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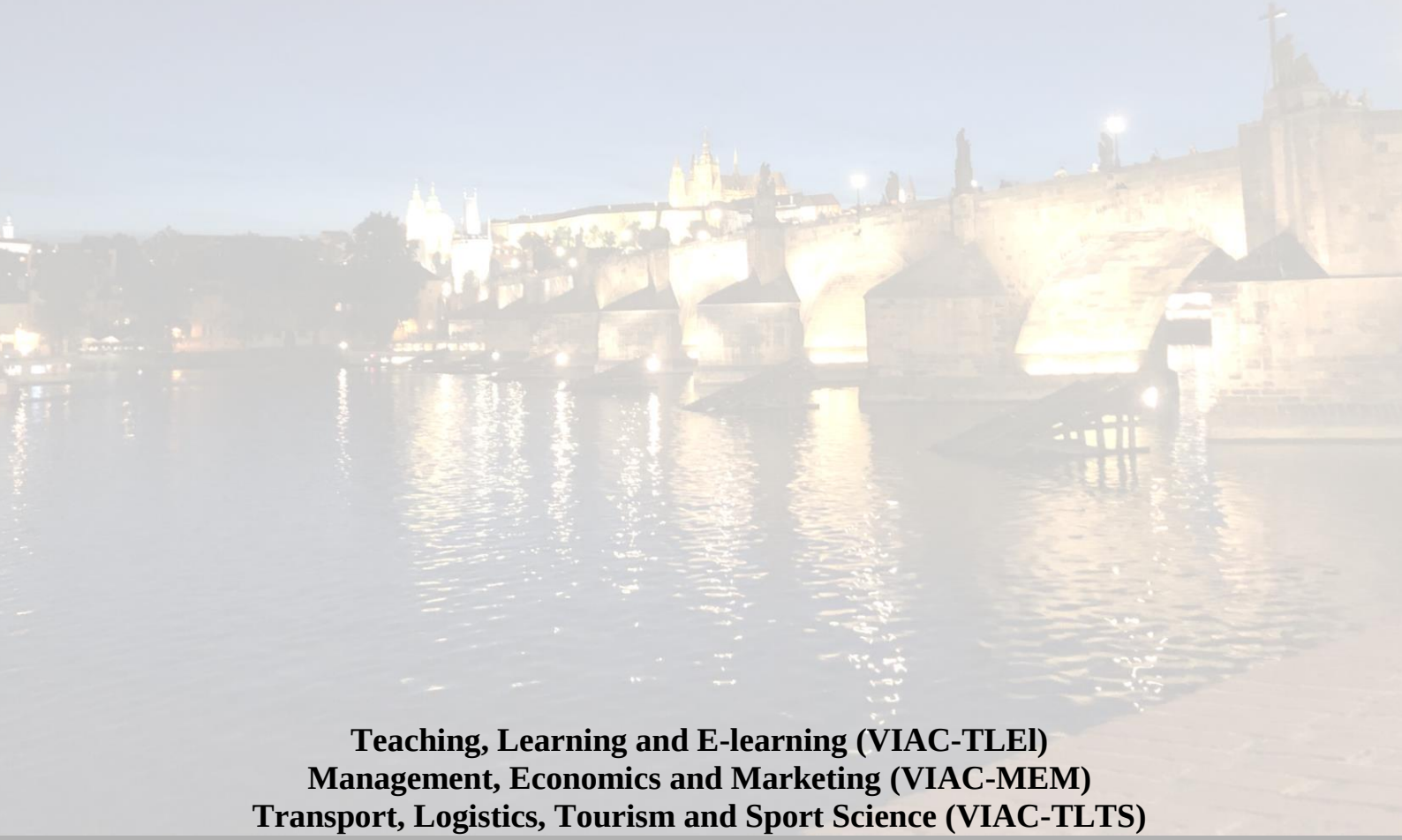

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Table of Contents

The Dual Impact: Rurbanization and the Corona-Pandemic on Small and Medium-Sized Cities

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Abstract

The dual phenomena of rurbanization and the Corona-Pandemic have significantly influenced small and medium-sized cities. This paper explores how the pandemic has reshaped urban dynamics and accelerated the trend towards rurbanization, examining the resultant effects on city marketing, infrastructure, socio-economic disparities, and sustainable development. By integrating findings from studies on the pandemic's urban impact and the principles of rurbanization, this paper offers a comprehensive overview of the challenges and opportunities facing small and medium-sized cities in a post-pandemic world. Recommendations for policy and strategic urban planning are discussed to leverage these trends for resilient and inclusive growth. Additionally, the paper highlights the importance of adaptive governance and community engagement in navigating these complex transformations, emphasizing the need for a holistic approach to urban planning that prioritizes sustainability and social equity.

Keywords: Rurbanization, Corona-Pandemic, City Marketing, Small and Medium-Sized Cities, Urban Development, Socio-Economic Disparities, Sustainable Development

1. INTRODUCTION

The landscape of urban living has undergone significant transformations due to the dual impacts of the Corona-Pandemic and rurbanization. While the pandemic has redefined work and living arrangements, pushing people towards less densely populated areas, rurbanization has emerged as a trend that integrates rural and urban benefits. This paper seeks to explore these intertwined phenomena, focusing on their effects on small and medium-sized cities and how city marketing strategies can adapt to these changes. By analyzing the shifts in urban dynamics and the implications of rurbanization, this study aims to provide insights for policymakers and urban planners to navigate these trends effectively.

The Corona-Pandemic has precipitated an unprecedented shift in urban dynamics, influencing patterns of mobility, economic activity, and social interactions. As cities grappled with lockdowns and social distancing measures, many residents sought refuge in less crowded, more spacious environments. This migration trend towards smaller cities and rural areas has highlighted the need for these regions to adapt to new demographic and economic realities. The pandemic has thus acted as a catalyst, accelerating trends that were already underway, such as remote work and the decentralization of economic activities (Fischler, 2021).

Rurbanization, which blends rural and urban characteristics, offers a promising framework for addressing the challenges and opportunities arising from these changes. By promoting sustainable development and enhancing the

* Corresponding author.

quality of life, rurbanization can help small and medium-sized cities attract and retain residents. This paper examines how these cities can leverage rurbanization to enhance their appeal, improve infrastructure, and foster socio-economic resilience in the wake of the pandemic. The integration of green spaces, local agriculture, and innovative urban planning strategies will be critical in achieving these goals (Ritchie & Roser, 2021). Sustainable development in rurban areas is a multifaceted challenge that requires a balance between economic growth and environmental preservation. The dynamics of rurban development, as seen in various case studies, highlight the importance of strategic planning and community involvement.

2. EFFECTS OF THE CORONA-PANDEMIC ON URBAN DYNAMICS

2.1. Changes in City Living and Working Patterns

The Corona-Pandemic has profoundly impacted urban living and working patterns. With the rise of remote work, many individuals have opted to move away from densely populated cities to smaller towns and rural areas. This shift has reduced the pressure on urban infrastructure but has also led to decreased economic activity in major cities. (Motta, 2020)

Moreover, the pandemic has highlighted the importance of flexible work arrangements and the need for cities to adapt to changing lifestyles. The transition to remote work has necessitated the development of robust digital infrastructure in smaller cities to support new residents and businesses (Fischler, 2021).

2.2. Impact on City Economics

The pandemic has led to significant economic disruptions, with many businesses closing or downsizing. However, it has also opened opportunities for small and medium-sized cities to attract new residents and businesses by offering a balance of urban amenities and rural tranquility. (Motta, 2020)

The economic impact of the pandemic has varied across sectors, with some industries, such as hospitality and retail, facing severe challenges, while others, like e-commerce and digital services, have experienced growth. This differential impact underscores the need for diversified economic strategies to support recovery and resilience in smaller cities (Anguelovski et al., 2021).

3. RURBANIZATION: CONCEPT AND IMPLICATIONS

3.1. Definition and Characteristics

Rurbanization refers to the blending of rural and urban elements, creating spaces that offer the best of both worlds. This concept promotes sustainable development by integrating green spaces and local agriculture into urban planning, enhancing the quality of life for residents.

Rurbanization encourages the preservation of natural landscapes and cultural heritage while fostering economic development. Key characteristics include mixed-use developments, community-based initiatives, and environmentally friendly infrastructure. These features help create vibrant, resilient communities that can adapt to changing socio-economic conditions (Hoffmann et al., 2023).

3.2. Enhancements in City Branding

Small and medium-sized cities can leverage rurbanization to enhance their branding. By promoting the unique combination of rural charm and urban conveniences, these cities can attract a diverse population and stimulate economic growth.

Effective city branding strategies should highlight the quality of life, sustainability initiatives, and opportunities for innovation. Marketing campaigns can emphasize the benefits of living in rurban areas, such as lower cost of living, access to nature, and strong community ties. Collaborative efforts with local businesses and organizations can further strengthen the city's brand and attract investment (Anguelovski et al., 2021).

The phenomenon of "rurbanization" presents a unique opportunity for small and medium-sized cities to develop a distinctive brand identity that seamlessly blends rural charm with urban amenities. This hybridized identity can serve as a powerful tool in attracting tourists, new residents, and businesses seeking a balanced, experiential lifestyle.

The growing trend of experiential tourism, where travelers actively seek authentic experiences that combine natural beauty with cultural richness, provides a compelling rationale for city branding through the lens of rurbanization. Rurban cities can offer such immersive experiences by strategically promoting their unique heritage, local cuisine, and outdoor activities. This approach not only boosts tourism but also fosters a heightened sense of pride and identity among residents, further strengthening the city's brand image and positioning it as a desirable destination for a diverse audience.

Moreover, the integration of rural and urban elements can enhance the aesthetic appeal of a city, making it more attractive to both residents and visitors. Green spaces, community gardens, and well-preserved historical sites contribute to a city's charm, creating a pleasant and inviting atmosphere. Effective branding strategies can highlight these features, emphasizing the city's commitment to preserving its natural and cultural heritage while offering modern urban amenities.

This distinct rurban identity can serve as a powerful tool in city marketing, helping to position the city as a unique and appealing destination. By capitalizing on the rurbanization trend, cities can develop a competitive edge in the global landscape, attracting not only tourists but also potential new residents and businesses drawn to the balanced, experiential lifestyle that the rurban model offers.

4. COMBINED EFFECTS OF THE PANDEMIC AND RURBANIZATION

4.1. Infrastructure and Technological Adaptions

The pandemic has accelerated the need for technological advancements and infrastructure upgrades in small and medium-sized cities. Smart technologies and improved transportation networks are crucial to accommodate the growing population and ensure efficient service delivery.

Investments in digital infrastructure, such as high-speed internet and smart city solutions, can enhance connectivity and support remote work and education. Additionally, sustainable transportation options, such as bike-sharing programs and electric public transit, can reduce environmental impact and improve mobility (Ritchie & Roser, 2021).

Effective planning and management are essential in addressing the infrastructural challenges faced by cities. Comprehensive urban planning that anticipates future growth patterns and incorporates flexible design approaches can help cities adapt to evolving needs and changing conditions over time. Robust governance structures and transparent decision-making processes are crucial to ensure that infrastructure development is inclusive, equitable, and closely aligned with the long-term strategic vision for the city's sustainable development.

4.2. Socio-Cultural Integration and Challenges

As more people move to rurban areas, integrating diverse populations poses socio-cultural challenges. Differences in lifestyles and values can lead to friction, necessitating inclusive policies and programs to promote cultural exchange and community cohesion.

Community engagement initiatives, such as local festivals, volunteer programs, and intercultural dialogues, can help bridge gaps and foster a sense of belonging. Educational programs and public awareness campaigns can also play a role in promoting tolerance and understanding (Fischler, 2021).

Addressing the socio-cultural integration challenges inherent in the rurbanization phenomenon requires a steadfast commitment to the principles of social justice and equity. Effective policies and targeted initiatives that promote equal access to opportunities and resources, offer dedicated support for marginalized communities, and address systemic inequalities are essential in creating an inclusive and cohesive urban environment.

By prioritizing social equity as a core component of the rurbanization model, cities can ensure that all residents, regardless of their socioeconomic status or cultural background, can equitably benefit from the opportunities and growth associated with this hybrid urban-rural development approach. This commitment to inclusive growth and social integration is crucial in fostering a sense of belonging, community, and shared prosperity among the diverse inhabitants of rurbanized cities.

Strategies that facilitate the integration of marginalized groups, such as affordable housing initiatives, community-based skill development programs, and intercultural dialogue platforms, can help bridge socioeconomic divides and

promote social cohesion. Furthermore, transparent and participatory decision-making processes that involve diverse stakeholders in the planning and development of rurban spaces can empower residents and ensure that the unique needs and aspirations of all community members are reflected in the city's vision and growth trajectory.

By embedding social equity as a fundamental pillar of the rurbanization approach, cities can harness the transformative potential of this hybrid model to create more inclusive, resilient, and sustainable urban environments. This holistic perspective, which balances economic, environmental, and social considerations, can serve as a blueprint for other cities seeking to embrace the rurbanization paradigm and foster equitable and vibrant communities.

4.3. Economic Disparities and Policy Recommendations

The influx of new residents can drive up property prices, creating economic disparities. Policymakers must implement strategies to ensure equitable development, such as affordable housing initiatives and support for local enterprises. Workforce development programs and access to education are essential to create pathways for upward mobility.

Policies should focus on promoting economic diversity, supporting small businesses, and ensuring that all residents benefit from growth. Incentives for sustainable practices and social enterprises can also contribute to a more inclusive economy (Hoffmann et al., 2023).

Furthermore, rurbanization should be approached as an opportunity to foster community-driven economic models that prioritize shared prosperity. The integration of cooperative structures, community land trusts, and social impact investment schemes can empower residents to collectively shape the economic development of their rurban neighborhoods. By cultivating localized, inclusive economic ecosystems, cities can harness the rurbanization process to reduce wealth disparities, support local entrepreneurship, and create equitable pathways for marginalized groups to participate in and benefit from the city's growth and transformation.

This multifaceted approach to economic development, rooted in principles of social justice and sustainable practices, can help ensure that the rurbanization process leads to the creation of thriving, equitable, and resilient communities. By addressing the potential pitfalls of uneven development and displacement, cities can leverage the rurbanization trend to foster inclusive, place-based prosperity that enhances the overall well-being and quality of life for all residents.

5. SUSTAINABLE DEVELOPMENT STRATEGIES

5.1. Promoting Green Spaces and Local Agriculture

Rurbanization promotes the integration of green spaces and local agriculture into urban planning. This approach not only enhances the aesthetic appeal of cities but also supports sustainable food systems and improves residents' quality of life.

Community gardens, urban farms, and green rooftops can provide fresh produce, reduce food miles, and promote environmental stewardship. Additionally, green spaces such as parks and nature reserves offer recreational opportunities, improve mental health, and increase biodiversity (Anguelovski et al., 2021).

5.2. Circular Economy and Resource Management

Implementing circular economy principles in rurban areas can minimize waste and promote resource reuse. Encouraging local production and consumption strengthens local economies and reduces the environmental impact of transportation and logistics.

Strategies include recycling programs, composting, and sustainable manufacturing practices. By prioritizing resource efficiency and waste reduction, cities can enhance resilience and contribute to global sustainability goals. Collaboration with businesses, non-profits, and community groups is crucial to develop and implement effective circular economy initiatives (Hoffmann et al., 2023).

6. CONCLUSION

The dual impact of rurbanization and the Corona-Pandemic presents both challenges and opportunities for small and medium-sized cities. By embracing the principles of rurbanization and implementing strategic urban planning

initiatives, these cities can navigate the complexities of this transformation. Sustainable development, inclusive policies, and adaptive governance are essential to create resilient, vibrant communities that can thrive in the post-pandemic world.

Strategic planning and inclusive policies are essential to maximize the benefits of rurbanization and navigate the challenges posed by the Corona-Pandemic. Small and medium-sized cities can leverage these trends to foster resilient, vibrant, and sustainable communities. Balancing urban amenities with rural charm is key to achieving sustainable and inclusive growth in the evolving urban landscapel.

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A Cognitive Mapping Framework for Evaluating Customer Behavior in Buying Processes of Green Products

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Abstract

This study investigates the factors influencing consumer behavior within the context of green marketing. Through a quantitative analysis, it examines how criteria such as environmental consciousness, green product, price, green place and green advertising affect consumers' purchasing decisions. The results provide useful information for companies trying to match their marketing plans to the growing market for eco-friendly goods and eco-friendly activities. This work introduces a fuzzy cognitive map technique to determine the importance degrees of factors influencing customer behavior in the buying process of green products. Causal links among the factors, the presence of positive relationships between pairs of criteria, and the lack of crisp data make the fuzzy cognitive map an appropriate methodology for evaluating green product buying factors from the perspective of customer behavior.

Keywords: Fuzzy cognitive map, green marketing, customer behavior, causal links

1. INTRODUCTION

The term "green marketing" was initially introduced during a seminar on "ecological marketing" organized by the American Marketing Association (AMA) in 1975. This event outlined the entry of the related concept into the literature. The proceedings of this seminar led to the publication of one of the earliest books as titled as "Ecological Marketing" [1]. Since then, a number of further publications that provide a thorough analysis of eco-friendly marketing strategies have been published [2,3,4]. According to Pride and Ferrell [4], green marketing is also known as sustainable marketing, environmental marketing or ecological marketing. It refers to the organization's effort at designing, promoting, pricing and distributing products that will not harm the environment. As stated by Polonsky [3], green marketing consists of all the activities designed to generate and facilitate any exchanges intended to satisfy human needs, such that the satisfaction of these requirements occurs, with minimal detrimental impact on the natural environment.

Green marketing is the process of creating and advertising goods and services with an eye on the environment. This strategy aims to meet the increasing demand from consumers for sustainable and eco-friendly products [5]. Reducing the environmental impact of industrial processes, using renewable resources, making sure that the products are recyclable or biodegradable, and encouraging sustainable consumption patterns are the fundamental tenets of green marketing. The positive effects of green marketing for the companies and customers have been mentioned in the literature. Increased brand loyalty, competitive difference, cost savings and access to new market segments are all possible outcomes of green marketing for the firms. On the other hand, customers make use of accessing more eco-

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friendly options that support a sustainable planet [6]. Green marketing will probably play an increasingly bigger role in encouraging sustainable production. The organizations should fulfil the needs of environmentally concerned consumers and further the larger objective of sustainable development by incorporating green marketing strategies [7].

This work introduces a fuzzy cognitive map (FCM) technique to determine the importance degrees of factors influencing customer behavior in the buying processes of green products. FCM, emerged from the combination of fuzzy logic and neural networks, is a causal knowledge-based method which is employed to model decision systems. FCM represents human experience and knowledge, determines the causal links among the concepts for modeling a system's behavior. It has been widely utilized as a method in different scientific and managerial problems to model decision aid systems [8]. It has been used in different fields such as agriculture, tourism, manufacturing, energy, information systems, etc. Moreover, it has been addressed to solve problems in transportation and medical areas.

The rest of the paper is organized as follows. Section 2 explains briefly fuzzy cognitive map methodology. Section 3 gives the application steps of the proposed FCM technique. The following section illustrates the application via a case study conducted in a marketing department of a firm performing in cosmetics sector. Final section delineates conclusions and future research directions.

2. FUZZY COGNITIVE MAPS

Fuzzy cognitive map (FCM) is a causal information-based tool that combines fuzzy logic and neural networks. The extension of the tool is provided by including fuzzy numbers or linguistic variables for expressing the causal links among concepts in the map. These concepts represent an entity, a state, a variable or a characteristic of a system, a behavior of the information-based system is denoted by concepts in FCM [9]. Concept nodes and weighted arcs are the elements of FCM which can be graphically showed with feedback. Signed arcs indicate the sign of causality: whether the causal relationship is positive, negative or null; and connected nodes produce causal relationships among concepts [10]. $C = \{C_1, C_2, ..., C_n\}$ is the set of concepts, arcs (C_j, C_i) demonstrate how concept C_j causes concept C_i, and are used for causal relationships between concepts. The weights of causality links range can be represented with linguistic variables such as "negatively medium", "zero", "positively medium", etc. The value of each concept is computed, taking into account the effect of the other concepts on the under-evaluation concept, by applying the following iterative formulation.

$$A_i^{(k+1)} = f\left(A_i^{(k)} + \sum_{\substack{j=1 \\ j \neq i}}^{N} A_j^{(k)} w_{ji} \right) \quad (1)$$

where $A_i^{(k)}$ is the value of concept C_i at k^{th} iteration, w_{ji} is the weight of the connection from C_j to C_i and f is a threshold function.

3. APPLICATION STEPS OF FCM

The application steps of the proposed approach are as [10]

Step 1: Determination of the factors influencing customer behaviours in the buying process of green products: In this work, factors are indicated through expert opinions, 5 factors are listed in Table 1.

Table 1. Digital transformation factors

Label	Factor
C_1	Environmental consciousness
C_2	Green advertising
C_3	Green product
C_4	Price
C_5	Green place

Step 2: Sign of causal links: The decision-makers indicate the direction of causal relationships in three categories: positive, negative, null.

Step 3: Fuzzifying: Experts decide the degree of causal links by using linguistic variables; subsequently linguistic variables are transformed into fuzzy numbers. In this study, nine linguistic terms are used as negatively very strong (nvs), negatively strong (ns), negatively medium (nm), negatively weak (nw), zero (z), positively weak (pw), positively medium (pm), positively strong (ps), positively very strong (pvs). The corresponding triangular fuzzy numbers for these linguistic variables are reported in Table 2.

Table 2. Scale of fuzzy numbers [10]

Linguistic term	Triangular fuzzy number
nvs	(-1,-1,-0.75)
ns	(-1,-0.75,-0.5)
nm	(-0.75,-0.5,-0.25)
nw	(-0.5,-0.25,0)
z	(-0.25,0,0.25)
pw	(0,0.25,0.5)
pm	(0.25,0.5,0.75)
ps	(0.5,0.75,1)
pvs	(0.75,1,1)

Step 4: Aggregation result: Using MAX method, the outputs corresponding to each causal relationship are transformed into a single fuzzy set, hereafter, this fuzzy number belonging to the interval [0,1] is defuzzified by using Centre of Gravity (COG) method and is converted to a crisp value.

Step 5: Copying the matrix: The FCM process starts with the initial vector.

Step 6: Checking the matrix: The values of the initial vector is updated by applying Formulation (1).
Sigmoid function is an appropriate threshold function for restricting the values of concepts in the interval [0,1].

Step 7: Computing concepts' values: Each performance indicator's values are calculated via formulation (1).

4. EVALUATION OF GREEN MARKETING FACTORS

This work presents a FCM approach for evaluating factors influencing customer behaviour in the buying process of green products. The case study is conducted in a marketing department of a firm performing in cosmetics sector through three experts' opinions. First, the decision makers determined whether there is a causal relationship between each pair of factors. Second, they indicated the direction and the power of relationship, respectively. The matrices of direction and power of causalities are given in Table 3,4,5,6,7,8.

Table 3. The matrix of sign according to the Expert 1

	C_1	C_2	C_3	C_4	C_5
C_1			+		
C_2	+				
C_3	+	+		+	+
C_4					
C_5	+		+		

Table 4. The matrix of sign according to the Expert 2

	C_1	C_2	C_3	C_4	C_5
C_1			+		
C_2	+				
C_3	+	+		+	+
C_4					
C_5	+		+		

Table 5. The matrix of sign according to the Expert 3

	C_1	C_2	C_3	C_4	C_5
C_1			+		
C_2	+				
C_3	+	+		+	+
C_4					
C_5	+		+		

Table 6. Power of causalities according to the Expert 1

	C_1	C_2	C_3	C_4	C_5
C_1	z	0	ps	0	0
C_2	pvs	z	0	0	0
C_3	ps	pw	z	pm	pm
C_4	0	0	0	z	0
C_5	ps	0	pw	0	z

Table 7. Power of causalities according to the Expert 2

	C_1	C_2	C_3	C_4	C_5
C_1	z	0	ps	0	0
C_2	ps	Z	0	0	0
C_3	pm	pw	z	pm	pm
C_4	0	0	0	z	0
C_5	ps	0	pm	0	z

Table 8. Power of causalities according to the Expert 3

	C_1	C_2	C_3	C_4	C_5
C_1	z	0	pvs	0	0
C_2	ps	z	0	0	0
C_3	pm	pw	z	pm	pw
C_4	0	0	0	z	0
C_5	pvs	0	pm	0	z

The linguistic data collected by the experts are converted into triangular fuzzy numbers according to the fuzzy scale given in Table 2. The matrices of power of causalities that are transformed into triangular fuzzy numbers with regard to three experts. Afterwards, these triangular fuzzy numbers are aggregated via MAX aggregation, and then defuzzified by using COG method, and the weight matrix is obtained as in Table 9. MATLAB fuzzy tool box is used for these operations.

Table 9. Weight matrix

	C_1	C_2	C_3	C_4	C_5
C_1	0	0	0.798	0	0
C_2	0.798	0	0	0	0
C_3	0.625	0.25	0	0.5	0.375
C_4	0	0	0	0	0
C_5	0.798	0	0.375	0	0

The iterative formulation of FCM is run via FCMapper software for obtaining concepts' values. The resulting concept values are listed in Table 10.

Table 10. Values of concepts

Label	Concept	Value of concept
C_1	Environmental consciousness	0.933657
C_2	Green advertising	0.718184
C_3	Green product	0.869152
C_4	Price	0.769196
C_5	Green place	0.744721

5. CONCLUSIONS

In order to obtain the importance degrees of factors influencing customer behaviour in the buying process of green products, related factors influencing the decision of buying are listed through expert opinions and then algorithm of the study is reported by considering the methodology of FCM. The resulting concepts' values are given by applying FCM methodology, being environmentally conscious and is the most important factor followed by producing green product, however green advertising is the least important one. Future research directions will focus on taking into consideration the hesitation in data. The intuitionistic fuzzy extension methodology for the same problem will be the topic of the future researches.

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Bibliometric Mapping of Agile Leadership: Analyzing Research Development and Impact

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Abstract

The concept of Agile leadership has garnered significant attention in both academic and professional realms, prompting a surge in scholarly publications. This study aims to provide a comprehensive bibliometric analysis of the existing literature on Agile leadership, utilizing the Bibliometrix R package to analyze 58 relevant articles retrieved from the Web of Science database. The analysis focuses on identifying key research trends, prolific authors, influential journals, and collaborative networks within the Agile leadership domain. The results reveal a steady increase in publications over the past years, highlighting the growing interest and relevance of Agile leadership in contemporary management practices. Furthermore, the study uncovers core research clusters and thematic evolutions, offering insights into the central topics and methodological approaches employed by researchers. Notably, the analysis identifies a shift in focus from early work on software development to broader organizational applications, including innovation management and leadership adaptability. The findings also underscore the global nature of Agile leadership research, with significant contributions from countries like the United Kingdom and Indonesia. This bibliometric review not only maps the intellectual landscape of Agile leadership but also identifies potential areas for future research, such as the impact of digitalization and the role of agile work environments, thereby contributing to a deeper understanding of this dynamic and evolving field.

Keywords: Leadership, Agile leadership, Agility, Bibliometrix, Bibliometric mapping, Web of Science

1. INTRODUCTION

All regions face similar challenges in delivering sustainable transport solutions to meet their current and future mobility requirements. Transport authorities are aware of the real needs specific to their region but often find it difficult to identify detailed information on targeted solutions that would deliver direct and tangible positive outcomes.

In the rapidly evolving landscape of modern organizations, Agile leadership has emerged as a pivotal concept, driving transformation and innovation (Akaya et al., 2022). Agile leadership, characterized by its flexibility, responsiveness, and collaborative approach, aligns with the principles of Agile methodologies originally developed in the software industry (Akaya et al., 2022). This leadership style emphasizes adaptability, continuous improvement, and a people-centric approach, making it particularly relevant in today's volatile, uncertain, complex, and ambiguous (VUCA) environment (Porkodi, 2024; Tandon et al., 2024; Rozman et al., 2023; Akaya et al., 2022; Hall & Rowland,

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2016). The environment of continuous disruption makes it necessary for organizations to adopt an Agile approach (Tandon et al., 2024). Digitization is fostering this disruptive environment and accelerating innovation, changing customer expectations, and generally making many things more complex and competitive (Crnogaj et al., 2022). For this reason, Agile leadership has become one of the key factors for corporate success (Chen et al., 2022; Bushuyeva et al., 2019; Parker et al., 2015). By implementing Agile management methods, organizations can achieve significant increases in efficiency (Chen et al., 2022). Agile leadership can also improve companies' ability to innovate and enhance their innovation efficiency (Porkodi, 2024). The contribution that managers make to the professional success of employees should not be underestimated (Akaya et al., 2022). In this context, the availability of knowledge has also changed because of rapid technological progress, so while managers today should still have a broad range of expertise in their field, aspects such as agility and soft skills are becoming increasingly important in team leadership (Hall & Rowland, 2016). In the future, managers will not see themselves as mere 'commanders' but rather as promoters of self-organization, transferring autonomy and responsibility to their teams (Maximini, 2022). Motivation, performance, and effectiveness can be increased with this management style (Porkodi, 2024). Nevertheless, this change requires a shift in mindset from managers, as they must learn to trust their employees and give them the freedom to make their own decisions (Rigby et al., 2016). A consistent focus on Agile leadership principles can also provide a competitive advantage in today's world, ensuring competitiveness and maintaining attractiveness as an employer (Akaya et al., 2022).

The growing interest in Agile leadership is reflected in the expanding body of scholarly literature dedicated to this topic. Researchers and practitioners alike are exploring its implications for organizational performance, employee engagement, and change management. There are already several analyses that do not provide a generic overview of the literature on Agile leadership but rather highlight individual aspects. For example, the study by Porkodi (2024) emphasizes the aspect of efficiency in Agile leadership, while Chen et al. (2022) focus on increasing innovation speed and efficiency. Akaya et al. (2022) examine the relationship between Agile leadership and business success, and Tandon et al. (2024) explore the context of organizational and leadership agility in their literature review. Another study, by Spiegler et al. (2021), investigates the necessary change in leadership style within Agile teams. Despite the increasing number of studies, there remains a need for a comprehensive overview that synthesizes existing research and highlights key trends and patterns within this domain.

This study aims to fill this gap by conducting a bibliometric analysis of Agile leadership research. By examining 58 articles from the Web of Science database using the Bibliometrix R package, this analysis seeks to map the intellectual landscape of Agile leadership, identify influential works, and uncover collaboration networks among researchers. Additionally, the study will explore the thematic evolution of Agile leadership research, providing insights into its development and identifying potential avenues for future investigation.

- What are the predominant research trends and thematic clusters in the scholarly literature on Agile leadership as revealed by a bibliometric analysis of publications from the Web of Science database?
- Who are the most influential authors, and what are the countries and institutions contributing to the field of Agile leadership?
- How have the themes and methodological approaches in Agile leadership research evolved over time, and what are the emerging areas that warrant further investigation?

The findings from this bibliometric analysis will not only contribute to a deeper understanding of Agile leadership but also offer valuable guidance for scholars and practitioners seeking to navigate and contribute to this dynamic field. By elucidating the key themes and research trajectories, this study aims to enhance the discourse on Agile leadership and support its application in fostering resilient and adaptive organizations.

2. METHODS

Methodologically, the knowledge framework of agile leadership research is to identify essential components within the knowledge base and establish connections. The present study employs bibliometric analysis to understand the organized network of relationships within the Agile leadership domain, as detailed in the relevant subsections of this section.

Data Retrieval Process and Data Scrubbing: For this research, the Web of Science (WoS) database was used. WoS is commonly utilized in bibliometric analyses due to its reputation as a reliable bibliographic indexing tool that effectively captures scientific knowledge (Azam et al., 2021; Chen & Liu, 2020). It catalogs approximately 11,000 journals based on their citation counts, with its primary measure of significance being the widely recognized impact factor (García-Villar & García-Santos, 2021). Articles were searched using the term "Agile leader*" in the topic field,

meaning the system looked for the terms “agile leader(s)” and “agile leadership” in the title, abstract, keywords plus, and author keywords. This search yielded 58 results.

Sources of Data and Analytical Tools: For the bibliometric analysis, we retrieved datasets from the Web of Science database using the Biblioshiny application, which utilizes an R package designed for bibliometric research (Ab Rashid, 2023). Web of Science was selected due to its extensive coverage of academic literature across various disciplines such as business, finance, and sustainability, encompassing scholarly journals, conference proceedings, and books. Biblioshiny, designed for non-coders, provides an intuitive interface with advanced bibliometric tools, enhancing user accessibility. Biblioshiny integrates data from diverse databases including Web of Science, Scopus, Dimensions, Lens.org, PubMed, and the Cochrane Library. It features organized menus for statistical and graphical analysis across multiple metrics and knowledge structures (Aria & Cuccurullo, 2017). The methodology included various review approaches such as citation dynamics, keyword analysis, thematic evolution, and chronological evaluation. The use of Biblioshiny significantly improved the analysis of Agile leadership literature, enabling us to effectively address the core research questions.

3. RESULTS AND DISCUSSION

Descriptive attributes: The examination covers the period from 2005 to 2024, including 58 publications from 51 different sources. The research field is characterized by contemporary contributions, with an average document age of 3.66 years, and a significant impact, reflected in an average of 6.672 citations per document. The annual growth rate of the research is 10.78%. A total of 166 authors have contributed to this field, indicating a high level of collaboration, with 39.66% of the documents featuring international co-authorship. The documents vary in type, with the majority being 36 articles. The study's depth is further enhanced using 151 Keywords Plus and 225 Author's Keywords, which provide a comprehensive analysis of the research area. This extensive review highlights a vibrant, globally collaborative, and highly influential research environment, underscoring the dynamism and importance of the field. For more details see table 1.

Table 1. Summary statistics of the sample data

Description	Results
Timespan	2005:2024
Sources (Journals, Books, Etc)	51
Documents	58
Annual Growth Rate %	10.78
Document Average Age	3.66
Average Citations Per Doc	6.672
References	3205
DOCUMENT CONTENTS	
Keywords Plus (ID)	151
Author's Keywords (DE)	225
AUTHORS	
Authors	166
Authors Of Single-Authored Docs	8
AUTHORS COLLABORATION	
Single-Authored Docs	9
Co-Authors Per Doc	3.16
International Co-Authorships %	39.66
DOCUMENT TYPES	
Article	36
Article; Book Chapter	1
Article; Early Access	4

Editorial Material	2
Proceedings Paper	13
Review	2

Source: Own processing based on data from WOS, processed in Biblioshiny

3.1. Annul Publication Trends

Interest in publishing on the topic of Agile leadership has been increasing as agility enables organizations to respond quickly to changes, improve efficiency, and maintain a competitive edge in a rapidly evolving business environment (Chen et al., 2022; Maximini, 2022). Another reason for this growing interest is the increasing uncertainty and volatility in the global marketplace (Akaya et al., 2022). Technological innovation, geopolitical instability, and rapid changes in consumer preferences require companies to be highly adaptable (Chen et al., 2022; Maximini, 2022). Agile leadership provides a framework for managing this uncertainty by promoting flexibility and the ability to react swiftly. Digitization has fundamentally transformed the way companies operate (Aubert-Tarby et al., 2018; Chen et al., 2022). Traditional, rigid management structures often reach their limits in this context, as digital innovations demand quick action and iterative processes (Fähndrich & Pedell, 2024; Crnogaj et al., 2022). Employee expectations have also shifted significantly in recent decades. Younger generations, in particular, place greater value on autonomy, meaningful work, and a good work-life balance (Maximini, 2022). Agile leadership meets these needs by focusing on self-organization, personal responsibility, and a collaborative work culture (Ibid.). Companies that have successfully implemented Agile principles often demonstrate enhanced innovative capacity and greater flexibility (Doz, 2020; Chen et al., 2022). It is also worth mentioning that agility has gained prominence at conferences and in academic debate in recent years (Denning, 2018). Annual research output on Agile leadership has shown a significant upward trend in recent years. After sporadic publications from 2005 to 2018, substantial growth began in 2020, with four publications. Research output continued to rise steadily, peaking in 2022 with 16 publications. While the number of publications has declined slightly, with 12 outputs in 2023 and only 6 so far in 2024, the final count for this year may recover. For more details, see Figure 1.

3.2. Citation Dynamics

Researchers have developed various bibliometric measures to evaluate the influence of individual scholarly publications or groups of publications. These metrics often include citation-based indicators, where the number of citations serves as a key measure of an article's scholarly impact (Šubelj et al., 2014). According to Chuang et al. (2007), there is a correlation between the longevity of a publication's relevance and its citation count, providing insights into research themes through citation patterns. Senadheera et al. (2022) have also shown that citation count correlates with the age of a publication, serving as a metric to assess its visibility in scholarly discussions. Their research offers a dynamic perspective on the scholarly impact of publications over time. The data reveals a varied pattern of citations per year for publications on Agile leadership. As shown in Figure 1, there has been a continuous increase in citations—from just 22 in 2020 to 42 in 2021, 92 in 2022, and 110 in 2023. So far this year, there are 78 citations, and it is anticipated that the final total for 2024 will surpass last year’s result.

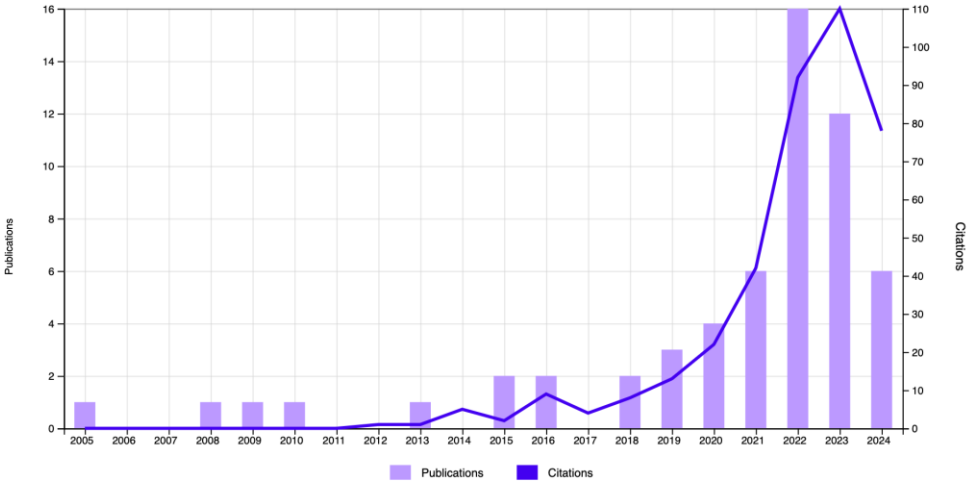

Figure 1. Times Cited and Publications Over Time
Source: Web of Science

The three-field plot is designed to visually depict the relationships analyzed in Agile Leadership and its impact on performance by strategically positioning countries, authors, and keywords. It is divided into three sections: countries are represented on the left, authors in the middle, and keywords on the right. Using a Sankey diagram approach, which visually shows the flow between different entities, the plot illustrates the connections and interactions among these elements. The height of rectangular nodes indicates the frequency of each country, author, or keyword within the collaboration network, while the thickness of the lines connecting countries signifies the strength of these connections (Koo, 2021).

The three-field plot reveals that Turkey and Slovenia have the highest node heights, indicating their prominent frequency within the collaboration network. Additionally, the thickness of the lines connecting these countries signifies the strength of their connections. Significant keywords according to the three-field plot include Agile Leadership, Digitalization, Agile Work Environment, and Covid-19. For more details, see Figure 2.

Covid-19 is included as a significant keyword because the pandemic has accelerated the adoption of agile practices in many organizations (Aldianto et al., 2021; Akaya et al., 2022; Chen et al., 2022). The unprecedented challenges and rapid changes brought about by Covid-19 have highlighted the need for agile leadership and agile work environments to quickly adapt to new realities, maintain operational continuity, and ensure business resilience (Akaya et al., 2022; Chen et al., 2022). As a result, research on the impact of agile leadership during the pandemic has gained importance, reflecting the relevance of these themes in the context of Covid-19.

Digitalization is a major megatrend of the current era. It necessitates a new understanding of leadership and organizational structure due to rapid technological changes and progress (Hall & Rowland, 2016; Tsai et al., 2019; Chen et al., 2022). Digitalization has accelerated the transformation of organizations, and agility will play a key role in this process (Chen et al., 2022). It also compels companies to be more flexible and adaptive in a fast-changing environment (Porkodi, 2024).

Another crucial keyword is Agile Work Environment. This term is often used in connection with agile leadership because it encompasses organizational and cultural aspects (Maximini, 2022). It is closely linked to the leadership style of the respective manager, focusing on promoting independence, autonomy (Ibid.), and also flexibility and adaptability (Porkodi, 2024). The introduction of an agile work environment is closely tied to digitization and technological progress (Rozman et al., 2023). Agile managers create conditions where employees can experiment, learn from mistakes, and foster continuous learning and innovation (Crnogaj et al., 2022).

The keyword Organizational follows closely. To successfully implement agile leadership within a company, the organizational framework conditions must first be established (Crnogaj et al., 2022). This includes not only hard factors such as processes and organizational structures but also soft factors like the cultural framework (Doz, 2020).

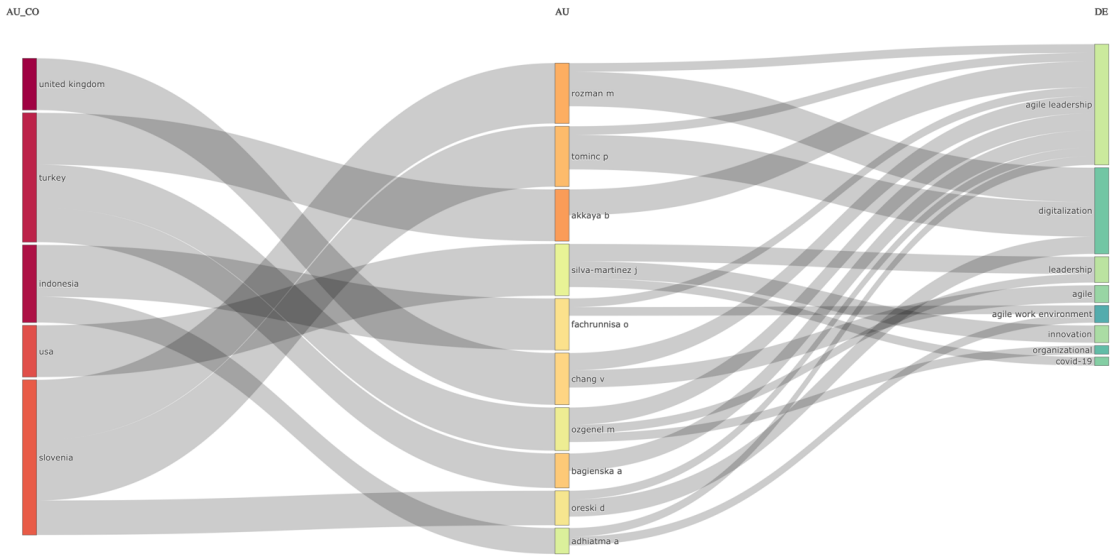

Figure 2: A three-field plot or Sankey diagram
Source: Own processing in Biblioshiny

3.3. Analysis of sources

In Table 2, the data presents a bibliometric analysis of various sources, detailing their h-index, g-index, m-index, total citations (TC), number of publications (NP), and the year of first publication (PY_start). The h-index is defined as the number of papers with citations equal to or greater than h, serving as a valuable measure to quantify a researcher's scholarly output (Hirsch, 2005). Hirsch argued that the h-index is effective for comparing researchers or journals within the same field. If two researchers or journals have a similar h-index, their overall influence in the scientific community is comparable, regardless of the number of papers they have published or their total citation count. Additionally, an individual's h-index typically increases steadily over time (Ireland et al., n.d.). Hirsch later introduced the m-index by dividing the h-index by the number of years since the researcher's or journal's first publication. An m-index of 1 is considered very good, 2 is outstanding, and 3 is exceptional. Renowned English physicist and author Stephen Hawking achieved an m-index of 1.6 (Shah & Jawaid, 2023).

The g-index, introduced by Leo Egghe in 2006 (Egghe, 2006), improves upon the h-index by considering the number of citations received by an author's or journal's most highly cited publications. The g-index value increases with the total citations received by these top publications. A set of publications has a g-index value of g if g is the highest rank (order) such that the top g publications collectively received at least g^2 citations (Ondrišová, 2011).

Sustainability has the highest indices with an h-index of 3, a g-index of 5, an m-index of 0.75, and 50 total citations from 5 publications, starting in 2021. Empirical Software Engineering shows an h-index and g-index of 2, an m-index of 0.5, with 35 total citations from 2 publications, starting in 2021. Frontiers in Psychology has an h-index of 2, a g-index of 3, an m-index of 0.667, and 12 total citations from 3 publications, starting in 2022. The variety in m-index values indicates differing levels of impact over time. Despite the low number of publications, the total citations highlight the influence these sources have in their respective fields. For more details, see Table 2.

Table 2: Source Impact

Source	H_Index	G_Index	M_Index	TC	NP	PY_Start
Sustainability	3	5	0.75	50	5	2021
Empirical Software Engineering	2	2	0.5	35	2	2021
Frontiers In Psychology	2	3	0.667	12	3	2022
2022 Acm/Ieee 44th International Conference on Software Engineering (Icse 2022)	1	1	0.333	4	1	2022
Agile Processes in Software Engineering and Extreme Programming	1	1	0.063	3	1	2009

Agile Processes in Software Engineering and Extreme Programming (Xp 2020)	1	1	0.2	11	1	2020
Agile Processes in Software Engineering and Extreme Programming, Proceedings	1	1	0.059	9	1	2008
British Journal of Educational Technology	1	1	0.167	48	1	2019
Complex, Intelligent and Software Intensive Systems	1	1	0.25	3	1	2021
Education Excellence and Innovation Management Through Vision 2020	1	1	0.167	1	1	2019

Source: Own processing in Biblioshiny

3.4. Prominent authors, institutions, and countries making significant contributions to the field of Agile Leadership literature

Table 3 below shows the number of articles published by various authors. Akkaya, B.; Rozman, M.; and Tominc, P. have each published the most, with 3 articles on the selected topic. Metrics in Table 4 provide insights into the research impact and citation performance of each author, considering factors such as publication output, citation counts, and the duration of their research careers.

Akkaya, B. has published 3 articles on Agile Leadership. His results show a balanced h-index and g-index, indicating moderate impact relative to the number of publications (NP) and total citations (TC). The m-index of 0.667 suggests a decent average citation rate per publication, considering the short research career since 2022. Chang, V., like Akkaya, B., has an h-index and g-index of 2, reflecting consistent impact relative to publications and citations. The m-index of 0.667 indicates a commendable average citation rate per publication. Davies, R., despite having a high h-index and g-index of 2, has an m-index of 0.118, indicating a relatively low average citation rate per publication. This might suggest fewer highly cited papers or a shorter citation period since beginning research in 2008.Fachrunnisa, O., like others, has an h-index and g-index of 2, with an m-index of 0.5 suggesting a moderate average citation rate per publication since beginning research in 2021. Aldianto, L., despite a high total citation count (TC) of 42, has an h-index and g-index of 1, suggesting a lower impact relative to the number of publications (NP = 1).

Table 3: Most Relevant Authors

Authors	**Articles**
Akkaya, B.	3
Rozman, M.	3
Tominc, P.	3
Bagienska, A.	2
Chang, V.	2
Fachrunnisa, O.	2
Oreski, D.	2
Ozgenel, M.	2
Silva-Martinez, J.	2
Adhiatma, A.	1

Source: Own processing in Biblioshiny

Table 4: Authors' Local Impact

Author	**h_index**	**g_index**	**m_index**	**TC**	**NP**	**PY_start**
Akkaya, B.	2	3	0.667	14	3	2022
Chang, V.	2	2	0.667	29	2	2022
Davies, R.	2	2	0.118	12	2	2008
Fachrunnisa, O.	2	2	0.5	10	2	2021
Gren, L.	2	2	0.4	15	2	2020

Adhiatma, A.	1	1	0.5	7	1	2023
Adnan, A.	1	1	0.333	8	1	2022
Aftab, A.	1	1	0.333	8	1	2022
Aftab, S.	1	1	0.333	8	1	2022
Aldianto, L.	1	1	0.25	42	1	2021

Source: Own processing in Biblioshiny

3.5. Document analysis

Document analysis involves evaluating how often a researcher's work is referenced by others, indicating its influence and contribution within a specific field. This method assesses the impact and quality of research articles by studying their citation frequency in other publications. Such analysis yields valuable insights that help researchers make informed assessments of their scholarly output. The study analyzed the top 10 most frequently referenced works in the field of Agile Leadership in detail. Each work was characterized by its total number of citations (TC) and its citations per year (TC/Y), providing a comprehensive overview of their scholarly impact over time.

1. (Tsai et al., 2019) TC = 48, TC/Y = 8; analyzed in the article the challenges of introducing learning analytics based on 23 interviews at 21 British universities. The analysis was carried out using a systematic coding scheme. The result of the study is that the challenges lie in particular in the area of tension between innovation and operations. This area of tension reveals that a new understanding of leadership is necessary in order to support innovation and increase the success of the transfer to line operations.
2. Parker et al., (2015) TC = 48, TC/Y = 4.8; examined assumptions and prejudices about the leadership of self-organized teams in 23 companies. Based on a comprehensive literature analysis, hypotheses were derived that were tested in practice. The result of the empirical study is that although there is considerable knowledge about self-organized teams, there is little understanding of the beneficial and detrimental effects of self-organized teams on internal productivity or the appropriate leadership style. The authors make it clear that further research is needed to build on this.
3. Aldianto et al., (2021) TC = 42, TC/Y = 10.5; created a framework for greater business resilience by examining capabilities such as innovation ambidexterity, dynamic and technological capability and behavior. To this end, a literature analysis is first carried out to synthesize these in order to gain a better understanding of the resilience of start-ups. In addition to the literature review, a case study based on three semi-structured interviews will be presented. Four theses were formulated for further research.
4. Carroll et al., (2010) TC = 35, TC/Y = 2.33; dealt with the topic of boredom in leadership in their article. In an initial interview-based study, it was found that the discussion about boredom contrasts with the perceived challenges and complexity of work as a manager. In a subsequent second empirical survey, the authors determined that boredom is a phenomenon of followers and can be solved by the manager through initiated changes.
5. Chen et al., (2022) TC = 27, TC/Y = 9; investigated the contribution of CEO networks to innovation efficiency at company level in Chinese listed companies. Based on 13,516 observations between 2007 and 2017 of the listed companies, a frontier analysis was conducted to measure innovation efficiency based on innovation input and innovation output. Three key findings were identified. Firstly, it was determined that innovation efficiency is higher if the CEO holds more board mandates. Secondly, there is a positive correlation between a larger CEO network and innovation efficiency within the company. Thirdly, the positive effect between higher innovation efficiency and the CEO's network disappears when the number of directorships is above the annual median.
6. Hall & Rowland, (2016) TC = 25, TC/Y = 2.78; aimed to determine the current requirements for managers and to analyze the connections between management training and agile leadership. Based on the well-known acronym VUCA, its effects on certain management characteristics are examined in order to check how these are covered by current management training programs. As a result, it was identified that VUCA is not yet established in academic management education and that there is a discrepancy between the content of the training programs and the expectations of companies. The authors suggest the use of live consulting companies as a possible solution.
7. Strode et al., (2022) TC = 20, TC/Y = 6.67; presented in their article the agile teamwork effectiveness model (ATEM) for co-located agile development teams. The model consists of shared leadership, team orientation,

redundancy, adaptability and peer feedback. The article critically reflects on the model and discusses extensions for very small, multi-team, distributed and safety-critical development environments. The target group of the model are researchers, coaches and managers who work agile.

8. Spiegler et al., (2021) TC = 15, TC/Y = 3.75; investigated what kind of leadership is needed to support teams in agile work. The aim of the article is to use the role of the Scrum Master to determine how leadership changes as the team matures. A grounded theory study of 75 practitioners from 11 departments at Robert Bosch GmbH was used to identify nine leadership roles that are transferred from the Scrum Master to the development team during the maturing process. A positive team climate and a leadership gap favour the role transfer process, whereas role conflicts can impair the transfer. Trust and freedom are essential for team members to be able to take on a leadership role.
9. O'Connell, (2016) TC =15, TC/Y = 1.67; worked on the creation of a new degree program to better meet the needs of educators in the digitally networked world. The aim is to teach agile leaders the tools of formal and informal learning. The challenge here is the tension between academic knowledge and practical orientation. Another aspect considered is the contribution of global networking to the success of educational processes.
10. Akkaya et al., (2022) TC =11, TC/Y = 3.67; investigated the relationship between agile leadership and career success. In this context, the focus is on the communication of job embeddedness in healthcare organizations. The results of the study suggest that agile leadership promotes career success. In particular, the COVID-19 pandemic has confronted managers with many challenges, which has led to the use of characteristics such as problem solving, internal and external communication and rapid adaptation to an uncertain environment to increase professional success.

In the provided table 5, authors from various affiliations have contributed significantly to the selected topic. The University of Maribor leads with 8 articles, showcasing a robust research output in this area. Istanbul Sabahattin Zaim University and Manisa Celal Bayar University follow closely with 5 articles each, highlighting their active engagement in the field. Several institutions, including the University of Gothenburg, Islamic Sultan Agung University, University of Oxford, and University of Sharjah, have contributed 4 articles each, demonstrating their substantial presence in the academic discourse. Additionally, Aston University, Carolina University, and Fatih Sultan Mehmet Vakif University have each contributed 3 articles, indicating a notable contribution to the topic under consideration.

Table 5 Affiliations' Production over Time

Affiliation	Articles
Univ Maribor	8
Istanbul Sabahattin Zaim Univ	5
Manisa Celal Bayar Univ	5
Univ Gothenburg	4
Univ Islam Sultan Agung	4
Univ Oxford	4
Univ Sharjah	4
Aston Univ	3
Carolina Univ	3
Fatih Sultan Mehmet Vakif Univ	3

Source: Own processing in Biblioshiny

The distribution of articles across different countries reveals varying levels of scholarly activity and collaboration in the selected field. The United Kingdom leads with 7 articles, constituting 12.1% of the total, showcasing a dominant presence and high percentage of Multiple Country Production (MCP) at 71.4%. Indonesia closely follows with 6 articles (10.3%), emphasizing significant contributions with most of the Single Country Production at 83.3%. Turkey and the USA both contribute 5 articles each (8.6%), with Turkey having a substantial MCP percentage of 40% compared to the USA's 20%. Germany and Australia each present 4 and 3 articles, respectively, reflecting solid contributions, albeit with varying levels of international collaboration. Slovenia, Austria, Israel, and Italy each contribute 2 articles, demonstrating a balanced distribution with notable MCP percentages highlighting collaborative research efforts.

Table 6: Authors' Country

Country	Articles	Articles %	SCP	MCP	MCP %
United Kingdom	7	12.1	2	5	71.4
Indonesia	6	10.3	5	1	16.7
Turkey	5	8.6	3	2	40
Usa	5	8.6	4	1	20
Germany	4	6.9	4	0	0
Australia	3	5.2	2	1	33.3
Slovenia	3	5.2	1	2	66.7
Austria	2	3.4	1	1	50
Israel	2	3.4	2	0	0
Italy	2	3.4	1	1	50

Source: Own processing in Biblioshiny

Keyword analysis involves examining how often specific terms or phrases appear together in titles, abstracts, or documents. This approach maps out relationships between terms within a particular field of study. The choice of keywords used in publications provides an up-to-date overview of the literature relevant to a specific research area (Khanra et al., 2020). Typically, the outcomes of this analysis are represented visually, often as maps. To enhance clarity, only the most frequently occurring terms meeting a specified threshold are depicted (Ondrišová, 2011). Figure 3 illustrates a map generated from co-word analysis of keywords plus within the dataset. The word "performance" was used the most, following by the words "model", "innovation", "management".

The word "performance" is probably used most frequently because improving performance is a central goal of agile leadership. It is also conceivable that agile leadership promotes a culture of continuous improvement (Porkodi, 2024). Through regular feedback loops, retrospectives and iterative work processes, the performance of teams and individuals is continuously evaluated and optimized (Ibid.). Agile leadership is strongly results-orientated (Ibid.). Success is not only measured by the resources or processes used, but above all by the results achieved (Maximini, 2022). Agile leadership aims to promote the motivation and commitment of employees, which has a positive effect on their performance. Autonomy, meaningfulness of work, self-organization and the opportunity for personal development are core principles of agile leadership that contribute to employees being more efficient and productive (Ibid.).

The term "model" as a key word in connection with agile leadership should probably be viewed from a methodological perspective. Agile leadership models provide a practical guide to help leaders effectively put agile principles into practice. Such a model can include step-by-step instructions, best practices and concrete tools that facilitate the transition to agile leadership (Knaster & Leffingwell, 2020). Another aspect can be seen in the context of digitization and the disruptive nature of digital transformation (Crnogaj et al., 2022). These make business model innovations necessary, which is supported by agile leadership. Establishing a new business model requires the previously discussed attributes of adaptability, flexibility and the ability of responsiveness. Models for agile leadership are often not rigid, but dynamic and adaptable. They can be further developed and tailored to the specific needs and contexts of an organization (Rigby et al., 2018). The iterative and flexible nature of agile models reflects the basic principles of agility (Ibid.).

The word "innovation" is often mentioned in the context of agile leadership because agile leadership provides a framework that encourages creativity and the development of new ideas, which is crucial for innovation (Akaya et al., 2022). Agile leadership encourages a culture of experimentation where risk is seen as a necessary part of learning and developing new ideas. This experimental culture is critical to innovation as it allows teams to try new approaches, learn quickly from mistakes and scale successful solutions (Maximini, 2022). Agile leadership emphasizes customer centricity and the ability to react quickly to changes in the market (Chen et al., 2022). By constantly engaging with customers and gathering feedback at short intervals, organizations can develop innovative solutions that are better aligned with customers' needs and wishes (Crnogaj et al., 2022). As already mentioned, several times, agile leadership requires flexibility and self-determined work in order to promote a culture of innovation (Parker et al., 2015).

The word "management" is a central keyword in the context of agile leadership, as it is an evolution of classic management practices (Fähndrich & Pedell, 2024; Crnogaj et al., 2022). Agile leadership often means moving away from traditional hierarchical management structures towards a more flexible and adaptable management style (Fähndrich & Pedell, 2024). This change requires a redefinition of what management means in an organization. Instead

of control and direction, agile leadership emphasizes the support, encouragement and development of teams (Maximini, 2022). Agile management practices emphasize decentralization, self-organization and the promotion of autonomy (Ibid.). It is about changing the way organizations are led and managed so that they are better adapted to the dynamic and complex demands of today's business world (Hall & Rowland, 2016). In agile organizations, the boundaries between management and leadership become blurred. Agile leaders often also take on management tasks, but with a strong focus on empowerment and coaching rather than control and direct instruction (Ibid.).

Figure 3: Word Cloud based on Keywords Plus
Source: Own processing in Biblioshiny

Co-occurrence network analysis of keywords represents a valuable methodology for exploring relationships among terms within research literature. This approach enables the identification of frequently co-occurring keywords, thereby offering insights into the interconnections between topics and concepts within a defined research domain. Through the examination of such networks, researchers can discern predominant themes and significant concepts that hold sway in the literature or bear relevance to specific research inquiries. This analytical framework enhances the understanding of the semantic associations and thematic concentrations prevalent in scholarly discourse, aiding in the elucidation of research trends and the formulation of informed research strategies. Based on the analysis, 5 different clusters could be observed within the keyword network. The first cluster includes topics such as leadership, innovation, agile transformation, sustainable etc., the second cluster covers topics such as agile leadership, organizational change, covid-19, digital transformation, job satisfaction etc. The third cluster includes digitization and topics like CEO-transition, social capital, innovation efficiency and CEO-networks. The fourth cluster shows agile work environment and artificial intelligence. And the fifth cluster covers topics such as agile software teams, emergent leadership, social network analysis, etc.

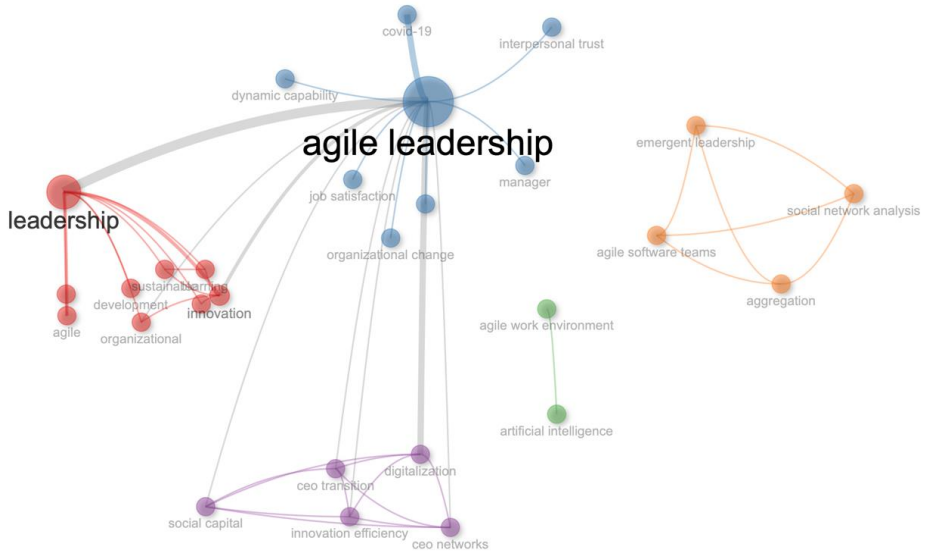

Figure 4: Keyword cluster
Source: Own processing in Biblioshiny

Table 7: Keyword cluster and context

Node	Cluster	Betweenness	Closeness	PageRank
aggregation	5	0	0.333	0.036
agile software teams	5	0	0.333	0.036
emergent leadership	5	0	0.333	0.036
social network analysis	5	0	0.333	0.036
digitalization	4	0	0.023	0.047
CEO networks	4	0	0.023	0.039
CEO transition	4	0	0.023	0.039
innovation efficiency	4	0	0.023	0.039
social capital	4	0	0.023	0.039
agile work environment	3	0	1	0.036
artificial intelligence	3	0	1	0.036
agile leadership	2	164	0.037	0.164
covid-19	2	0	0.021	0.02
digital transformation	2	0	0.021	0.013
dynamic capability	2	0	0.021	0.013
interpersonal trust	2	0	0.021	0.013
job satisfaction	2	0	0.021	0.013
manager	2	0	0.021	0.013
organizational change	2	0	0.021	0.013
leadership	1	82.875	0.03	0.099
innovation	1	17.125	0.028	0.059

agile	1	0	0.019	0.025
organizational	1	0	0.026	0.027
learning	1	0	0.02	0.028
management	1	0	0.019	0.02
agile transformation	1	0	0.019	0.021
development	1	0	0.019	0.013
sustainable	1	0	0.02	0.028

Source: Own processing in Biblioshiny

Thematic maps serve as powerful tools for visualizing key themes within a research area and constructing a conceptual framework. Utilizing Keywords Plus, we created Figure 5, which clusters these keywords and identifies themes based on centrality (x-axis) and density (y-axis). Centrality reflects the importance of a theme, while density indicates its development (Madsen et al., 2023). The thematic map is structured as a 2 × 2 matrix with four quadrants, where the size of each circle represents the occurrence of Keywords Plus. Basic Themes represent early developmental topics, which can progress into more prominent Motor Themes. Niche Themes capture well-established and mature subjects, while Reducing/Emerging Themes illustrate emerging or declining topics related to Agile Leadership. In the upper left quadrant, niche themes such as career, engagement and work. Moving to the upper right quadrant, motor themes like performance, challenges, outcome satisfaction is currently prominent. The lower left quadrant encompasses themes in flux, such as knowledge management and technology. In the lower right quadrant, fundamental themes include innovation and dynamic capabilities.

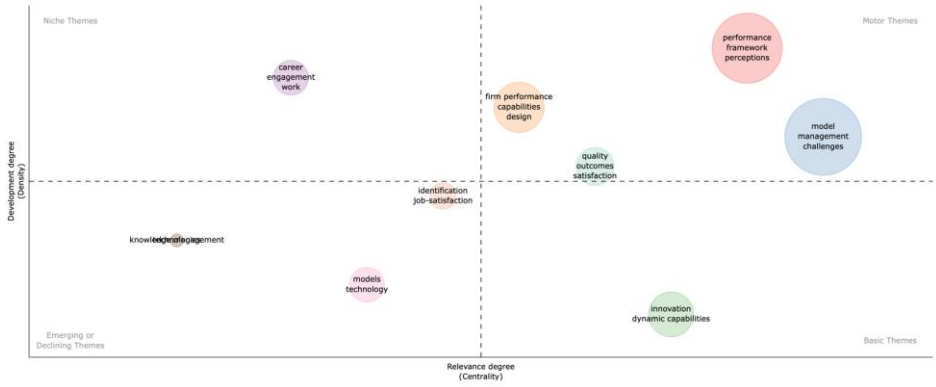

Figure 5: Thematic map – by Keywords Plus
Source: Own processing in Biblioshiny

4. CONCLUSION

This article has demonstrated that the topic of Agile leadership is gaining increasing significance, with a growing number of publications on the subject in recent years. Revisiting the research questions raised at the beginning, we can summarise the findings as follows:

Predominant Research Trends and Thematic Clusters: Key topics such as innovation management, sustainability, and agile working environments are central to research on Agile leadership. Innovation, coupled with an innovative work environment, is essential for rapid adaptability and maintaining competitiveness. Efficiency and the organisational design of Agile leadership also play a pivotal role in this research area. As digitalisation emerges as a global megatrend, it becomes a significant subject of inquiry within Agile leadership studies. Leadership, in general, garners research interest, particularly as it transitions from traditional management styles to Agile approaches. In this context, organisational change and adaptation to evolving competitive conditions form an important research branch.

Influential Authors, Countries, and Institutions: The analysis of leading authors in Agile leadership research is presented on two levels. Firstly, the 10 most prolific authors in the field were identified (cf. Table 3). Secondly, the

influence of these authors was assessed by examining their citation performance, number of publications, and research longevity. This provides insights into each author's impact on the field and serves as a quality indicator. Additionally, the top 10 most-cited articles were examined through document analysis, alongside an exploration of publication distribution across universities. The results show a broad and diverse range of contributors. Country-level analysis also reflects this diversity, with the United Kingdom and Indonesia each contributing over 10% of publications, accounting for a significant share of global research on Agile leadership.

Evolution of Themes and Methodological Approaches: An analysis of publication trends since 2005 reveals a steady increase in scholarly output, with a surge beginning in 2020 and peaking in 2022. Initially focused on software development, the scope of Agile leadership research has expanded to include sustainability and broader Agile processes. The dominance of articles over books suggests that Agile leadership is currently a central theme in academic discourse. Bibliometric analysis highlights critical gaps in existing research, including the need for deeper exploration into resilience, leadership traits, and the long-term effects of Agile leadership on organizational performance. These gaps present opportunities for future research, particularly in broadening the theoretical framework beyond its software-centric roots.

For theorists, this analysis provides a clear trajectory for further exploration, particularly in areas such as resilience and the definition of essential leadership traits. Investigating the long-term effects of Agile leadership on organizational performance can contribute to a richer theoretical understanding of the field.

On the practical side, organizations can use these insights to refine their leadership approaches. Emphasizing flexibility, digital transformation, and employee autonomy is crucial for staying competitive in dynamic environments. Furthermore, understanding global research trends allows businesses to adopt best practices from leading countries and institutions, driving innovation and enhancing overall effectiveness.

In conclusion, this article underscores the growing significance of Agile leadership as a vital area of research while acknowledging that the field is still in its developmental stages. There remains significant potential for further investigation, particularly into resilience, key leadership traits, and the adaptation to technological and market changes. Agile leadership will continue to be a major focus for both academic inquiry and practical application, presenting opportunities for deeper research and broader adoption of Agile principles in the coming years.

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The Effect of School-Based Management on Improving the Quality of Education

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Abstract

School-based management (SBM) is a policy established by the government in the education sector, which allows schools to create policies and manage their own institutions and aims to increase the quality of education in an efficient and effective manner. School-based management (SBM) is the most effective and efficient step in increasing the quality of education in schools. Schools are given the freedom to create their own policies in accordance with the needs and conditions of the school environment. Both the internal and external environments of the school directly support learning. In the study, it is tried to discuss the Implementation of School-Based Management, and its effect on improving the quality of education. In this article, we discussed what school-based management (SBM) is, how it is implemented, the weak aspects of SBM and improving the quality of education under the light of literature. It has been concluded that School-based management should become a powerful educational reform in terms of student-centered education, democratization, transfer of authority, realization of school goals and functions, and restructuring of culture.

Keywords: School-based Management, Quality of Education, Educational Management, Education Policy

1. INTRODUCTION

Education is one of the most important things in everyone's life, which means that all groups have the right to education and are expected to continue to develop their knowledge. Everyone receives their first education in the family as informal education, in the school as formal education, and in the society as non-formal education. Schools as formal institutions are responsible for providing education Schools have a very important role as a place for students to exchange ideas with each other. Schools are a place to produce quality human resources that are competitive in the global world. The role of schools in creating school quality greatly influences the quality of learning, therefore school management should be regulated very well so that educational goals can be achieved together (Alpian, et al. 2019; Setiawan et al., 2021; Djamudi et al., 2023).

Education or schools have a close relationship with society because they need each other, therefore School-Based Management is needed. School-Based Management (SBM) is a decentralized strategy for educational decision-making that requires involvement from parents, students, teachers, officials, and the community to achieve autonomy, flexibility, participation, independence, responsibility, and accountability of schools. The purpose of SBM is to improve the quality, effectiveness, efficiency, productivity, and innovation of education. To achieve this goal, schools are given greater authority and responsibility to do what they want. SBM occurs through a process carried out jointly by the community and schools in the field of education. Human resources are currently empowered and managed to achieve educational goals. Through SBM, schools are expected to be able to improve their ability to plan, manage,

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and organize education in schools to improve the quality of education. SBM can not only improve the level of quality of education, but can also increase independence, flexibility, openness, participation, cooperation, accountability, and school initiatives to manage education. On the other hand, SBM can broaden the attention of school residents and local areas to the implementation of learning through shared navigation. An additional advantage of SBM is that schools are more accountable to parents, community members, and the government about the quality of education they offer. SBM can also help schools compete healthily to achieve the same goals (Rukayah, 2016; Ritonga, 2020; Hamid, 2013; Yanti Nasution, 2018; Patras et al., 2019; Amuntai & Selatan, 2022; Tabrani, 2013).

2. CHARACTERISTICS OF SCHOOL BASED MANAGEMENT

School-based Management must be known, internalized, and practiced by those involved in early childhood education, basic education, and secondary education. Therefore, there are several characteristics of SBM that must be understood by schools that want to implement it. It is hoped that schools that pay attention to and have SBM characteristics will be able to implement it successfully. There are eight characteristics of School-Based Management.

- Schools with SBM have a mission or ideal to run a school to represent a group of shared hopes, beliefs and school values, guide school residents in educational activities and provide work direction. This mission has a great influence on the function and effectiveness of the school, because with this mission school residents can develop the right school organizational culture, build a high commitment to the school, and have the initiative to provide a better level of educational services.
- Educational activities are carried out based on the characteristics of the needs and situations of the school. The nature of the activity is very important for schools to improve the quality of education, because it indirectly introduces changes in school management from external control management to a school-based model
- The occurrence of a process of changing management strategies concerning the nature of humans, school organizations, decision-making styles, leadership styles, use of power, and management skills. Therefore, in the context of implementing SBM, changes in management strategies look more at the development aspects that are appropriate and relevant to the needs of the school.
- Freedom and authority in managing effective resources to achieve educational goals, in order to solve educational problems faced, both educational personnel, finances and so on.
- SBM demands an active role from schools, school administrators, teachers, parents, and parties related to education in schools. With SBM, schools can develop students and teachers according to the characteristics of each school. In this context, schools play a role in developing initiatives, solving problems, and exploring all possibilities to facilitate learning effectiveness. Likewise with other elements such as teachers, parents, school committees, school administrators, education offices, and so on according to their respective roles.
- SBM emphasizes open interpersonal relationships, cooperation, team spirit, and mutually beneficial commitment. Therefore, organizational climate tends to lead to a commitment type so that school effectiveness can be achieved.
- The role of administrators is very important in the SBM framework, including the qualities possessed by administrators.
- In SBM, school effectiveness is assessed according to multilevel and multifaceted indicators. Assessment of school effectiveness must include the learning process and methods to help school progress. Therefore, assessment of school effectiveness must pay attention to multilevels, namely at the school, group, and individual levels, as well as multifaceted indicators, namely school input, process and output and student academic development.

3. IMPLEMENTATION OF SCHOOL BASED MANAGEMENT

The school-based management system creates its own unique culture in each school. This management style has its own culture. It creates a strong structure to manage the school and gives its members the chance to determine their own personalities. This shows a high organizational performance. These strong social feelings vary from school to school in determining the schools' own vision.

In order for the implementation of school-based management to run effectively and efficiently, cooperation is needed from all components of education, starting from the principal, educators, education personnel, parents and the community. In addition to these components, the availability of adequate facilities and infrastructure also affects the sustainability of the implementation of school-based management. The principal as a leader certainly has an important role in utilizing all components of education, the principal must have the ability to plan, implement, coordinate and control and evaluate the implementation of school-based management. In addition to the principal, teacher educators

also have an important role in implementing school-based management by improving teaching skills, renewing teaching methods and improving the classroom atmosphere as comfortable as possible. The implementation of school-based management can be seen from how schools optimize their performance, manage human resources and other resources, and manage the teaching and learning process well.

The following steps should be followed in school-based management (Oswald, 1997)

- Developing differences in the system,
- Determining what the system and school are ready for,
- Establishing a developed committee consisting of those living in the school environment
- Determining the values necessary to improve education,
- Determining the goals and priorities of education,
- Planning the time required for self-development, selecting the committee, collecting the necessary information and implementing the new budget procedure,
- Training the committee members and teaching the system,
- Managing, evaluating and organizing according to the needs of the executive,
- Being prepared to eliminate obstacles.

In order for schools to achieve success in school-based management, the following points should be emphasized:

- A clear mission focused on student education and training should be started,
- Clear successes should be targeted in the development of decision-making,
- A series of innovations should be introduced by the councils in order for school-based management to be established and strengthened,
- Teachers, parents and other community members should be given authority in school-related affairs,
- Parents and other community members related to the school should be made aware of their responsibilities,
- Teachers should be given time to make program changes so that they can take part in decision-making,
- Significant changes in activities for high-quality professional development should be planned, organized and carried out,
- Necessary experts should be used in basic matters,
- Active support should be provided at all stages of the organization,
- Every small or large success should be rewarded,
- A collaborative school culture focused on development should be created.

3.1. Stages of School-Based Management Implementation

There are three stages of implementation, namely Socialization stage, Piloting stage, and Dissemination stage.
Socialization stage is a stage that is very necessary to provide information widely to the community and educational institutions so that they can understand and participate in its implementation.
Piloting stage is the stage of conducting trials on the application of the school-based management concept.
Dissemination stage is the stage of implementing the SBM model to the community and educational institutions after conducting previous trials.

The school-based management system creates its own unique culture in each school. This management style has its own culture. It creates a strong structure to manage the school and gives its members the chance to determine their own personalities. This shows a high organizational performance. These strong social feelings vary from school to school in determining the schools' own vision.

3.2. Implementation Strategy of School-Based Management

According to Mulyasa (2002), in order for school-based management to run optimally, a strategy is needed in its implementation, including grouping, staging and implementation.

Grouping, intended so that schools can be grouped based on the school's ability to manage their schools, so that it will be easier to know which schools require more attention in implementing school-based management.
Staging, the implementation of school-based management is carried out through stages, namely from short-term stages to long-term stages.

Implementation, after conducting an implementation trial of the application of SBM, the next step is to carry out a permanent implementation that requires binding regulations.

From the description above, it can be argued that the implementation of school-based management is essentially choosing the best alternative for schools in developing their schools. School-based management must be carried out continuously so that it will later result in an increase and development in education.

3.3. Factors Inhibiting the Implementation of School-Based Management

Implementation of school-based management is the task of all school residents; if school-based management can be run optimally, the quality of the school will increase. However, in its implementation, several factors inhibit school-based management, namely: Financial sector; Lack of human resources; Facilities and infrastructure; Lack of community support.

3.3.1. Lack of Finance

Each action must be organized as well as possible so that it can be completed flawlessly, smoothly, and implemented effectively. Every movement in the school certainly requires funds, so good management is very important. Financial management is needed to manage finances. According to Akbar (2019), school financial management consists of various activities such as structuring, bookkeeping, fund reserves, disclosure, monetary bookkeeping. To meet the needs of school subsidies, financial administration is responsible for ensuring that assets can be prepared, obtained, registered and used to implement school education programs easily. Therefore, the core of financial administration is to further develop school executives, increase transparency and responsibility, and reduce resource misuse (Kristiawan & Asvio, 2018).

3.3.2. Lack of human resources

Quality education is the gateway to every progress and increase in the value of human resources (HR). Quality HR is able to compete in the digital era (Yanti & Mansur, 2020). The existence of quality human resources and the fulfilment of human resources in each institution will create a balance in running each school program. The lack of adequate human resources (HR) in managing school-based management in elementary schools is an inhibiting factor in implementing all aspects of school-based management. Schools that implement SBM require educators who have a deep understanding of the SBM concept and relevant management skills. Lack of specific training in this regard can hinder the effectiveness of SBM implementation.

3.3.3. Lack of Facilities and Infrastructure

Management of educational facilities and infrastructure is related to all facilities and infrastructure available in schools with the aim of providing optimal contributions so that the continuity of the education process can be carried out properly (Junindra et al. 2022). The lack of facilities and infrastructure such as school buildings, teaching and learning facilities, and other supporting equipment is also an inhibiting factor in implementing school-based management. School-based management aims to provide autonomy to schools in decision-making, planning, and resource management. However, when the facilities and infrastructure are inadequate, several obstacles will arise. Limited physical facilities hinder interaction between teachers, students, and school staff. Limited space can limit flexibility in implementing learning activities and extracurricular activities. It is important to note that good management of facilities and infrastructure is an integral part of school-based management. If facilities and infrastructure are managed well, schools can be more effective in implementing school-based management policies to improve the quality of education.

3.3.4. Lack of Community Support

The relationship between schools and the local community is a correspondence interaction that aims to increase local community awareness of educational needs and practices and efforts to increase understanding regarding the importance of school attendance. One of the characteristics of a good school is the high contribution of parents in providing education for their children. Thus, the extent to which the local community can be involved in the learning cycle will be a sign that the school board has good quality. (Ajefri, 2017). To get a good school, community empowerment is very important. The level of local community support in the education cycle at school has a significant impact on the progress of the school and the nature of the service of learning, which then has an impact on the progress and learning achievement of children at school. Many community members may not fully understand the

concept and benefits of SBM. This lack of information and understanding can lead to distrust or disagreement with changes proposed by the school.

3.4. Weaknesses of School-Based Management

The weaknesses of school-based management can be listed as follows

- *More work.* Shared decisions require more time. Since some unimportant issues take a long time to be discussed or are not discussed in the presence of senior management and most of the time is taken by senior management, it requires more work and labor.
- *Low effectiveness.* Central organizations seem to be cheaper to run than local organizations. A decision made at the center can easily be applied to the entire organization.
- *Weakening the effect of expertise.* School-based management restricts the roles of experts within the organization. An expert can sometimes have more technical knowledge than a group alone. However, since school-based management shifts the central authority to the school, this expert knowledge is not used effectively. Although the power of parents and teachers in the school district increases, it negatively affects professionalism in education.
- *Uncertainty in school performance.* It is not certain that local administrators will use the given autonomy effectively.
- *Increasing need for staff development*. Staff need to learn the new roles required by school-based management. Moreover, the need for new knowledge and skills will continue to be constant.
- *Confusion of new roles and responsibilities.* The new roles and responsibilities that are developed may also cause some misunderstandings. Uncertainty and misunderstandings may be seen among the staff.
- *Difficulty in coordination.* Some coordination problems may arise between managers, teachers, students and parents. Different interests and approaches within the organization may cause some conflicts between the groups.

4. CONCLUSION

School-based management is one of the most important innovations proposed for the development of education in recent years. Giving decision-making authority to schools is the most important education strategy after the 1980s. Today, the aim is to strengthen the school environment, increase management efficiency and reduce central authority. School-based management focuses on innovation in education, renewal of personnel, continuous personnel development and improvement of school activities.

School-based management means that all kinds of decisions regarding education are made at school. It is a decentralized management style of education that accepts schools as the basic decision-making unit, based on increasing authority and responsibilities at school level, autonomy and participatory decision-making in order to improve education and training.

School-based management can be formulated as Autonomy and Participation in decision-making. SBM increases autonomy by giving decision-making authority and responsibility to schools. This management style is a system where internal dynamics are effective in terms of change, innovations are embraced, authority is shared, and the school and its surroundings have full authority in program, budget and personnel selection. This approach in particular focuses on ensuring the participation of internal and external elements in the decision-making process at school, providing schools with an autonomous structure in terms of budget, curriculum, personnel and teaching, teachers playing a more active role at school, enriching teaching, re-determining the roles of the school environment and teaching staff, ensuring and determining the participation of administrators, teachers, experts, students and society in determining the goals of the school in terms of vision, mission and structure.

One of the most important successes of school-based management is the development of the student's education and teaching environment and its positive effect on student performance. It is important for decisions to be made jointly in school-based management. It is certain that group decisions consisting of teachers, principals, regional education administrators, parents, students and other members of society will be of higher quality. School-based management should become a powerful educational reform in terms of student-centered education, democratization, transfer of authority, realization of school goals and functions, and restructuring of culture. Because sharing authority will only become useful with more control over the education process.

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Evaluation of Urban Heat Islands in a Peripheral Area in Tirana, Albania, with the Envi-Met Model

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Abstract

Analysis of climate conditions in urban scale can fundamentally influence in the environmental sustainable building design. Urban morphology can affect local climate conditions, as increasing for example temperature of a living area causing the so-called phenomenon of Urban Heat Islands (UHI). The purpose of this study is to analyze possible UHI in the context of a small area in a peripheral zone in Tirana, Albania; using the microclimate software ENVI-met®. Some of the most important microclimate factors such as air temperature, air humidity, solar radiation and wind speed have been considered. Three main case studies were taken in analysis: the base case, the green case (use of green roofs) and the cool case (use of cool roofs). Each of them differ in some parameters, offering various extra parameters, which may affect thermal conditions. The area taken in consideration have low-density urban structure, with a large open plaza and streets with vegetation. Our work a good reference for further urban planning studies in city center or high-density areas.

Keywords: urban heat islands, energy and buildings; building simulation; Envi-met.

1. INTRODUCTION

Owing to rapid urbanization of these last decades, most cities in Albania have changed their urban structure tremendously. New urbanized areas and cities centers represent now the densest built-up areas.

Accurate urban planning, optimal use of land and future development should also take in consideration endurable urban elements. In order to better understand urban system and provide techniques for sustainable development, results from computational models should be taken in consideration.

Hasty change of urban morphology may contribute in harmful microclimate changes. Urban Heat Islands is the well-known phenomena of accumulative effects of air pollution, chemical changes of atmosphere and soil. UHI is defined as the rise in temperature of any man-made area, resulting in a well-defined, distinct "warm island" among the "cool sea" represented by the lower temperature of the areas nearby natural landscape [1].

Our work was focused on the use of ENVI-met® 3.1 software version for microclimate analysis of certain areas. ENVI-met® is a tree-dimensional modelling system designed to simulate surface-plant-air interactions in urban environment [2]. Michael Bruse, professor of University of Bochum in Germany, developed ENVI-met (and LEONARDO) models. Since then, the programs were used to help planning strategies of living areas, open space etc. (Ozkeresteci, I., Crewe, K., Brazel, A.J. and Bruse, M. 2003.) This process was also encouraged by the partnership of local government and universities. In other cases, ENVI-met was part of investigation of influences of different use of materials in facades and roofs (Bruse M., Thönnessen M., Radtke U. 2003). It is obvious that the

* Corresponding author.

program could be used to help finding the best parameters for outdoor comfort in neighbourhoods (see for example Kariminia Sh., Sh. Ahmad S., Saberi A., 2015. Ambrosini D., Galli G., Mancini B., Nardi I., Sfarra S. 2014; Rossi M., Rocco V. M., Grascelli R. Magny A.A.A., Leuzzi A. G. 2013; Yang X., Zhao L., Bruse M., Meng Q. 2012 amog others).

Albania have limited work in this on evaluation of urban heat islands through computational models. Our work will give contribution in the academic and practical field about this issue.

This study takes in consideration a number of issues. In the first part will be discussed the methodology used for our work and some explanations of the scenarios chosen. The second part will relate to selection of case study and its analysis. Thirdly, there will be shown graphics extracted from model simulations. Lastly, we develop some discussion on the conclusions drawn from the previous session.

2. CASE STUDY SELECTION

Fig. 1. Map of area selected (source: Google Earth, 2017)

A small area located in Kombinat neighborhood, Tirana, Albania, (Fig 1) was used as a model for this analysis. The following pictures represent different views of Kombinat.

Picture nr. 2 below showed expresses Kombinat central square, located in the central part of our model. It is mostly paved with concrete slabs with inner wholes where grass have been grown. Some palm trees, planted on the edges of the square, represent low greenery of the area. The two stores building is part of the ex-textile combine, now out of function, a part of which is being used by the Municipality of Tirana as local units. The main road called "Llazi Miho" (Fig 3) is compounded by four lanes (Fig 6). There are secondary roads in both sides of the main road divided by sidewalks and greenery (Fig 4). There is a good level of greenery at roadsides but not the same situation was done in the inner spaces of the neighborhood. However, this area does offer also a small garden, opposite the main square, about 3000 m^2. The total surface studies are about 20800 m^2 compound of around 29% buildings, 10.5 % roads, 6.7 % sidewalks, 5.6 % open square and 48 % greenery.

Fig. 2. Photo of the central square in Kombinat

Fig. 3. Photo of the main road in Kombinat

Fig. 4. Photo of the secondary road in Kombinat

Fig. 5. Photo of residential buildings in Kombinat

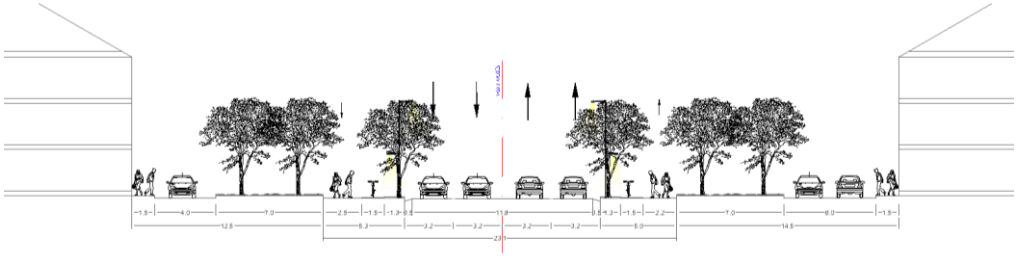

Fig. 6. Main Road “Llazi Miho” section (drafted by the author)

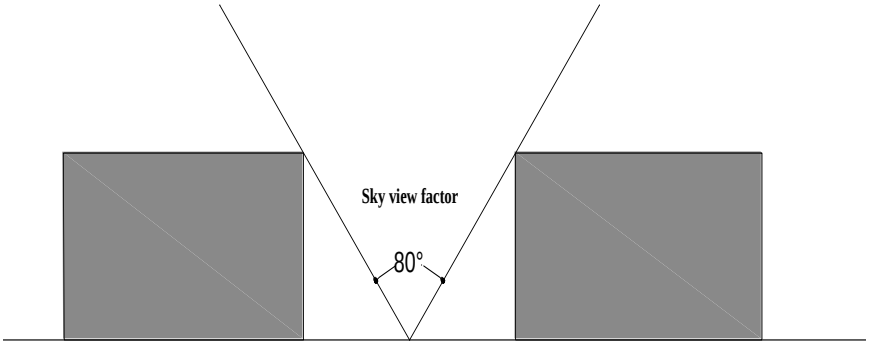

Fig. 7. Sky View Factor

Building density is relatively low in the first construction line. Most of new buildings, made after 1990, are residential with 2-4 floors and a few of 6-10 floor, mostly located inside the neighbourhood. Meanwhile, low buildings of 2-3 floors located in the first lime, facing the main roads; were built in 1960 with retaining walls (Fig 5). Their façade, in most cases is still with brown tiles and their wooden roofs are still standing. Sky view factor is about 80°, reflecting some good open spaces between the areas (Fig 7).

3. METHODOLOGY

The aim for this study is to evaluate urban heat islands in a peripheral area of Tirana, Albania. In this context, we demonstrate the application of a model via ENVI-met® program.

The model takes in consideration many subsystems as the physical parameters of soil and vegetation, atmospheric changes due to localization of area simulation, meteorological characteristics, various surface covering, building parameters [3].

The area of the selected case study has been modelled according to the real situation (ex. geometry, materials, greenery). Fig 8 shows the model simulated using ENVI-met® 3.1.

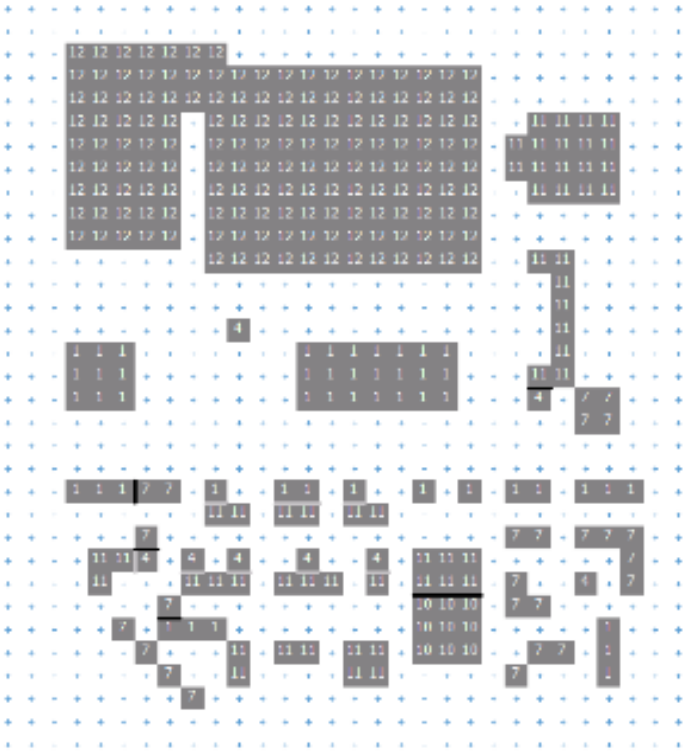

Fig. 7. Sky Model created in ENVI-met® 3.1

The urban microclimate is determined by different factors: local air velocity, temperature and humidity; solar irradiation and specular and diffuse reflections, surface temperatures of building and ground, and the respective long-wave radiation exchange, also with the sky [14]. However, different scenarios have been taken in consideration in order to evaluate the impact of material change in urban microclimate. The same Configuration File was used for all cases. In all cases Heat Transmission Walls = 1.94 W/m²K and Heat Transmission Roofs = 6 W/m²K.

Following is the summarizing table of all case studies taken in consideration with relevant parameters.

Table 1. Base Case Scenario

Case	Scenario	Simulation values	Description
1	Base Case	Roof albedo = 0.3 Wall albedo = 0.2 Initial Temp = 293 K (19.85°C) Relative Humidity 57 % Wind Speed 3 m/s	Walls = 25 cm red brick Roof covered with ceramic tiles Windows = single glazing Sim. date = 7.5.2017 Sim. time 09:00:00 - 16:00:00

Table 2. Other Scenarios

Case	Scenario	Simulation values	Description
2	Cool Case	Roof albedo = 0.9 All other parameters are the same as the base case	Roof covered with high reflectance material All other parameters are the same as the base case
3	Green Case	Roof albedo = 0.26 All other parameters are the same as the base case	Roof covered by 50 am tall grass All other parameters are the same as the base case
4	Base Case	All parameters are the same as the base case	Sim. date = 9.8.2017 All other parameters are the same as the base case
5	Cool Case	Roof albedo = 0.9 All other parameters are the same as the base case	Roof covered with high Sim. date = 9.8.2017 All other parameters are the same as the base case
6	Green Case	Roof albedo = 0.26 All other parameters are the same as the base case	Roof covered by 50 am tall grass Sim. date = 9.8.2017 All other parameters are the same as the base case

4. RESULTS AND DISCUSSIONS

This section reflects the most important calculated parameters: atmospheric air temperature, relative humidity, wind velocity, direct solar radiation, and relative solar radiation.

Thermal maps are shown in plan, pedestrian level z = 1.2 m (average visibility height), and in section at the level y = 30 m (relative to the highest building in model). Below you can find some of the results from each case study.

Simulation graphs of pot temperature, relative humidity, wind speed and direct solar radiation at 14:00, on 07.05.2017 are represented at Fig. 9, 10 for case 1, Fig. 11, 12 for case 2, Fig. 13, 14 for case 3, Fig. 15, 16 for case 4, Fig 17, 18 represent simulations for case 5 and Fig 19, 20 for case 6.

Case 1 - Base Case

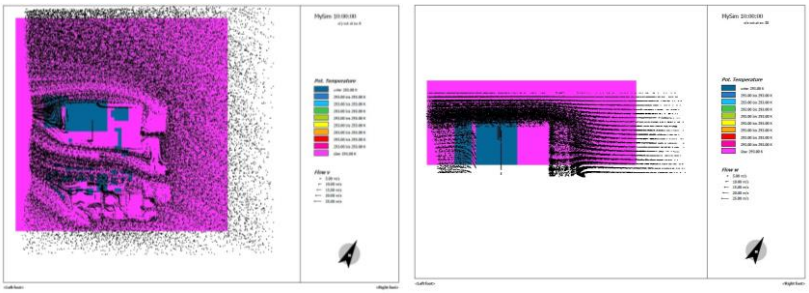

Fig. 9. Simulation 10:00 h, 07.05.2017, Pot Temp (plan and section)

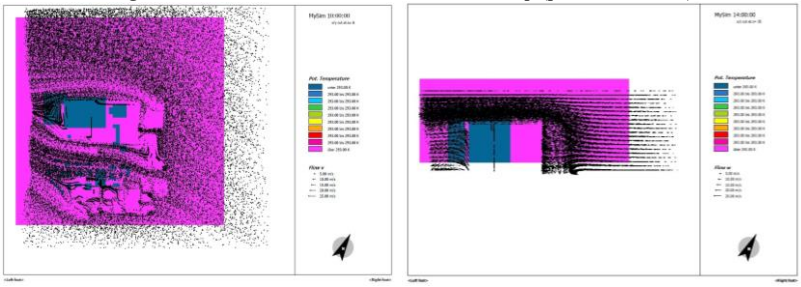

Fig. 10. Simulation 14:00 h, 07.05.2017, Pot Temp (plan and section)

Case 2 - Cool Case

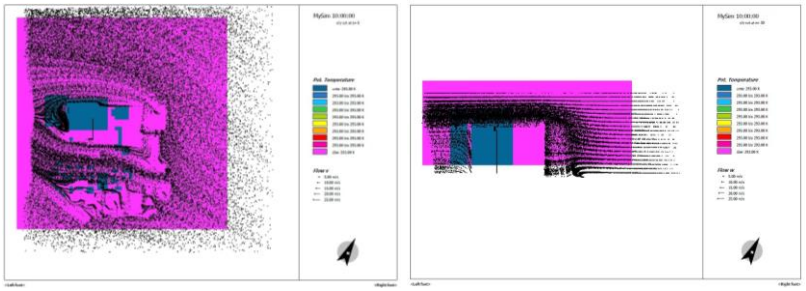

Fig. 11. Simulation 10:00 h, 07.05.2017, Pot Temp (plan and section)

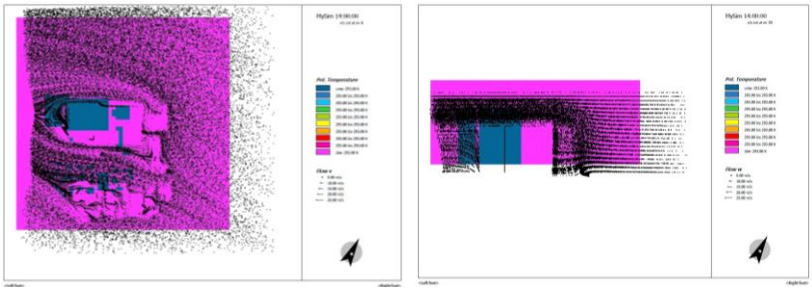

Fig. 12. Simulation 14:00 h, 07.05.2017, Pot Temp (plan and section)

Case 3 - Green Case

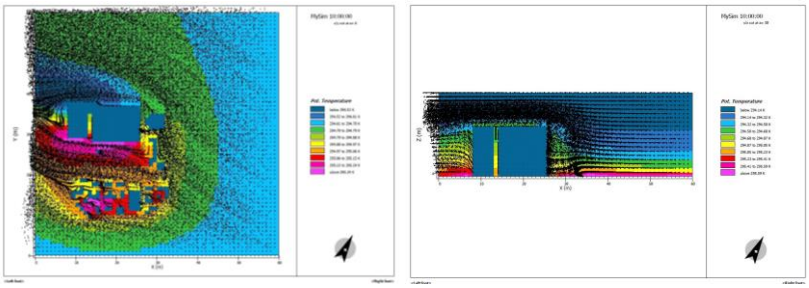

Fig. 13. Simulation 10:00 h, 07.05.2017, Pot Temp (plan and section)

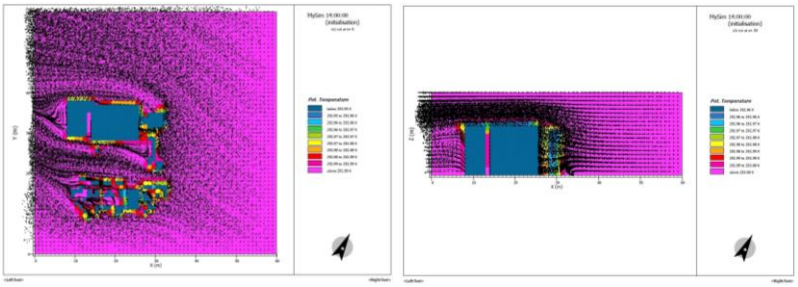

Fig. 14. Simulation 14:00 h, 07.05.2017, Pot Temp (plan and section)

Case 4 - Base Case

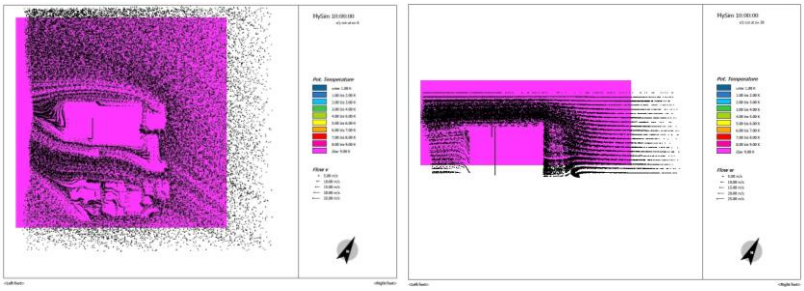

Fig. 15. Simulation 10:00h, 09.08.2017, Pot Temp (plan and section)

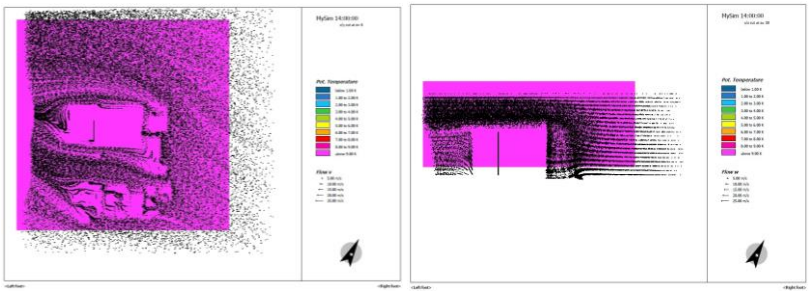

Fig. 16. Simulation 14:00h, 09.08.2017, Pot Temp (plan and section)

Case 5 - Cool Case

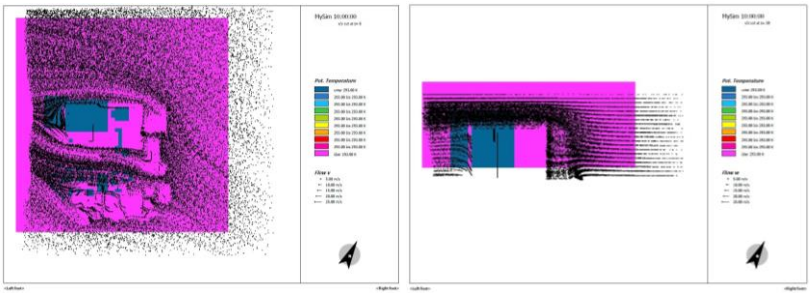

Fig. 17. Simulation 10:00 h, 09.08.2017, Pot temperature (plan and section)

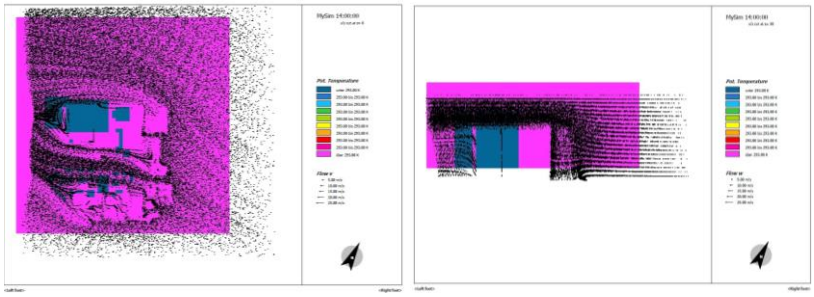

Fig. 18. Simulation 14:00 h, 09.08.2017, Pot temperature (plan and section)

Case 6 - Green Case

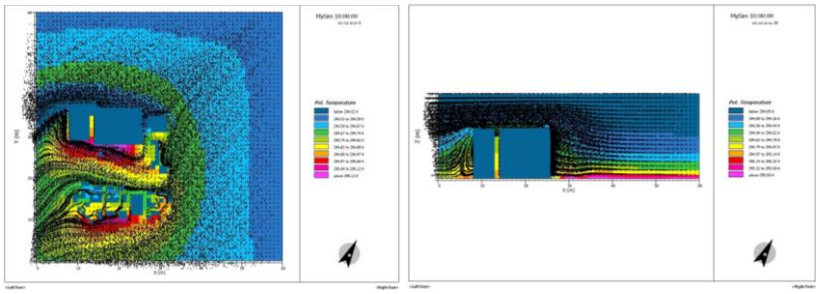

Fig. 19. Simulation 10:00 h, 09.08.2017, Pot temperature (plan and section)

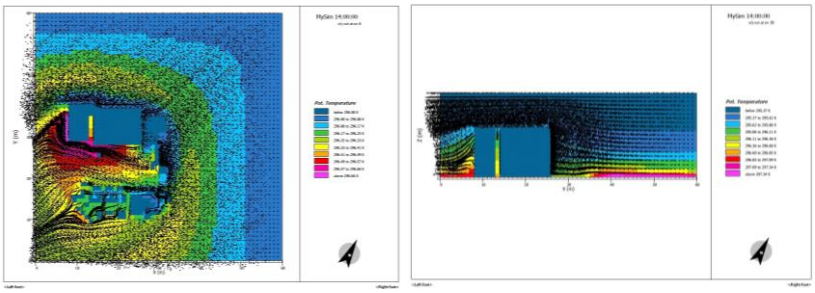

Fig. 20. Simulation 14:00 h, 09.08.2017, Pot temperature (plan and section)

The following (Fig. 21-24) are presented the conclusive graphics of the pot temperature max and average of the above simulations, comparing various scenarios (maximal and minimal, h 09:00 – 16:00), for Case 1 to 6.

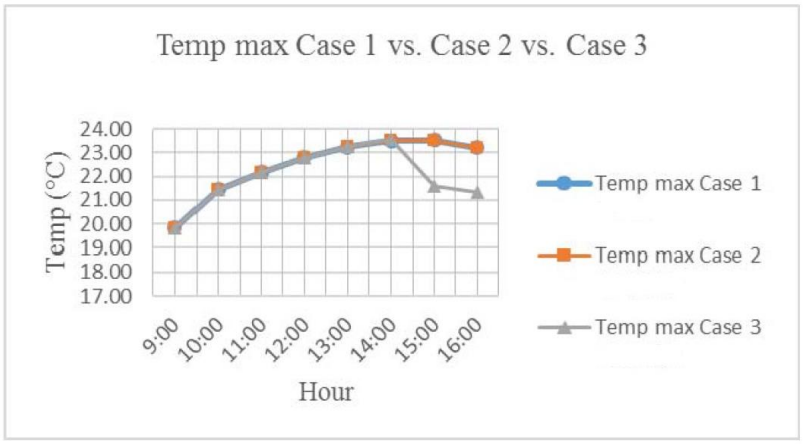

Fig. 21. Temperature max of Case 1 vs. Case 2 vs. Case 3

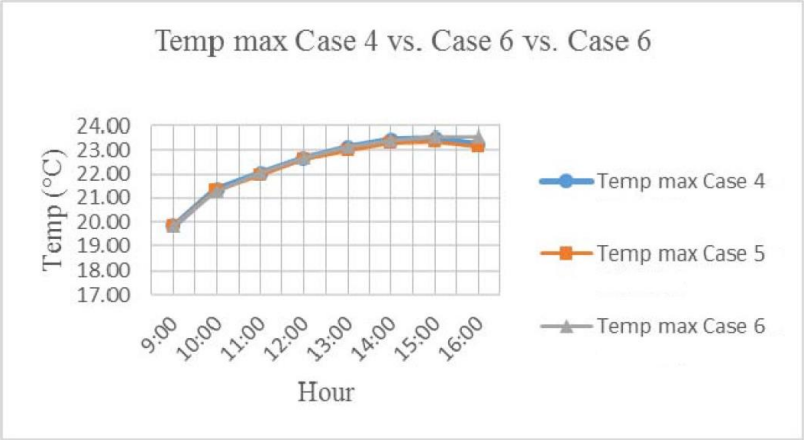

Fig. 22. Temperature max of Case 4 vs. Case 5 vs. Case 6

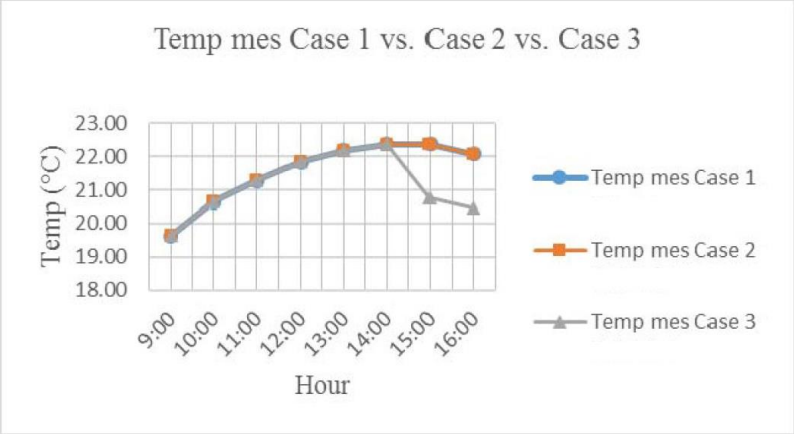

Fig. 23. Temperature average of Case 1 vs. Case 2 vs. Case 3

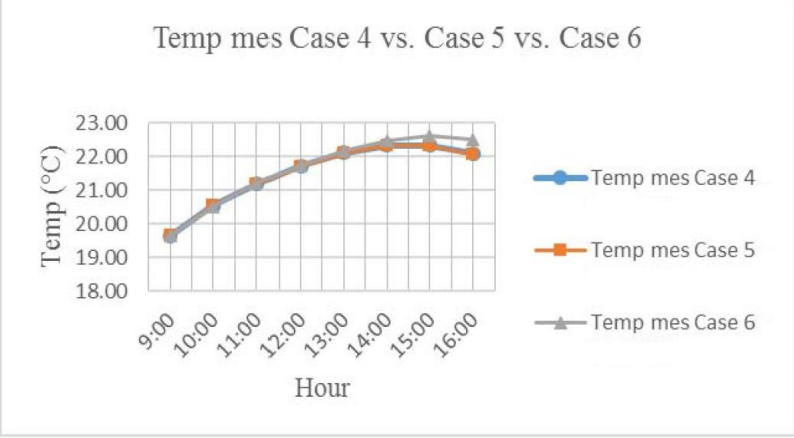

Fig. 24. Temperature average of Case 1 vs. Case 2 vs. Case 3

5. CONCLUSION

Urban heat islands have direct impact on amount of energy demand for buildings [17]. Hence, detailed analysis of microclimate parameters in Albanian neighbourhood should be focus of further studies.

This study was concentrated in concluding difference in temperatures between buildings with different albedo or various days of year, in cold and warm weather. The use of materials with high albedo can have positive and

negative effect on buildings, but other factors as site outline and building design can be decisive in local microclimate [18].

Acknowledgements

The completion of this research paper would not have been possible without the support and guidance of Prof. Ass. Sokol Dervishaj.

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Impact of Aggregate Characteristics on Strength of Concrete

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Abstract

This study was inspired by the demands of today's worldwide market for high rise buildings, with the intention of better territorial use and faster response to market changes. In this context, the production of durable concrete comesnot only as a result of these requirements, but also because with the entry into force of Eurocode, a code approved inAlbania, the lifespan of buildings must be not less than 80 years. For these reasons, it is suggested to produce durable concrete with aggregates of our sources, which impact can be tested in the compressive strength of durable concrete. For the purpose of this study were used two types of aggregates: crushed and natural, collected respectively from carbonic layers of Fushe Kruja mountain and Perroi i Thate, Mat river. Based on international references and author experience, the ratio w/c=0.4 constant was determined [1]. To observe the effects of crushed and natural river aggregates, all other components like water, cement, admixture, temp of environment of mix design were kept constant. Compressive strength difference for all groups at 7, 28, 90 days were analyzed at the end of the study. The compressive strength of concrete, made with crashed aggregates are 1.7% more than the other aggregates.

Keywords: Durable Concrete1, aggregate effect2, Albanian aggregates characteristics3**.**

1. INTRODUCTION

Aggregates occupy about 80 percent of the volume of typical concrete mixtures, and their characteristics have a definitive impact on the performance of fresh and hardened concrete [2]. This study was concerned mainly with the geometric and chemical characteristics of aggregate particles, that is, shape, grading, and the amount and type of aggregates, as well as their effect on the workability (assessed by means of the slump cone) of fresh concrete and their effect on the compressive strength of hardened concrete [3]. The results conclude that shape and type play an important role on the performance of fresh concrete, particularly in slump and flow. Results from mixtures with the same grading show that the slump and flow of mixtures increased with the packing density of aggregates and that the super plasticizer dosage required to reach the target slump decreased with the packing density of aggregates. Themean slump varied from 160 mm. for crashed materials to 2.1 in. for **natural aggregate** from Lumi Matit (Perroi i Thate) and **crashed aggregates** (carbonate aggregate from Fushe Kruja) quarries. The mean dosage of super plasticizer required to reach a 200 mm target slump varied from 1-1.2% of cement [2]. Natural river materials were the aggregates with the smallest packing density and crashed materials were the one with the highest packing.

The effect of grading was also verified. Differences in grading resulted in differences in slump as high as 50mm. Formixtures with the same amount of fines, differences due to grading were found. Aside from slump or flow the effect of grading on place ability and finish ability was observed [5].

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To reach a desired slump, the water reducer demand increased with the amount of fines. However, the type of fines also played a significant role in the water reducer demand. In this study, limestone fines consistently required less super plasticizer than natural aggregate fines, even when limestone fines were composed of finer particles than the other two. The super plasticizer demand increased with the amount of fines without exception. However, the rate of increase of super plasticizer demand was low for low amounts of fines and high for high amounts of fines.

The amount and type of fines had only a slight effect on compressive and flexural strength in mixtures with water reducers. Natural river aggregates consistently produced mixtures with higher strength than the rest of the mixtures (with limestone) that had about the same strength. Natural river aggregates resulted in mixtures with compressive strength about 7 percent higher than mixtures with limestone.

From the results no conclusions could be made about the effect of shape and texture on strength since it depends not only on shape and texture but on the mechanical and the chemical characteristics of aggregates. The tests were designed to separate these effects [1].

2. MATERIALS AND METHODOLOGY

For the purpose of this analysis, the concrete is produced in SAG concrete plant. Concrete components are produced according to Albanian Standard S EN 206-1: 2000, with resistance class C30/37 for expose class XS1, structures near or to on the coast (in Durres, Albania), CEM I 42.5 R, admixture Chryso-Fluid Premia 180, using crashed aggregates (carbonic, obtained in Fushe Kruja) and natural river aggregates (obtained by Perroi i Thate, Mat River).

2.1 Cement

Composition of Portland Cement, CEM I 42.5 R type, from ANTEA, Titan cement, conforming EN 197-1 was used in this study. In the following table (1) are presented chemical compositions of cement used. Knowledge of this chemical composition is of particular importance, as exceeding the standard limits can damage the properties of concrete. This analysis data was obtained by Titan manufacturer, on May 2019, from whom have been obtained the cement used in this study, with specific gravity 3.08 gr/cm^3. The manufacturer included its own laboratory and publication of this data are made with their approval.

Table 1 Chemical Composition of CEM I 42.5 R TITAN cement

No.	Chemical composition	Units	Test results	Standard limit based onEN 197-1 standard	Conformity
1	SiO_2 (Min.)	%	20.04	Over 80%	ok
2	Fe_2O_3 (Min.)	%	3.68	Over 60%	ok
3	Al_2O_3 (Min.)	%	5.02	Over 25%	ok
4	MgO (Max.)	%	1.72	Up to 5.00%	ok
5	CaO (Min.)	%	64.26	Over 10.00%	ok
6	SO_3 (Max.)	%	2.97	Up to 3.50%	ok
7	Chloride content (Cl) (Max.)	%	0.0034	Up to 0.10%	ok
8	Loss on ignition (L.O.I)	%	1.53	Up to 5.00%	ok
9	Insoluble residue (Max.)	%	1.03	Up to 1.50%	ok

2.2 Aggregates

Two sources of aggregates were selected, crushed and natural. These sources were intended to cover a wide range ofaggregates commonly used in the Albania in terms of shape and texture. The crushed aggregates consisted of limestone (LS); gravel (GR) and crashed sand (CR) from Fushe – Kruja quarries, all with more than 12 percent fines [2].

- **Fine aggregate,** – sand is produced by processing rocks into limestone, with strength resistance of 80 N/mm2; granulometric 0-5 mm; production according to Standard **S SH 505:1987**; bulk density 2.687 gr/cm^3; volumetric mass 1452 kg/m^3; fine modulus 2.74,

- **Coarse aggregates** – granulated stone is produced by the processing of rocks into limestone with strength resistance -80 N/mm2; granulometric 5-25 mm; production according to Standard **S SH 509:1987**; specific gravity 2.696 gr/cm^3; volumetric mass 1484 kg/m^3; fine modulus 6.07. Aggregate analyzes were performed by the laboratory "KIBE 1 LABORATORI", located in Durres, Albania. Chemical characteristics of aggregates used for production of durable concrete are represented in table 2.

Table 2 Chemical composition of crashed aggregates

Measured parameters / Percent [%]	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	Cl
	9.8	54.9	0.49	4.12	0.01	0.013

The natural aggregates were siliceous river gravels from Mat river quarries in north of Albania. Coarse and fine aggregates obtained from Mat river Perroi i Thate quarry units have been used for this study. Maximum size of coarse aggregate used is 25 mm and specific gravity of ranging from 2.6 - 2.7 kg/m3 based on standard S SH 509:1987; bulk density 1484 kg/m3 and fine modulus 6.07. For fine aggregates maximum size used is 5 mm and specific gravity of ranging from 2.687 kg/m3 based on standard S SH 509:1987; and fine modulus 2.74.

Chemical characteristics of aggregates used for production of durable concrete are represented in table 3.

Table 3 Chemical composition of natural river aggregates

Measured parameters / Percent [%]	SiO_2	CaO	MgO	Al_2O_3	Fe_2O_3	Cl
	43.67	4.68	13.3	2.05	5.67	0.001

Aggregates are inert and chemically solid bodies that are held together by cement. They are presented by different shapes and dimensions, ranging from fine sand fragments to large stone fragments. 70% to 80% [2] of concrete volume consists of aggregates which provide low cost of the concrete. The selection of an aggregate is determined, depending on the characteristics of the desired concrete, for instance the density of concrete is determined by the density of the aggregates. Soft and porous aggregates can result in poor concrete quality and consequently lead to structure breakdown, while the use of hard aggregates may result in strong concrete with high abrasion resistance (corrosion) [6].

In order to get the best results, the aggregates must be clean, tough and strong. The aggregate is usually washed to remove any dust, clay, organic substance or other impurities that may interfere with the bonding reactions of the cement paste. In addition, they are divided according to different dimensions, during the process of passing the material in series of sieve with holes of different sizes, EN 12620 [2].

Table 4 Use of aggregates in concrete classes [2]

Classes	Examples of aggregates used	Usages
Very light weight	Vermiculite Ceramic spherePerilit	Very lightweight concrete that can be cut or nailed down. They are also distinguished for their insulatingproperties.
Light weight	Swelling clays Chopped bricks	Mainly used for the production of concrete with lightweight structures, as well as for insulation properties.
Normal weight	Crushed stoneSandy River gravel Recycled Concrete by fragmentation	Used for the design of normal concrete

Heavy weight	Iron or steel shells Iron or steel hinges (dismantled)	Used for the production of high density concrete for shielding against nuclear radiation.

The choice of aggregates is determined by the concrete proposed to be produced; where sandstone, gravel and crushed stones are normally used. The aggregate should be well classified to improve efficient collection and minimize the amount of cement required, making the concrete more workable.

2.1.3 Water

Water infiltration into cement is the key of reaction happening in cement hydration. Potable tap water available from the production site was used for mixing and curing of concrete. Water and cement initially form the cement paste which begins to react and harden (freezing). This paste binds the aggregate particles to the chemical process of hydration. In cement hydration, chemical changes occur slowly, eventually creating new crystalline products that are associated with heat development and other readily available indicators.

cement + water = hardened cement paste

The properties of this hardened cement paste control the properties of concrete. This infiltration causes the concrete to start freezing, hardening and finally solidifying. After freezing begins, the concrete continues to harden for a long period of time, often up to several years. Concrete resistance is dependent on water/cement ratio which, for a value above 0.6, produces low strength concrete, due to increased porosity created during the hydration process. Most concrete is produced with a ratio of water / cement mass in the range of 0.35 to 0.6. To produce durable concrete this ratio is seen to be in the range 0.35-0.45 [6].

Potable tap water available production site was used for mixing and curing of concrete.

The water is filtrate based on standard **S Sh** 2751:1987, with Chemical analysis of water used in mix design, table 5.

Table 5: Chemical analysis of water used in mix design

No.	Characteristics	Units	Test results	Standard limit EN 1008
1	Water		Well water	-
2	Color		Transparent	-
3	Odor		None	-
4	Water density @ 190 C	kg/l	1.0082	0.9982
5	Total hardness (CaCO3)	mg/l	2.91	-
6	Total dissolved solids at 180 ˚C	mg/l	3.82	≤ 4
7	pH value		7.61	≥ 4
8	Chloride content Cl-	mg/l	1241	≤ 1000
9	Sulphate content SO4-	mg/l	4996	≤ 2000
10	Salts content	mg/l	0.02	≤ 100

2.1.4 Concrete admixtures

Additives used in this project are; Chryso-Fluid Premia 180 (super plasticizer). According to EN 206-1, in quantities1-1.2% of cement weight in concrete and according to the requirements described in EN 934-2. Additive is used to produce concrete class C30/37 N/mm2 and the result was decreasing the amount of water. The effect of using the lowest amount of water is increasing the durability and resistance of concrete. The additive used was purchased by KIBE1 laboratory, in quantities 3 l/m³ concrete [2].

3. METHODOLOGY

3.1 Selection and analysis of aggregates

For the production of the durable concrete, with **ratio** $_{w}$ **= 0.4**, with both types of aggregates, first, we perform granulometric analyzes of each type and for the three fractions [6]. The following characterization tests were conducted on coarse aggregates:Sieve analysis: EN 933-1, Specific gravity and absorption capacity: EN 1097-7

The following characterization tests were conducted on fine aggregates:Sieve analysis: EN 933-1

Specific gravity and absorption capacity: EN 1097-7.
In tables 6 & 7, for crashed aggregates, are presented the Granulometric grain analysis & cumulative passing calculations of natural river materials and their Specific gravity and absorption.

Table 6 Granulometric grain analysis & cumulative passing calculations of crashed materials

eve ening	Retaining on sieve [g]			Cumulative passing [g]			Cumulative passing [%]		
	Fraction I	Fraction II	FractionIII	Fraction I	FractionII	FractionIII	FractionI	FractionII	Fraction III
[mm]	0/5mm	5/10mm	10/25mm	0/5mm	5/10mm	10/25mm	0/5mm	5/10mm	10/25mm
37.5	0.00	0.00	0.00	2318.62	2515.30	6671.80	100.00%	100.00%	100.00%
25	0.00	0.00	215.00	2318.62	2515.30	6456.80	100.00%	100.00%	96.78%
19.1	0.00	0.00	3546.80	2318.62	2515.30	2910.00	100.00%	100.00%	43.62%
12.5	0.00	0.00	2154.30	2318.62	2515.30	755.70	100.00%	100.00%	11.33%
9.5	0.00	30.20	652.30	2318.62	2485.10	103.40	100.00%	98.80%	1.55%
4.75	0.00	829.20	98.20	2318.62	1655.90	5.20	100.00%	65.83%	0.08%
2.36	8.10	1611.50	2.00	2310.52	44.40	3.20	99.65%	1.77%	0.05%
1.18	578.24	30.40	0.00	1732.28	14.00	3.20	74.71%	0.56%	0.05%
0.6	551.20	1.00	0.00	1181.08	13.00	3.20	50.94%	0.52%	0.05%
0.3	544.86	0.00	0.00	636.22	13.00	3.20	27.44%	0.52%	0.05%
0.15	421.84	0.00	0.00	214.38	13.00	3.20	9.25%	0.52%	0.05%
0.075	158.20	6.10	0.00	56.18	6.90	3.20	2.42%	0.27%	0.05%
Passing	56.18	6.90	3.20						
Total	2318.62	2515.30	6671.80						

Table 7 Specific gravity and absorption of crashed materials

Crashed aggregate fractions	Specific density [kg/m^3]	Humidity [%]	Absorption [%]
Fraction I (0/5mm):	2610	4	1.5
Fraction II (5/10mm):	2589	2	0.6
Fraction III (10/25mm):	2541	1	0.8

In tables 8 and 9, for natural river aggregates, are presented the Granulometric grain analysis & cumulative passingcalculations of natural river materials and their Specific gravity and absorption

Table 8 Granulometric grain analysis & cumulative passing calculations of natural river materials

Sieve opening	Sieve retaining [g]			Cumulative passing [g]			Cumulative passing [%]		
	Fraction I	Fraction II	Fraction III	Fraction I	Fraction II	Fraction III	Fraction I	Fraction II	Fraction III
[mm]	0/5mm	5/10mm	10/25mm	0/5mm	5/10mm	10/25mm	0/5mm	5/10mm	10/25mm
37.5	0.00	0.00	0.00	2476.40	2787.50	6703.30	100.00%	100.00%	100.00%

25	0.00	0.00	125.30	2476.40	2787.50	6578.00	100.00%	100.00%	98.13%
19.1	0.00	0.00	3222.00	2476.40	2787.50	3356.00	100.00%	100.00%	50.06%
12.5	0.00	0.00	2845.30	2476.40	2787.50	510.70	100.00%	100.00%	7.62%
9.5	0.00	10.30	453.10	2476.40	2777.20	57.60	100.00%	99.63%	0.86%
4.75	0.00	1023.60	54.00	2476.40	1753.60	3.60	100.00%	62.91%	0.05%
2.36	2.00	1700.30	1.00	2474.40	53.30	2.60	99.92%	1.91%	0.04%
1.18	658.30	50.30	1.00	1816.10	3.00	1.60	73.34%	0.11%	0.02%
0.6	635.20	0.50	0.00	1180.90	2.50	1.60	47.69%	0.09%	0.02%
0.3	725.30	0.00	0.00	455.60	2.50	1.60	18.40%	0.09%	0.02%
0.15	323.20	0.00	0.00	132.40	2.50	1.60	5.35%	0.09%	0.02%
0.075	120.30	1.00	0.00	12.10	1.50	1.60	0.49%	0.05%	0.02%
Passing	12.10	1.50	1.60						

Total	**2476.40**	**2787.50**	**6703.30**

Table 9 Specific gravity and absorption of natural river materials

Crashed aggregate fractions	**Specific density [kg/m^3]**	**Humidity [%]**	**Absorption [%]**
Fraction I (0/5mm):	2703	6	0.9
Fraction II (5/10mm):	2710	4	0.5
Fraction III (10/25mm):	2674	3	0.4

According to European Standards EN 480-1, in term of the presence of fine particles (below 0.063 mm) aggregate fractions used for concrete are given in graphic below [9]. The following graph shows the granulomatous composition of the aggregate and the corresponding optimal curve "L(OP)" or the optimal combination (table 10, Fig 1).

Table 10 Grading curve range to EN 480-1, Grain maximal diameter = 31.5 mm - crashed and natural river materials.

EN 480-1	**Sieve (mm)**	**0.075**	**0.15**	**0.300**	**0.600**	**1.18**	**2.36**	**5**	**10**	**14**	**20**	**28**	**37.5**	**FM**
Aggregates		**passing in %**												
Crush. sand from mountain 0/4 mm		18.61	22.3	25.27	28.28	40.86	71.33	99.76	100	100	100	100	100	3.94
Natural sand from river 0/4 mm		4.41	5.79	14.33	26.08	50.96	77.96	97.8	100	100	100	100	100	4.23
Crush. aggregate stone 05/10 mm		0.55	0.55	0.55	1.59	1.71	2.44	19.03	98.29	100	100	100	100	6.75
Crush. aggregate stone 10/35 mm		0.36	0.40	0.43	0.45	0.48	0.51	0.54	7.63	36.13	53.33	96.51	100	9.03

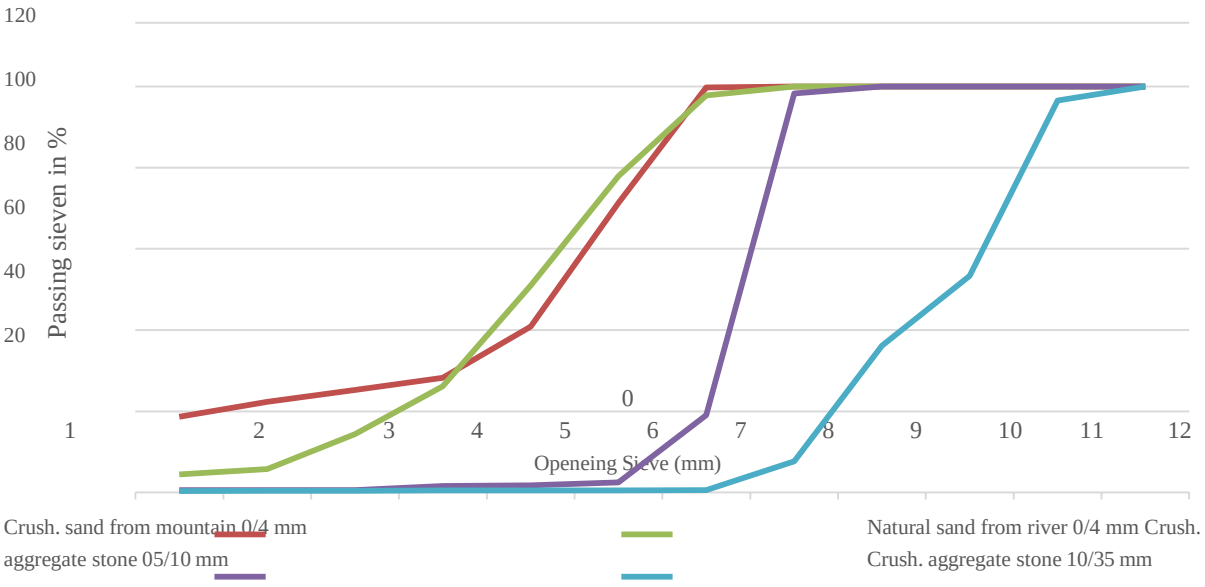


Fig 1 Graphics presentation of sieve analysis on aggregates.

In addition to above said, there have been taken into account also physical-chemical and mineralogical-petrographiccharacteristics, including:

- Chemical composition of pattern rock,
- Mechanical solidity of the stone,
- The shape and structure of the grains after fracture and fractionation,
- Purity of aggregates.

In all aggregate fractions, the amount of fine particles (below 0.063 mm) has been determined in advance.

3.2 Proportioning methods study

In this study, two proportioning methods were evaluated. Different sets of mixtures were proportioned and analyzed using these Bolomey methods. The potential of the methods to optimize aggregates was evaluated and, accordingly the method was selected for the Optimization Study.

Except from international literature, the preparation of Mix design was also referred to the PhD Dissertation of AlmaGolgota, as well as in the authors book “Durable concrete made with raw aggregates mountain materials” [1]. With this mix design were prepared the recipes and quantities of all concrete ingredients, following up with the production of concrete cubes (table 11).

After concreting, the cubes were treated by keeping them in water baths at a temperature 18-20°, in order to test them in compressive strength after 7, 28 and 90 days. For the selected aggregates, the graph of the granulometric analysis is presented below.

Table 11 Concrete mix designs formulations, for concrete with resistance class C30/37

m3 concrete [kg] withW/Cem =0.4			Crashed materials	Natural river materials	EN 206-1	
1. Aggregates:						
	Fraction I (0/5 mm)	0/5 mm=	895	915	48%	48%
	Fraction I (5/10 mm)	5/10 mm=	298	294	16%	15%
	Fraction II (10/25mm)	10/25mm=	668	695	36%	37%
	Total quantity of aggregates	a=	1861	1904		
2. Cement:						
	Cem I 42.5 R	c=	395	360	min= 300kg/m3	
3. Water:						
	Well water	w=0.4	158	144		
4. Additive:						
	Chryso-Fluid Premia 180	d_1=	3.32	4.32		

4. RESULTS AND TABLES

4.1 Effect of grading

Grading or particle size distribution affects significantly some characteristics of concrete like packing density, voids content, and, consequently, workability, segregation, durability and some other characteristics of concrete. Particle size distribution of fine aggregate plays a very important role on workability, segregation, and pump ability of fresh concrete. Many authors claim that uniformly distributed mixtures produce better workability than gap-graded mixtures although higher slumps could be achieved with gap-graded mixtures. Both coarse aggregate and fine aggregate should be uniformly graded. If fine aggregate is too coarse it will produce bleeding, segregation and harshness, but if it is too fine, the demand for water will be increased Proper grading should depend on shape and texture of aggregates. For instance, suitable grading for natural sands could lead to bad results when using manufactured sands. Grading should also be changed depending on the construction procedures [7].

Permeability, one of the most important factors affecting concrete durability, is significantly related to void content of aggregate mixture: the lesser the void content, the lesser the permeability. In reducing permeability, it is desirable to have the highest aggregate content possible. Consequently, well-graded mixtures produce concrete that is more durable [8].

The results obtained from granulometric grain analysis of tables 6 and 8, are present in graphs below. From these graphs we can clearly distinguish the percentage of gravity of each of the aggregates.

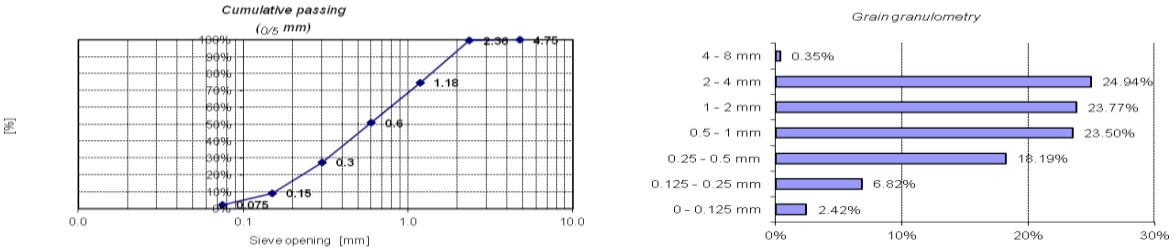


Fig 2.3 Granulometric grain analysis & cumulative passing diagram for fraction I (0/5mm) – crashedmaterials

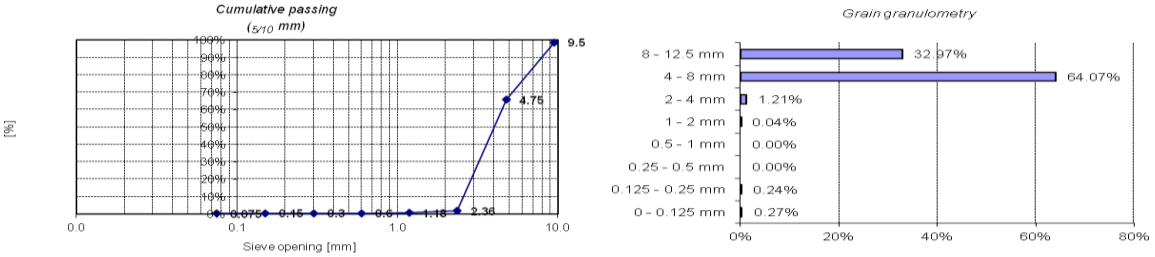


Fig 4,5 Granulometric grain analysis & cumulative passing diagram for fraction II (5/10mm) – crashedmaterials

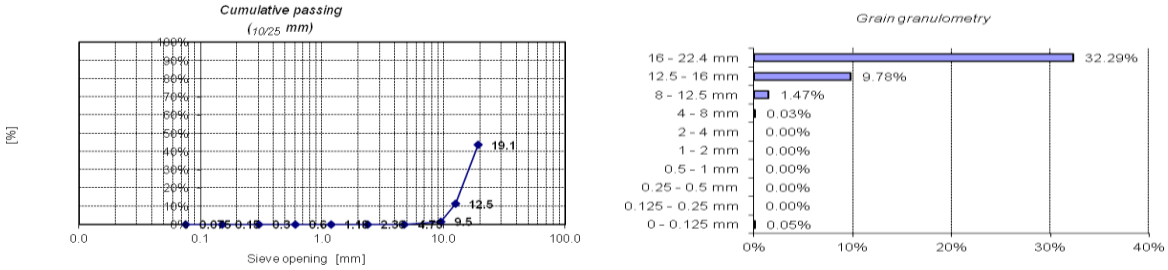


Fig 6,7 Granulometric grain analysis & cumulative passing diagram for fraction III (10/25mm) – crashedmaterials

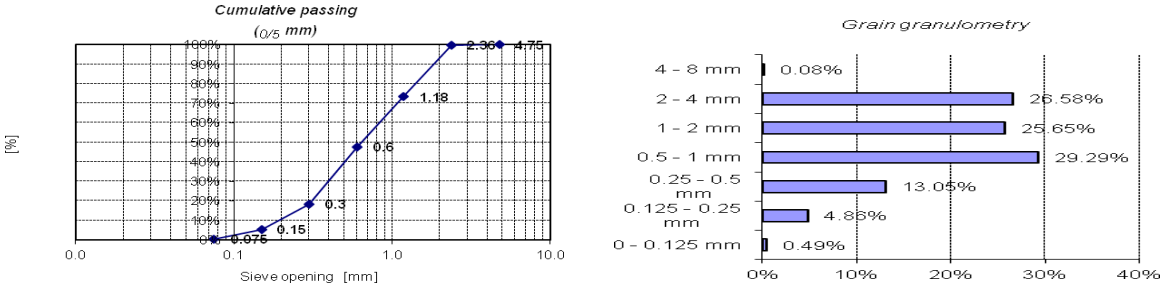


Fig 8,9 Granulometric grain analysis & cumulative passing diagram for fraction I (0/5mm) – natural rivermaterials

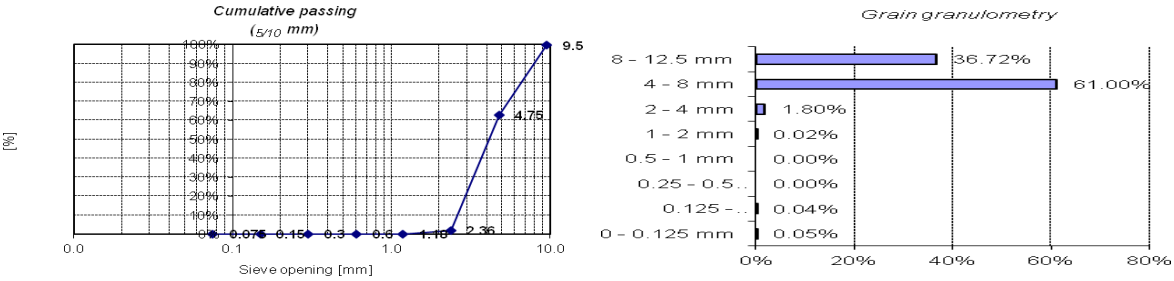


Fig 10,11 Granulometric grain analysis & cumulative passing diagram for fraction II (5/10mm) – naturalriver materials

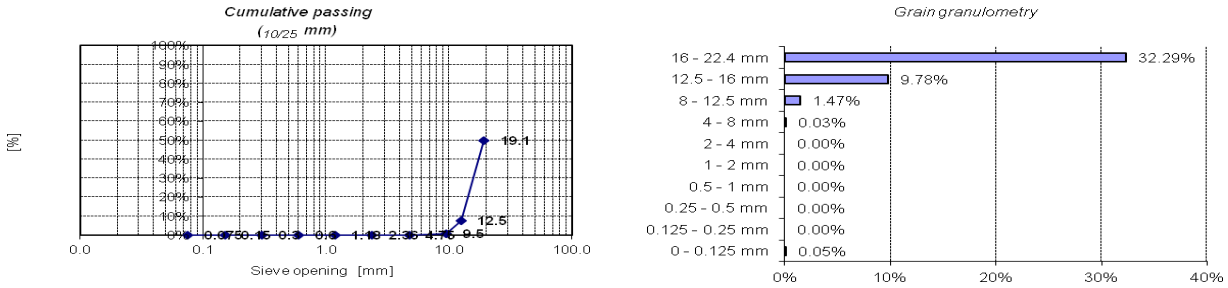


Fig 12,13 Granulometric grain analysis & cumulative passing diagram for fraction III (10/25mm) – naturalriver materials

4.2 Effect of Absorption

Aggregate porosity may affect durability as freezing of water in pores in aggregate particles can cause surface pop outs. However, the relationship between absorption and freeze-thaw behavior has not proven to be reliable. Nevertheless, absorption can be used as an initial indicator of soundness. Furthermore, aggregates with low absorption tend to reduce shrinkage and creep [9].

4.2 Effect of Absorption

Compressive strength, of mixes was determined at various ages as per EN 12390-3:2000, EN 12390-4:2000 and EN 12390-5:2000 are given in table 10 and 11. Cube Compressive strength at the age 7, 28 and 90 days. After casting the specimens were covered with sheets to minimize the moisture loss from them. Specimens were demolded after 24-hours and then cured in water at approximately room temperature till testing and under normal conditions of a construction site [4]. Compressive strength tests for cubes were carried out at 7 days up to 90 days, according to EN 206-1. All the specimens were tested in an automated compressive strength machine. Laboratory KIBE 1, analyzes of these cubes were performed after 7 days, after 28 days and after 90 days. The results are shown in table 12, 13 as follows:

Table 12 Main properties of fresh and hardened concrete

Hardened concrete properties	**Concrete made with crashedaggregates**	**Concrete made with natural riveraggregates**
Density of fresh concrete [kg/m^3]	2417	2412
Consistence (Slump test) [mm]	160	210
Water /cement ratio	0.4	0.4

Table 13 Main Compressive strength data for 7, 28, 90 curing days

Sample code	*7 Days [N/mm2]*		*28 Days [N/mm2]*		*90 Days [N/mm2]*	
	Crashed materials	*atural rivermaterials*	*Crashedmaterials*	*atural rivermaterials*	*Crashed materials*	*atural rivermaterials*
Sample 1	17.253	16.892	41.357	41.483	49.337	44.072
Sample 2	17.210	16.795	41.615	41.039	49.250	45.252
Sample 3	18.265	17.542	43.231	42.569	49.897	46.214
Sample 4	18.333	18.023	42.987	41.874	48.987	47.001
Sample 5	17.321	17.002	42.560	42.321	47.456	46.874
Sample 6	19.211	17.215	44.023	42.012	49.022	47.560
Sample 7	16.998	17.023	41.236	41.154	48.564	47.745
Sample 8	18.002	17.213	42.564	41.562	47.568	46.451
Sample 9	17.368	16.874	43.000	41.654	48.987	47.023
Sample 10	18.213	17.452	43.985	43.874	49.874	48.541
Average	**17.8174**	**17.2031**	**42.6558**	**41.9542**	**48.8942**	**46.6733**

The results obtained from table 11, are shown in graphs 14, giving us a clearer idea of the dependence and influence of the compressive strength of concrete, produced in both cases, made crashed and natural aggregates.

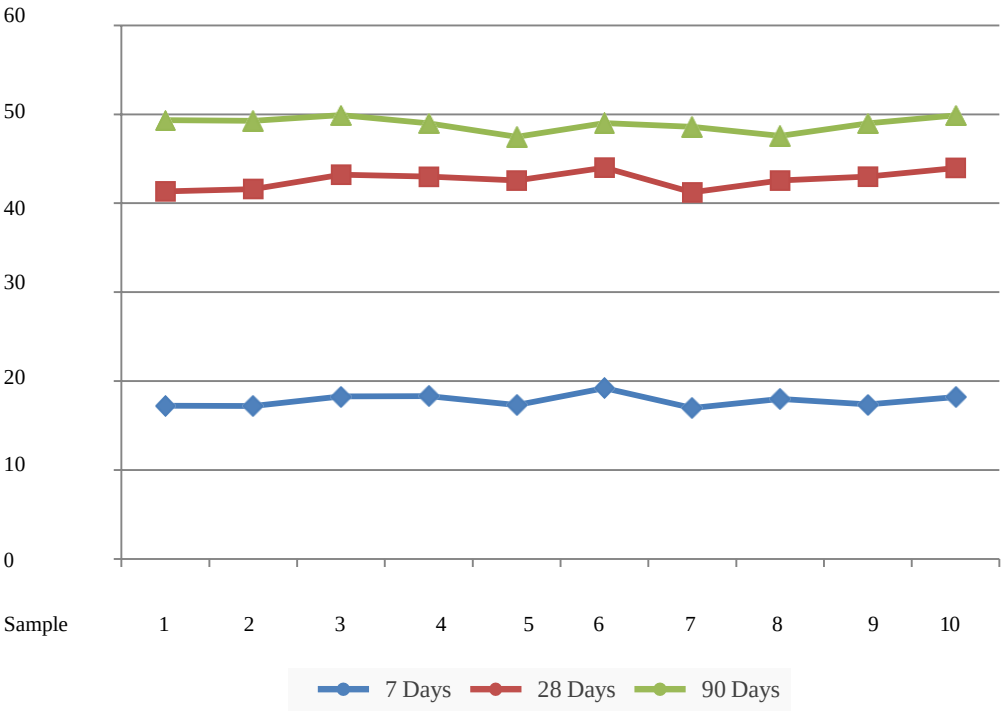
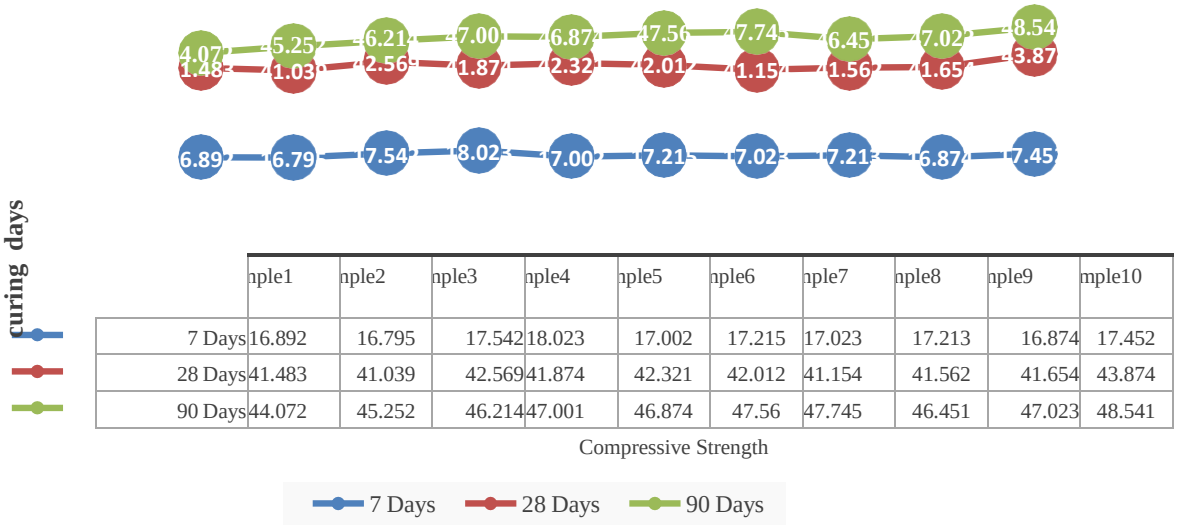


Fig 14. Comparison of compressive strength data for concrete made crashed aggregates



	nple1	nple2	nple3	nple4	nple5	nple6	nple7	nple8	nple9	mple10
7 Days	16.892	16.795	17.542	18.023	17.002	17.215	17.023	17.213	16.874	17.452
28 Days	41.483	41.039	42.569	41.874	42.321	42.012	41.154	41.562	41.654	43.874
90 Days	44.072	45.252	46.214	47.001	46.874	47.56	47.745	46.451	47.023	48.541

Fig 15. Comparison of compressive strength data for concrete made natural aggregates

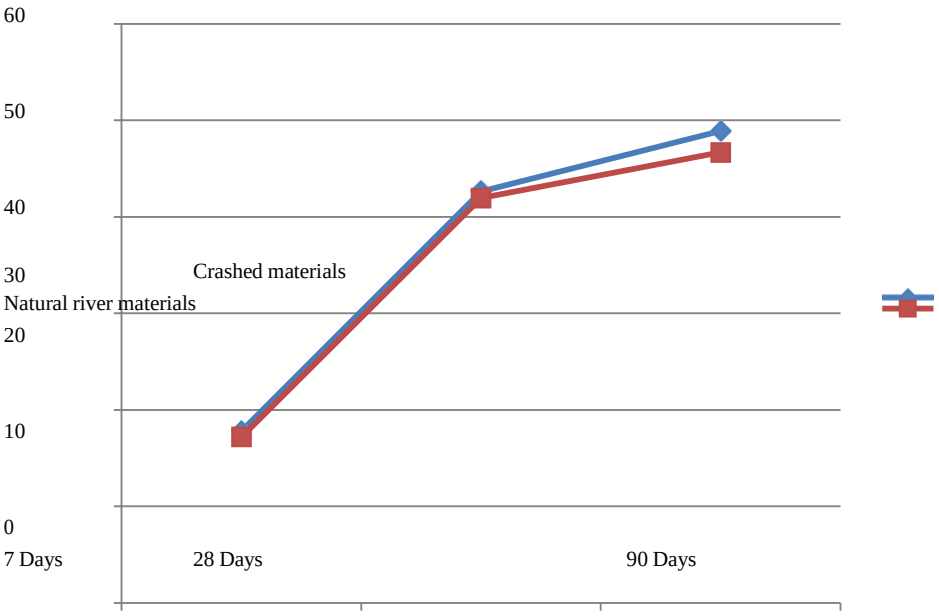


Fig 16. Comparison of compressive strength data for concrete made crashed and natural aggregates

5. CONCLUSIONS

In conclusion, was achieved the purpose of producing a durable concrete with country aggregates, studying concretewith resistance class C 30/37. The study tested two types of aggregates obtained from two different sources, mountain and river (crashed vs. rounded aggregates). Their individual characteristics had different infuences in the compressive strength of produced concrete.

From the laboratory tests of the concrete cubes treated for 7, 28 and 90 days, the following conclusions were reached:

- Aggregates are such important components in compressive strength of durable concrete.
- Durable concrete is a composite material that consists of filler and binding aggregates.
- The roundness and angularity are the important characteristics of aggregates. Roundness is the outline of the particle and it may be measured in terms of convexity where angularity indicates the sharpness of the edges and

corners.

- The overall or compressive strength of durable concrete depends on the certain properties of aggregates like source of aggregates, normal or light or heavy weight aggregate, size of aggregate, shape of aggregate, crushingtype of aggregates, angularity index, surface texture
- The amount of compressive strength, after 7 days, reached fck.cube=17.82 N/mm2 for crashed aggregates versus fck.cube=17.2 N/mm2 for natural river aggregates.
- The amount of compressive strength, after 28 days, reached fck.cube=42.66 N/mm2 for crashed aggregates versus fck.cube=41.95 N/mm2 for natural river aggregates or 1.7% more.
- The amount of compressive strength, after 90 days, reached fck.cube=48.89 N/mm2 for crashed aggregates versus fck.cube=46.67 N/mm2 for natural river aggregates.
- It is important to note that **compressive strength was achieved by both types of aggregates used**.
- It is suggested that in the production of concrete we use river aggregates and mountain aggregates: those of the river, in their rounded form, give the concrete high workability and better continuity of the pumped concrete process; while mountain aggregates, with their broken shapes, give concrete a higher chance of increasing the specific surface area, and consequently better and more durable bonding with cement, thus giving it higher compressive strength.
- In conclusion, **compressive strength of durable concrete is directly related to aggregates shapes** composition and properties.
- Durable concrete with the required resistance class C30/37, can be produced with both types of aggregates.
- All tests are performed in reference to Standard EN 206-1:2000, EN 12620:2000. EN 480-1, ATSM, for cement according EN 197-1.
- Future research should consider the properties of durable concrete characteristics on Slump.

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Perceived Behavioral Control Influences Young Employees' Intention to Behave Green

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Abstract

Universities play an important role in the development of economic systems based on knowledge and innovation, increasing resource efficiency, environmental friendliness, and competitiveness in order to encourage cultural progress, social and territorial cohesion. This article is a result of the project "Young Managers for a Greener Economy" at the University of Tirana in the framework of the grant "UT - Research, Excellence and Innovation". The project's major goal is to increase students' intention to be environmentally conscious as future managers and customers by including sustainability issues and green economy principles into the Faculty of Economics curriculum. The authors applied Ajzen's (1991) theory of planned behaviour to investigate how perceived behavioural control effects future managers' green behaviour in the workplace. An online survey of 319 students and a linear regression analysis revealed that perceived behavioural control has a positive effect on students' green behavioural intentions. The results showed that behavioural intentions were substantially connected with some demographic factors, specifically field of study and residence (urban or rural), but there was no significant relationship with gender or work status. However, additional research should be conducted to enhance students' knowledge of this critical topic. Universities, policymakers, and students should work together more effectively to promote environmentally friendly behaviours and green skills in order to create a more sustainable economy.

Keywords: perceived behavioural control, green behavioural intentions, subjective norm, green economy, attitude

1. INTRODUCTION

Concern for the environment and the diminishing availability of resources is undoubtedly a relevant issue, both personally and organizationally (Mendoza et al., 2022). Faced with internal and external pressure to adapt and implement environmentally friendly business activities, organizations are developing green organizational skills (El-Kassar & Singh, 2018). The need for human behavioral modification toward more pro-environmental behaviors is

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well recognized by researchers, who point to the need for empirical research that investigates how promoting workplace pro-environmental behaviors can be achieved (Robertson & Barling, 2013). The literature on environmental management has mostly focused on formal and organizational level practices: pollution prevention measures, green technologies, sustainability reporting, the implementation of environmental management systems, auditing and certification procedures (Boiral, Talbot, & Paillé, 2013).

Employee green behavior, is defined as "scalable actions and behaviors that employees engage in that are linked with and contribute to or detract from environmental sustainability" (Ones & Dilchert's, 2012). Anderton & Jack (2011), argue when people want to have an eco-friendlier behavior but do not know where to start or do not have the time to make the changes, the workplace represents a path for people's environmental behavior, toward a more sustainable future. However, it should be kept in mind that university students are the consumers, researchers and entrepreneurs of the future, and if future talent is able to make decisions that are beneficial to the environment, society is more likely to make progress along the path towards sustainability (Vicente-Molina et al., 2013). Nonetheless, little attention has been paid to the probable impact of students' fields of study on their awareness, knowledge, and implementation of sustainable practices (Alsharif & Ofori-Darko, 2024).

If employees are aware that becoming greener is an important objective of their employer, and the employer demonstrates its interest in creating, developing and maintaining high-quality relationships in the long term, individuals might be more prone to reciprocate by performing pro-environmental behaviors on the job (Paillé & Mejía-Morelos, 2014). This can be done through the use of the theory of planned behavior (TPB), one of the most successful models for identifying and assessing antecedent beliefs on green workplace behaviors (Boiral, Talbot, & Paillé, 2013; Li, et al., 2023). This theory states that employees' attitudes, norms, and perceived behavioral control predict behavioral intentions, which in turn predict behavior (Ajzen, 1991). In the context of TPB, the propose of the study is specifically on the impact of perceived behavioral control on students' intention to exhibit green behavior intention as new employees. Given the research gap in a developing country like Albania regarding green behavioral intentions, it is crucial to understand what drives new employees' intentions to implement green practices. This provides an opportunity to explore possible catalysts that can influence students' attitudes and green behaviors intention. The study aims to provide some suggestions for creating more effective green initiatives that will ultimately promote a culture of sustainability in universities. In this sense, the level of environmental knowledge and the role of environmental education in changing and addressing lifestyles and attitudes could be crucial in altering individuals' behavior and in turning society towards sustainability (Vicente-Molina et al., 2013).

The rest of the paper is organized as follows: Section 2, begins with a literature review summarizing research on the theory of planned behavior and intention to green behaviors. Section 3, contains the data gathering methods and variables, as well as a summary of the study's findings. Section 4, summarizes the key findings that support suggestions for higher education institutions and educational policymakers. Finally, this part discusses the key limitations of the work.

2. LITERATURE REVIEW

The theory of planned behavior (TPB) is an extension of the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) made necessary by the original model's limitations in dealing with behaviors over which people have incomplete volitional control (Ajzen, 1991; Mahon, Cowan, & McCarthy, 2006). The revised model, the theory of planned behavior, proposed that Perceived Behavioral Control (PBC) as an additional predictor of intention alongside attitude and subjective norm and that, in certain circumstances, PBC could also directly predict behavior (Ajzen, 1991; Sheeran, Trafimow, & Armitage, 2003).

According to the TPB, the immediate precursors of behavior are intention and perceived behavioral control (PBC). The theory postulates that the stronger the intention to perform the behavior, the more likely it becomes that the behavior will be performed (Steinmetz, Davidov, & Schmidt, 2011). Behavioral intentions can thus be used as proxy measures of behavior (Armitage & Conner, 2001; Webb & Sheeran, 2006).

Intention refers to the motivation to adopt a given behavior and is predicted by three antecedents: attitude, subjective norm, and PBC (Ajzen, 1991). *Attitude* is identified as an important predictor of behavior because it represents the positive or negative evaluation of an individual regarding his or her particular behavior (Ajzen, 1991; Yang, Zhang, & Zhao, 2016). *Subjective Norm* is the perceived social pressure the individual feels to perform or not to perform the behavior (Rannie & Craig, 1997) and represent perception by individuals whether others approve of the behavior exhibited (Singh, Rana, & Parayitam, 2022). *Perceived Behavioral Control* is an individual's perceived ease of achieving a particular behavior based on experience, which is mainly reflected in the resources and capabilities

that the individual has to achieve the behavior (Ajzen, 1991; Li, et al., 2023). When perceptions of control are accurate, PBC should predict behavior but when perceptions of control are inaccurate (do not reflect actual control), PBC should not predict behavior (Sheeran, Trafimow, & Armitage, 2003).

Perceived Behavior Contral and Green Behavior Intention

Employee green behavior refers to any behavior that harms the environment as little as possible, but in fact improves or preserves it (Steg & Vlek, 2009). Since the original conceptualization of TPB by Ajzen (1991), more than 2400 articles have cited and discussed this theory (Hsu, 2011). It has been successfully used to explain behavior in various contexts, such as consumer behavior, ecological behavior, and involvement in sports (Armitage & Conner, 2001), to improve understanding regarding what kind of intentions motivate employees to carry out green practice (Greaves, Zibarras, & Stride, 2013). Zierler et al., (2017), in their study of the energy efficiency behavior of individuals in large organizations in UK, also found that PBC significantly influenced the green behavior of employees. Therefore, employee perceived behavioral control (PBC) is necessary to support green training in actualizing environmental performance and organizational citizenship behavior (Cop, Alola, & Alola, 2020). Katz et al., (2022), report the results of a meta-analytic path model based on the theory of planned behavior, which showed that perceived behavioral control, and intentions positively predicted employee green behavior. Also, PBC had a significant impact on the intention of adopting sustainable lifestyles (Rex, Lobo, & Leckie, 2015) and in predicting intentions of employees to travel to work using alternative transportation and to make eco-suggestions directed toward their workplace (Yuriev, Boiral, & Guillaumie, 2020).

3. METHODOLOGY

3.1 Data and sample

This section presents the research methodology used in this study to examine the relationship between students perceived behavioral control and green behavioral intention. The authors conducted a survey among bachelor and master students, as new employees in the labor market. After a pretest and confirmation that each measurement reached an acceptable level, the data was collected using Google Forms and a link with the URL of the questionnaire was sent out from November to December 2024. A total of 319 questionnaires were collected. The authors also checked the data set for missing values or outliers, and there were no missing data.

3.2 Measurement

The questionnaire was divided into different sections: demographic information, behavioral intentions (5 items). The questions related to their decisions or behaviors to devote more resources to environmental protection. Improving and prioritizing actions to do more for the environment. The possibility of pursuing a career in green professions. In addition, the section on perceived behavioral control (5 questions). The questions related to the willingness to allocate resources to environmental protection in the company where they work or could work in the future. Analyzing work processes to identify interventions in environmental protection, starting a career in green jobs. Respondents were asked to indicate on a 7-point Likert scale (1 - not at all, 7 – extremely a lot) how often they engage in a particular green behavior.

A total of 319 filled in the questionnaire. Among them, 78.37% (250) were female students and 21.32.7% (68) were male students. Majority of the respondents were 3rd year undergraduate students (97.2%). The majority of them are employed, namely 74.3% (see Table 1).

Table 1. Demographic Profile of Respondents (n=319)

Gender	Frequency	Percent
Female	250	78.37%
Male	68	21.32%
Other	1	0.00%
Study program		
Bachelor	310	97.20%

Master	9	2.80%
Study field		
Business Administration	194	60.8 %
Finance	125	39.2 %
Year of studies		
II	9	2.80%
III	310	97.20%
Working Experience		
Yes	237	74.30%
No	82	25.70%
Origine		
Rural	107	33.50%
Urban	212	66.50%

4. DATA ANALYSIS

Reliability analysis was used to analyse the consistency and stability of the respondents' answers. Table 2, shows the internal consistency. The Cronbach's α coefficient is usually used as an indicator of the reliability of the survey and confirms the internal consistency and correlation of the individual variables (Tavakol & Dennick 2011). The factorial weights of PBC, shows that its value is greater than 0.4 and the alpha coefficient has a value of 0.854, for the behavioral intention the value of its reliability coefficient is 0.879, a very high reliability value according to George and Mallery (2003).

Table 2. Validity and Reliability

Variables	Cronbach's alpha	Number of questions
Perceived Behavioural Control	.854	5
Green Behavioural Intention	.879	5

First, the linear equation was analyzed using ANOVA to determine the impact of PBC on green behavioral intention among students as young managers. The study's results (see Table 3) demonstrate a correlation between the two variables for the df (7; 311) and F=48.407, with a coefficient Sig.=0.000<0.05. PBC and green behavior intention are statistically significant, accounting for 52.1% of the variation in the change in value of the dependent variable (R2=.521).

Tabel 3. Model Summary and ANOVA of Regression

R	R^2	Adjusted R^2	Std. Error of the Estimate		Sum of Squares	df	Mean Square	F	Sig.
.722a	.521	.511	.80904	Regression	221.789	7	31.684	48.407	.000[b]
				Residual	203.563	311	.655		
				Total	425.352	318			

The simple linear regression equation corresponds to the following:
(Perceived Behaviour Control) = 0.499 + 0.735 (Green Behaviour Intention)

Table 4. Regression Coefficients

Coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

Constant	.499	1.032		.484	.629
Gender	.119	.110	.043	1.082	.280
Study Field	.203	.095	.097	2.142	.033
Study Year	.185	.318	.027	.582	.561
Origine	-.214	.097	-.088	-2.216	.027
Working Experience	.118	.117	.045	1.009	.314
Working Relationship	-.051	.028	-.079	-1.784	.075
Green Behavior Intention	.735	.041	.711	17.955	.000

The equation shows the positive correlation between these two variables with the coefficient $\beta = + 0.735$ (see Table 4). Students as young employees who recognise a willingness to share and care for environmental resources in the company where they work or may work in the future are more likely to participate in green initiatives in their workplace. Therefore, the company's policies, trust and objectives should promote a sustainable environment for its employees, which has a positive impact on their green behaviour in the workplace.
In addition, an analysis of variance was performed to show the influences on the intention to behave green for each demographic characteristic. The result is a statistically significant correlation ($p=0.033$) between the students' intention to behave green and the study programme as well as the students' residence (urban or rural), ($p =0.027$). The analysis indicates that there are no significant statistical differences between the groups of students divided by gender, and employment status, as the corresponding values of their Sig are all greater than 0.05.

5. CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

A better understanding of what constitutes environmentally friendly behaviours is essential at all stages of human resource management (Ones & Dilchert's, 2012). Human activity is the main catalyst of climate change, and changing employees' behaviours is frequently considered to be the most important step in corporate greening (Robertson & Barling, 2013). Education institutes have an immense potential in this area (Dibra et al., 2023). The aim of this study was to analyse the impact of perceived behavioural control on students' green behaviour intentions as future employees. The results confirm that perceived behavioural control enhances the positive effect on the intention to behave in an environmentally friendly way. The result is in line with (Zierler et al., 2017; Banwo & Du, 2019; Yuriev et al., 2020; Khalid et al., 2022). Also, Greaves et al. (2013), who applied Ajzen's model, the theory of planned behaviour, to explore environmental behavioural intentions in the workplace, reported relatively high explained variance (from 46% to 61%) in intentions to engage in these behaviours and to mediate the effects of specific antecedent beliefs on employees' intentions to engage in these behaviours.

The second goal is to obtain insight into several sociodemographic factors that, according to the relevant literature, appear to influence the intention to engage in green behaviour. In the current study, this effect was proved by the students' origins, demonstrating that students from metropolitan regions contribute more to the development of green behavioural intentions. This result is also consistent with (Chen, et al., 2011). This outcome could be attributed to the increased level of information and knowledge that encourages awareness of environmentally friendly behaviours in metropolitan settings. Students in urban areas are more conscious of sustainability challenges, as Albania's population is spread and marked by a strong migration from rural to urban areas in search of better economic prospects, higher levels of education, and upward mobility. The subject of study was also associated with environmental awareness and behaviour. Business students are more inclined to be environmentally conscious than finance students. The finding is in line with the results of (Bici & Kasimati, 2024). The authors also propose enhancing present university curricula with thematic concepts on environmental sustainability and developing specific programs on sustainability and the sustainable development goals. The authors discovered no significant relationship between the intention to engage in green behaviour and gender or work position.

It should also be noted that the University of Tirana has contributed to the Faculty of Economy's efforts to enhance awareness of sustainability principles and promote green practices through programs and project funding. These findings have significance for educational institutions seeking to promote environmental sustainability. Furthermore, curricula can be extremely beneficial in providing faculty members with the knowledge and skills they require to properly incorporate sustainability problems into their teaching. Such activities would influence students' behaviour as future employees toward a greener approach and their actions. By teaching students about sustainable practices during their studies, we are preparing young managers for a greener economy in the future.

There are several limitations that should be considered before generalizing these results. First, the samples were drawn from a single university. This means that they may not reflect the different situations that prevail at other universities, so the results cannot be generalized. Although we consider the survey to be very representative, the samples could have been more comprehensive in different groups of students so that the results collected would have been more representative. In this way, further research can be conducted using mixed methods of data collection and perhaps an analysis with multiple groups of students from different universities to assess students' intentions towards green behaviours.

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