102. https://doi.org/10.1037/0021-9010.65.1.96

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EMPLOYEE COMPETENCIES AS A FACTOR ENSURING BUSINESS QUALITY

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Abstract: *Today, as the market changes from day to day and customer expectations continue to rise, organizations are seeking ways to ensure the quality of their products and services. In this pursuit, employees and their competencies play a central role. Through knowledge, commitment, communication skills, and the ability to function effectively in teams, employees directly influence the quality of business outcomes.The aim of this paper is to explore how the level of employee competence development affects the quality of business processes within organizations in Serbia. The research was conducted on a sample of 110 employees from different sectors, using a questionnaire that examined their views on professional and personal skills, as well as their perception of work quality within their organizations.The results show that employees particularly emphasize the importance of good communication skills, teamwork, professional knowledge, and responsibility in performing their duties. The study confirms that the higher the level of developed competencies, the higher the perceived quality of business performance, suggesting that quality truly begins with people.*

Keywords: *Employee competencies, quality of business operations, professional development, organizational efficiency*

JEL Classification*:*

1. INTRODUCTION

In today's business environment, characterized by rapid technological changes, intense competition, and constantly evolving market demands, organizations face an increasing need to maintain and improve the quality of their processes, products, and services. Business quality is no longer solely the result of implementing technological solutions or investing in infrastructure, but largely depends on

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the human factor that is, on how capable, engaged, and competent employees are in performing their tasks efficiently, innovatively, and with a high degree of responsibility. Employee competencies emerge as one of the key factors that enable organizations to ensure and enhance the quality of their operations.

Competencies are most often defined as a set of knowledge, skills, attitudes, and behaviors that enable an individual to successfully perform work tasks and contribute to achieving organizational goals (Özdemir, Akatay & Eroğlu, 2015). Research indicates that a high level of employee competencies positively influences both individual and organizational performance (Wijayanti & Sari, 2023). Therefore, analyzing employee competencies and their impact on business quality represents a significant area of study. In Serbia, as well as in other countries of the region where organizations often operate in unstable economic and institutional environments, it is clear that the formal structure of an organization or the possession of certificates alone is not sufficient to achieve high quality. The key factor is the level of competence and engagement of employees.

Employees who possess adequate professional and transversal skills such as communication, teamwork, and problem solving and who understand the importance of quality for the organization are in a much better position to contribute to consistent and sustainable quality outcomes. Conversely, organizational business quality implies not only meeting formal standards and procedures but also continuously monitoring and improving processes, fostering a culture of accountability, and promoting a proactive approach to errors. The literature emphasizes that competencies such as professional knowledge, adaptability to change, communication abilities, and leadership behavior have a significant and measurable impact on business quality (Memon, Soomro & Nasrullah, 2022). Vujičić et al. (2025) note that employee competencies have become a crucial factor influencing the competitiveness of organizations.

The aim of this paper is to examine, through empirical research conducted on a sample of 110 employees from organizations in Serbia, the relationship between the level of employee competency development and the perception of business quality. Specifically, the study seeks to identify which competencies employees consider most important for achieving quality, to what extent these competencies are represented, and whether there is a statistically significant relationship between the level of competencies and the assessment of business process quality.

2. LITERATURE REVIEW

Modern organizations operate in an environment characterized by business uncertainty, digital transformation, global competition, and rapid changes in knowledge. In such a business context, innovation is considered one of the most important factors for the survival and development of organizations (Vujičić, Nikitović & Minkov, 2016). Some authors argue that competitive advantage should not be achieved through cost reduction but through high-quality production, innovation, continuous development of products and services, a comprehensive concept of service delivery, and the ability to respond quickly to customer demands (Radović Marković, Salamzadeh & Vujičić, 2019). All of these factors highlight the growing need for employees who possess competencies necessary not only to perform tasks efficiently but also to contribute to the continuous improvement of processes and the overall quality of business operations. Today, the quality of products and services is largely viewed through the prism of the human factor that is, how well trained, motivated, communicative, and responsible employees are in performing their duties and achieving results.

Competencies have a long tradition in the field of human resource management, but only with the development of modern business theories have they gained strategic importance. The Resource-Based View (RBV) suggests that the abilities and knowledge of employees can serve as the foundation of sustainable competitive advantage, provided that they are sufficiently specific, rare, and difficult to imitate. According to this approach, competent individuals represent a potential that lies at the heart of organizational excellence and continuous improvement in work quality (Barney, 2001). This underscores the importance not only of formal education but also of continuous development

throughout one's career. The development of competencies is never an isolated activity; rather, it is part of a company's broader strategy that recognizes that quality does not arise from isolated elements but from the synergy of employees' knowledge, skills, and attitudes. Competency management includes analyzing key work roles, identifying necessary skills, planning training programs, implementing mentoring systems, and evaluating employee performance. Empirical research indicates that organizations that systematically develop these processes, using modern assessment and monitoring models, achieve higher levels of employee performance, reduce work errors, and increase customer satisfaction (Wijayanti & Sari, 2023).

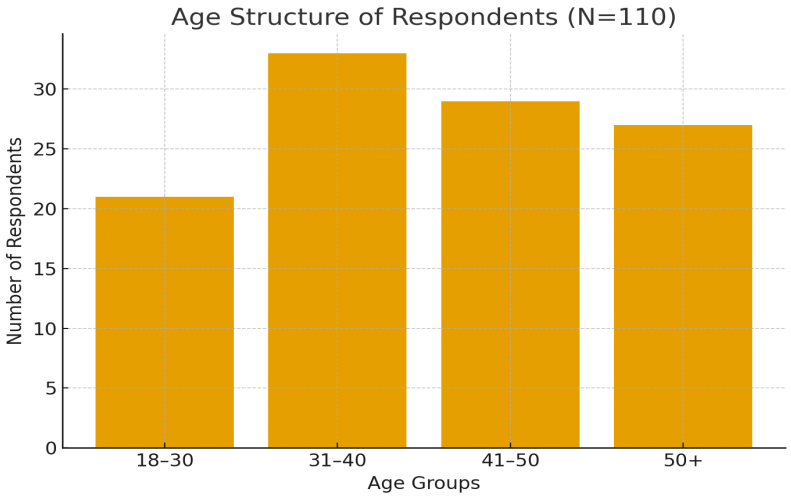
Attention should be given to soft competencies such as communication skills, teamwork, adaptability, and problem-solving. Regardless of how technologically advanced systems become, collaboration among people remains the decisive factor for achieving quality. Ahmed et al. (2015) point out that employers increasingly expect their employees to possess interpersonal skills that encourage knowledge sharing and process improvement. In this regard, effective communication prevents operational delays, misunderstandings, and the additional costs that arise from poor coordination.

At the level of leadership and organizational culture, the competencies of managers in leading teams, providing feedback, and creating a trust-based work environment have a strong impact on quality. When an organization fosters a culture of learning and innovation, employees experience greater psychological safety to propose ideas and point out problems, which directly contributes to reducing inconsistencies and increasing process efficiency (Harwina, 2022).

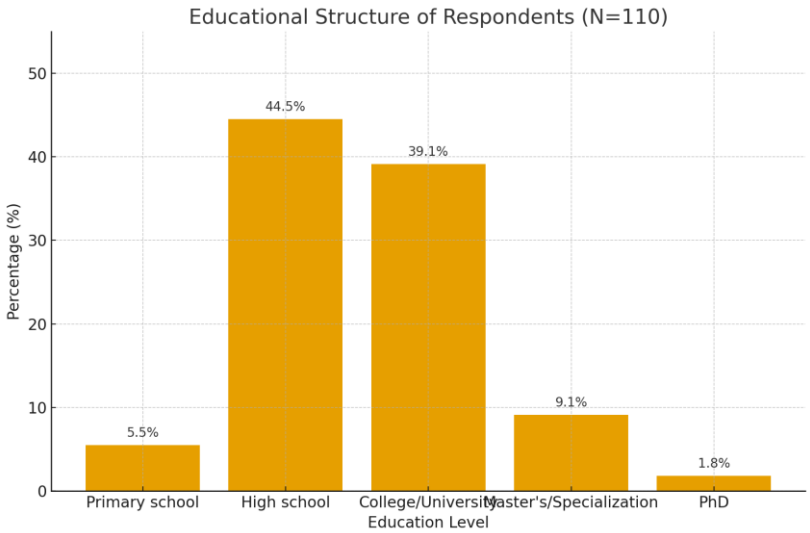
Knowledge and competencies today are more than ever a strategic issue that determines whether organizations will be able to meet the increasingly complex demands of their clients. Gavrić et al. (2024) emphasize that education is the cornerstone of every society and a key tool for shaping the future. Continuous improvement of competencies enables organizations to remain relevant in dynamic environments, to develop innovative business approaches, and to ensure quality that is not based solely on regulatory compliance but on creating value for customers. The quality of business performance is not the result of a single decision or one-time training it is an ongoing process that begins with people and their development.

3. RESEARCH METHODOLOGY

For the purposes of this study, empirical research was conducted between January and March 2025 on a sample of 110 employees from organizations operating in various economic sectors in Serbia (trade, education, administrative services, and manufacturing). Of the total number of respondents, 64 were women (58.2%) and 46 were men (41.8%). The age structure of the respondents shows that the majority were between 31 and 40 years old (30%), while the smallest group consisted of respondents aged 18 to 30 years (20%). The percentage of respondents in the 41–50 age group was 26.4%, and those over 50 years old accounted for 23.6% of the total sample.



The largest number of respondents had completed secondary education (44.5%), while the smallest number held a doctoral degree (1.8%).



The largest number of respondents had between 10 and 20 years of work experience (42.7%), followed by those with more than 20 years of experience (30.9%), while the smallest group consisted of respondents with 3 to 10 years of experience (26.4%).

For the purposes of the research, a questionnaire containing 20 questions was used, of which 4 were demographic and 16 were related to employee competencies and business quality. The responses were given using a five-point Likert scale ranging from 1 to 5 (1 – strongly disagree, 5 – strongly agree).

The questions were formulated to measure four key areas of competencies: professional (technical) competencies, soft skills (communication, teamwork, adaptability), organizational support for competence development (learning culture, feedback, knowledge sharing), and the perceived impact of competencies on business quality. This questionnaire provided a comprehensive understanding of the role of employees in ensuring quality through competencies.

The reliability of the instrument was verified through statistical calculations, which confirmed a high level of internal consistency (Cronbach's $\alpha = 0.89$). Data were collected anonymously through electronic forms and printed questionnaires, depending on the organization and the previously agreed method of participation. Before the start of the research, respondents were provided with clear information regarding the purpose of the study, data processing procedures, and confidentiality assurance, thereby fully respecting the ethical standards of research.

The methodological approach was designed to provide answers to the main research questions:

1. Which types of employee competencies contribute the most to business quality?
2. To what extent are employees aware of their personal impact on process quality?
3. Do organizations provide adequate support for the professional development of employees?
4. Which competencies represent the greatest challenge in practice?

This methodological framework enables a clear and empirically grounded identification of key elements of a competence-based approach to quality, as well as recommendations for improving human resource management aimed at enhancing performance and strengthening the competitive advantage of organizations.

4. RESEARCH RESULTS

To understand the main characteristics of the sample, the demographic data of the respondents were first analyzed. The study included 110 employees of different genders, ages, education levels, and

lengths of service. Regarding gender, a slightly higher percentage of participants were women, accounting for 58.2% (n=64), while men represented 41.8% (n=46). This structure is common in sectors such as education, administrative, and service industries, which were more represented in the sample. The age distribution of respondents shows that the most dominant group consisted of employees aged 31–40 years (30.0%), indicating the significant presence of the most professionally active population. They were followed by respondents aged 41–50 years (26.4%) and those over 50 years old (24.5%). The smallest group consisted of employees younger than 30 years (19.1%). This distribution indicates that the sample is largely composed of employees with well-established professional knowledge and experience, which may influence the findings.

The educational structure shows that the largest group of respondents had completed secondary education (44.5%) or held a university degree (39.1%). Employees with master's degrees accounted for 9.1%, while the smallest groups included those with primary education (5.5%) and doctorates (1.8%). Such a distribution demonstrates that the quality of organizational performance depends on the contribution of employees with different educational levels, especially those in operational positions. Data on work experience indicate that the largest proportion of participants had between 10 and 20 years of experience (42.7%), while 30.9% had more than 20 years of service. Employees with 3–10 years of experience accounted for 26.4%. The high percentage of experienced staff enables the analysis of the relationship between work experience and professional competencies. This part of the findings suggests that the sample provides insight into the perceptions of employees with relevant professional experience and direct involvement in the quality of organizational operations.

The analysis of responses to four questions related to professional competencies revealed high self-confidence among participants regarding their knowledge and skills necessary for quality job performance. The mean score in this domain was 4.42 on a 1–5 scale, indicating that respondents largely agree their technical and professional abilities represent a key factor in successful work. The highest-rated aspects were the ability to solve complex work tasks and make timely decisions affecting business quality. This finding indicates that organizations recognize the importance of utilizing employees' professional potential, and employees themselves believe that their competencies align with job requirements.

Soft skills such as communication, teamwork, and adaptability were rated even higher (M = 4.51). The statements related to communication with colleagues and active contribution to teamwork received the highest scores. More than 85% of respondents strongly agreed that their communication impacts work quality. This demonstrates that employees have a well-developed awareness of the importance of cooperative behavior and interpersonal relations in achieving quality standards. Moreover, results indicate that employees are willing to take initiative in situations where quality is at risk, which is a highly positive indicator of proactive behavior.

Scores for organizational support for employee competence development were slightly lower, with an average value of 3.58. The lowest level of agreement was recorded for statements related to receiving adequate feedback from superiors and institutionalized knowledge-sharing mechanisms among employees. Although employees believe they possess the necessary competencies, it appears that organizations do not provide sufficient systematic support for their development. The slightly lower scores suggest a potential risk: if employee competencies are not continuously developed through organizational training and support policies, their positive impact on quality may diminish over time.

When examining the impact of competencies on business quality, the highest mean score was recorded (M = 4.63). Almost all respondents (over 90%) agreed that their work directly affects product or service quality and customer satisfaction. In addition, a large proportion of respondents stated that adherence to work procedures contributes to higher quality outcomes. However, although employees recognize their contribution, significantly fewer respondents felt that their organization adequately rewards or acknowledges those who contribute to quality improvement. This may indicate a shortcoming in the organization's motivation policy.

The research results can be summarized through several key points: employee competencies are highly developed, particularly in the areas of communication, teamwork, and problem-solving; employees demonstrate a strong awareness of how their work affects business quality; while training systems and feedback mechanisms exist, they are not sufficiently developed; the demographic analysis highlights that employee experience plays an important role; and most importantly, the lack of adequate recognition and reward systems may affect the long-term sustainability of quality.

The findings confirm the paper's initial premise that the quality of business operations largely depends on employee competencies. However, the development and management of these competencies must be strategically guided. In other words, human competencies are indeed "the driving force of quality business performance, but only within an environment where the organization recognizes and values their contribution.

5. DISCUSSION

The research results indicate a strong relationship between the level of employee competencies and the perceived quality of business operations within organizations. The mean values of responses for most statements are above average, suggesting that employees hold a positive attitude toward their professional qualifications, communication skills, and teamwork abilities. The highest ratings were assigned to those competencies recognized in the literature as key determinants of quality: teamwork, communication, responsibility, and problem-solving.

However, the results clearly show that organizational support for competence development lags behind the individual capacities of employees. Questions related to the quality of feedback from superiors, institutionalized knowledge sharing, and the rewards of contributions to quality received the lowest ratings. This implies that organizations rely too heavily on the personal professionalism of employees while neglecting systematic management of human potential. This finding is directly aligned with the conclusions of numerous studies emphasizing that strategic HR practices are a prerequisite for sustainable process quality.

Another notable finding is that employees demonstrate a high level of awareness of how their work impacts clients and the overall quality of services and products. This sense of responsibility and motivation to deliver quality outcomes is directly associated with greater professional engagement, as confirmed by international employee engagement models. In practice, the stronger the sense of belonging and accountability for quality, the more stable the process outcomes.

The structure of the sample by age and education adds analytical value to the discussion. Employees over the age of 50 often have longer tenure within the organization and possess significant operational and tacit knowledge that contributes to error prevention and process reliability. At the same time, younger employees bring flexibility and openness to innovation, confirming that a combination of experience and innovation yields the best results for business quality.

The educational structure of respondents also indicates that quality does not depend solely on formal education levels. Employees with secondary education are often closest to the operational processes and directly influence quality control points. Highly educated staff contribute to system improvement, but only if there is an adequate environment for collaboration and learning. This aligns with the contemporary understanding that quality is created by people from diverse professional backgrounds, not just by those in expert positions.

Based on the research, several key challenges in organizations in Serbia can be identified:

- Lack of systematic training and competence development: Employees are willing to learn, but organizations often fail to provide a clear structure for professional growth.
- Limited learning and innovation culture: Mistakes are frequently viewed as failures rather than opportunities for improvement.
- Invisibility of employee contributions: Without proper reward systems, motivation can decline even among highly competent workers.

- Need for stronger internal communication: True quality requires a clear understanding of tasks, goals, and work standards.

The results clearly confirm the study's main assumption that employee competencies are a determining factor in business quality but only when the organization is capable of activating, developing, and valuing them. The research therefore conceptualizes quality as an interaction between individual abilities and organizational support, rather than as an isolated outcome of personal knowledge. Employees who participate in quality processes, work in trust-based teams, and have a clear role in creating customer value demonstrated the highest levels of engagement and work quality. This corresponds with the conclusions of quality management theory, which states that quality is planned at the top but truly built at the workplace.

It can therefore be concluded that organizations aiming for stable and measurable quality growth must invest in people and competencies just as much as in technical and control systems. Only through such an integrated approach do human resources cease to be seen as a cost and become the primary driving force behind quality and competitive advantage.

6. CONCLUSION

In today's dynamic business environment, ensuring a high level of business quality represents one of the key strategic goals of every organization. Quality is now an exceptionally complex concept that goes beyond the traditional framework of product and service control, encompassing the entire process of value creation. Employee competencies are recognized as the central driving force behind the quality of business processes, as the human factor through knowledge, skills, motivation, and responsibility directly influences the achievement of organizational outcomes.

The findings of the conducted research clearly confirm that employee competencies are a decisive factor in ensuring business quality. Employees possess a high level of professional expertise that enables them to perform their tasks successfully, but more importantly, they have demonstrated well-developed soft skills such as teamwork, effective communication, and proactivity in solving work challenges. These characteristics are essential for preventing errors, improving procedures, and creating a stable working environment. The results also indicate a high level of employee awareness regarding their direct contribution to business quality. Employees understand that their work affects customer satisfaction, the company's reputation, and market competitiveness. Such responsibility and motivation represent a strong form of organizational capital and can serve as a foundation for further improvement of business performance.

At the same time, the research reveals several important shortcomings in organizational human resource management practices. Although employees possess the necessary competencies, the results show that organizations have not provided sufficient systematic support for their development, particularly in areas such as feedback, formal training programs, and recognition or rewards for contributions to quality. When a system fails to acknowledge and value employees' contributions to quality, there is a risk of declining motivation and, consequently, decreased performance in practice. For this reason, it is crucial to understand that employee competencies alone are not enough to guarantee business quality. They must be activated through appropriate organizational practices, performance management, continuous learning, and the creation of a culture that encourages improvement. Only when a clear link is established between individual competencies and strategic quality management can a sustainable competitive advantage be achieved.

Particularly significant is the role of employees who have been with the organization for many years. Their experience serves as an important mechanism for error prevention and process stabilization. On the other hand, younger employees bring innovation, adaptability, and digital literacy. The combination of these generational capacities contributes to an optimal workforce structure that allows for both the preservation of existing standards and the continuous improvement of business practices.

Organizations that recognize employees as their most valuable resource and invest in the development of their competencies will build stable and sustainable business quality, increase productivity, customer satisfaction, and overall reputation. Conversely, organizations that neglect this aspect risk reduced competitiveness, higher employee turnover, and a decline in business standards. The development of employee competencies must become a top priority of modern management because only an organization with competent, motivated, and engaged employees can successfully respond to market challenges and remain competitive in the future. In other words, the future of business quality depends on the quality of employees, and therefore, investing in employee competencies is the most profitable investment an organization can make.

LITERATURE

[1] Ahmed, F., Capretz, L. F., & Campbell, P. (2015). Evaluating the impact of soft skills on software quality. arXiv preprint arXiv:1507.06873.

[2] Barney, J. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. Journal of Management, 27(6), 643–650.

[3] Boyatzis, R. (2008). Competencies in the 21st Century. Journal of Management Development, 27(1), 5–12.

[4] Gavric G., Dobrilović I., Mušinović F. (2024) Digital globalization and its impact on education and the labour market, 13. conference „Employment, Education and Entrepreneurship 2024, Belgrade

[5] Harwina, Y. (2022). Effect of Competence on Employee Performance. International Journal of Management, Business and Administration, 2(3), 1–8.

[6] Radović Marković M., Salamzadeh A.& Vujičić S. (2019) Selection of organization models and creation of competences of the employed people for the sake of competitiveness growth in global business environment, International Review, Visoka škola za poslovnu ekonomiju i preduzetništvo, Beograd, br. 1-2, str. 64-71.

[7] Vujičić S., Nikitović Z.&Minkov Đ.(2016) Influence of innovation on the competitiveness of small and medium enterprises and entrepreneurs in Serbia, International scientific conference „Leadership and organization development", Kiten, Bulgaria

[8] Vujičić, S., Maleš, Lj., Pavićević, N., & Đokić, S. (2025). The Role of Employee Competencies in Organizational Competitiveness. Journal of Entrepreneurship and Business Resilience, 8(1

[9] Wijayanti, R., & Sari, D. (2023). The Influence of Competency on Employee Performance: A Literature Review. International Journal of Economics & Business Administration, 11(4), 915–932.

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