



HOW TECHNOLOGY IS TRANSFORMING THE GLOBAL ECONOMY?

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EDITORIAL

How technology is transforming the global economy? _____

_____ ***Prof. Asoc. Dr. Teuta XHINDI*** _____

EDITOR IN CHIEF

“Any sufficiently advanced technology is indistinguishable from magic.”

- **Arthur C. Clarke,**

Profiles of the Future: An Inquiry into the Limits of the Possible

Technology is having profound effects on multiple facets of our societal fabric. The current developments, if we were to take them back in time, might appear to the earlier generations like magic. However, these seemingly magical developments are built upon hundreds of years of generated knowledge along the innovation funnel: invested by states and research centers along the basic research and development, commercialized by the industry and lately advanced by the users themselves as they act as innovators. This is nothing new in and of itself. What is new is the rate of change. According to the techno-optimist Ray Kurzweil, we will experience twenty thousand years of technological change over the next one hundred years. This, often described as an exponential rate of change combined with increasing complexity, makes even more important the need for social scientists of all fields, and economists in particular, to reflect on the changes that are about to occur.

So, how is technology changing the global economy? Digital technologies will significantly reduce trade costs and reshape the composition of trade, favoring services and time-sensitive products. Developing countries will potentially gain a larger share of global trade. International cooperation is essential to harness the benefits of digital trade and promote inclusive economic development.

In terms of the labor markets, news and media have inundated the readers with ominous titles such as “the end of labor”. However, according to state-of-the-art research, it appears that automation has shifted labor demand away from routine

middle-level jobs to non-routine ones, commonly denoted as the routine biased technological change (RBTC). Hence, researchers seem to be more concerned about the “decaying middle” and the quality of jobs, as opposed to the end of labor. Until recently, it was believed that Polyani’s paradox (named after the famous economist Karl Polanyi) could not be surpassed, the simple idea that “*you know more than you can tell*” inferring that not all our tacit knowledge can be fully explicitly articulated and codified.

Nevertheless, this paradox now seems, at least at first glance, to be challenged by the developments in Artificial Intelligence and more specifically its subfield Machine Learning. It remains unclear how that will impact the labor force. Also, in the face of a challenging decade, technology can be a critical tool in the transition to a cleaner, safer and more inclusive world. The rapidly emerging technologies of the 4IR have the potential to reduce emissions by up to 20% of the net-zero goals and allow billions of individuals to enjoy access to health, education or financial services for the first time. However, given the widely forecasted recession in 2023, the realization of this potential can only be achieved through sustained investment.

Those companies that are adopting AI are still gaining a competitive advantage; a shortage of tech talent is still a pressing issue for companies, so half of them are reskilling existing employees instead. To further ease concerns among the workers and companies alike, the private and public sectors need to work in close collaboration on skills investment from upskilling to reskilling, to make use of these new technological tools. Besides the upskilling of workers, recent research shows that organizations may need to reconfigure their allocation of tasks and their organizational routines to take full advantage of the up-and-coming technologies. Digital technology can indeed be considered as a key enabler for the broad set of challenges business and governments alike face. However, it brings its own set of issues related but not limited to the historical biases permeating datasets, the matters of liability and ownership, particularly for generative AI, possible job displacements, disruption to particular industries etc.

Competition policy must be modernized for the digital age, focusing on strengthening antitrust laws. Regulation should address data, competition, and market concentration challenges. Innovation ecosystem needs updating, including patent systems and investment in research and development. Bridging the digital divide requires enhancing digital infrastructure and access, particularly in developing economies transitioning from low-skill manufacturing.

Customer Experience in Industry 5.0 _____

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Abstract

Throughout history, technology development has created new eras named as Industrial Revolutions, beginning from Industry 1.0, until nowadays named as Industry 4.0, where industries make use of digital transformation, Cyber physical systems, and artificial intelligence. By the second decade of the 21st century concerns arise toward the use of technology for the wellbeing of the humans, workforce, society and global environmental impact. These challenges come along with new methodologies and processes, including new ways how business can benefit by evaluating and improving Customer Experience.

The purpose of the study is to analyze how Industry 5.0 can bring new approaches toward Customer Experience, by evaluating the importance, challenges and opportunities of the latter, thus creating a roadmap toward Industry 5.0. Throughout the study the literature review methodology is used by analytical research about the topic, analyzing the new tendencies, their impact on the business and summarizing academic researches. The study concludes that Customer Experience, although it is customer-centric, it is aligned with Industry 5.0's strategies. At the end, the study gives some recommendations on how Albanian business can improve the traditional ways of approaching the customers, thus increasing their overall value.

Keywords: *Customer Experience, Industry 5.0, value, revenue, CX technologies*

Introduction

Industry 5.0 is a new paradigm that combines the power of cutting-edge technologies such as Artificial Intelligence (AI), Internet of Things (IoT) and robotics with human creativity and skill to create highly personalized products and services. In this new era, companies are focusing on creating value for customers through innovative solutions that meet their needs and preferences. As a result, Customer Experience (CX) has become a key differentiator, influencing consumer behavior, and driving business growth. (B. R. Araújo, M. T. P. Monteiro, and J. V. Ferreira).

In recent years, digital transformation has been a driving force for businesses to improve their revenue growth and innovation in service offerings. However, the focus has now shifted towards improving the Customer Experience as a core goal for companies in the years ahead. This is because the internet has made it easy for customers to access hundreds of companies offering similar services,

increasing competition among businesses. In this scenario, providing excellent customer experience has become a key differentiator for businesses to attract and retain customers. (Verhoef, P. C., Reinartz, W., & Krafft, M). To achieve this, businesses need to invest in an intuitive omnichannel approach that caters to customers' self-service and agent-assisted needs. Customers today expect options beyond traditional phone and email support, and businesses need to be able to deliver seamless experiences across multiple channels, including social media, chatbots, and mobile apps. Technology plays a crucial role in this, and companies need to leverage it to provide personalized and effective customer support. For instance, businesses can use artificial intelligence and machine learning (ML) to analyze customer data and provide tailored solutions that meet their unique needs. (Verhoef, P. C., Reinartz, W., & Krafft, M)

Moreover, providing excellent customer experience is not just about offering good support during purchase or post-sale interactions. It's a holistic approach that involves building long-term relationships with customers by creating a positive brand image and emotional connections. This requires businesses to focus on the entire customer journey, from pre-purchase research to post-sale feedback, and create a seamless and memorable experience for customers at every touchpoint.

While digital transformation has been a key driver for businesses to improve revenue growth and innovation, the focus has now shifted towards improving the customer experience as a core goal. To achieve this, businesses need to invest in an omnichannel approach that caters to customers' needs and leverage technology to provide personalized and effective support. However, providing excellent customer experience is not just about support during purchase or post-sale interactions, but a holistic approach that requires businesses to focus on the entire customer journey and create emotional connections with customers.

Methodology

This study aims to give answers to the following research questions:

1. How Customer Experience can improve by making use of new technologies?
2. What are the most effective Customer Experience strategies?
3. Can Customer Experience strategies be aligned with Industry 5.0 objectives?

The methodology that this study use is literature review by semi-systematic review approach accompanied with a statistical meta-analysis. Descriptive statistics is used by analyzing secondary data. The literature review methodology is useful in researching, analyzing and finally reaching conclusions regarding the objective of the study.

Literature review

Industry 5.0

Industry 5.0 is an innovative approach that aims to position European industry as a major driver of economic and societal transitions. This approach goes beyond traditional goals of efficiency and productivity and emphasizes the importance of industry's contribution to society. By placing worker wellbeing at the center of the production process and using new technologies, Industry 5.0 promotes prosperity beyond job growth while respecting the planet's production limits. It complements the existing Industry 4.0 approach by specifically putting research and innovation at the service of a sustainable, human-centric, and resilient European industry. The Industry of the Future approach has the potential to address major societal challenges such as climate change, resource preservation, and social stability. It benefits not only industry, but also workers and society as a whole. It empowers workers and addresses their evolving skills and training needs, while increasing industry competitiveness and attracting the best talent. It is environmentally responsible, favoring circular production models and technologies that improve the efficient use of natural resources. In addition, Industry 5.0 can help make industries more resilient to external shocks such as the Covid-19 crisis, by revising existing value chains and energy consumption practices. The principles underlying Industry 5.0 can be summarized into three strategies, as described by Garrett (2021).

First, it is human-centric, which means that people are no longer viewed as mere resources but are recognized as valuable assets. In this approach, organizations serve people, rather than the other way around. Industry 5.0 seeks to create added value for workers in addition to creating a competitive advantage and value for customers, in order to attract and retain the best employees.

Second, Industry 5.0 prioritizes resilience overgrowth and profit (Industry 5.0, 2022). Instead of focusing solely on optimizing profits and improving efficiencies, resilient organizations aim to anticipate and respond to crises to ensure stability through challenging times. The Covid-19 pandemic and international supply shortages are examples of global matters that have highlighted the importance of resilience in today's world.

Finally, Industry 5.0 extends the concept of sustainability beyond reducing, minimizing, or mitigating climate damage. It aims to actively create a positive change and become part of the solution rather than being a problem or paying lip-service to sustainability goals through 'greenwashing' (Garrett, 2021). This goal is

sometimes referred to as ‘Net Positive’, where companies seek to make the world a better place.

Customer Experience

The notion of the “Customer Experience Economy,” where customers influence how brands offer goods and services, originated in the early 1990s. (Source: Harvard Business Review) Joe Pine II first introduced this concept while teaching a class to the IBM Consulting Group in New York in 1993 or 1994. (Source: Strategic Horizons LLP) Pine explained that “mass customization automatically turns a service into an experience,” giving rise to the Experience Economy, which has replaced the Agrarian and Industrial Economies. (Source: Strategic Horizons LLP) Today, customer experience is a crucial factor in a brand’s success or failure. (Source: Forbes) Thanks to social media, brands that don’t manage their product or service touchpoints effectively risk losing customers to more customer-focused brands. (Source: Harvard Business Review) One example of this is the ridesharing industry’s transformation, where Uber and Lyft’s customer-centric model has disrupted the taxi industry, which had remained unchanged since the 1940s. (Source: Harvard Business Review) Uber and Lyft’s mobile apps, real-time driver tracking, elimination of cash transactions, and driver/passenger rating systems have revolutionized the ridesharing industry, reducing wait times and offering efficient payment transactions while providing real-time driver and passenger ratings. (Source: Uber, Lyft) By focusing on the customer experience, Uber and Lyft have been able to win customers and capture more of the ridesharing market, despite higher rates in some cities. (Source: Harvard Business Review) Customer experience is a concept that has its roots in the marketing and consumer theories of the 1960s to the 1990s. (Source: Harvard Business Review) During this time, services were becoming increasingly commoditized, which meant that businesses needed to provide value through more than just price and availability to build customer loyalty and keep them coming back. (Source: Harvard Business Review)

This led to the development of the idea of the customer experience, which involves creating a positive, memorable, and personalized experience for each customer at every touchpoint. (Source: Forbes) One man who played a significant role in the development of the customer experience discipline is Lewis “Lou” Carbone. (Source: Forbes) He is credited with coining the term “customer experience” and is widely regarded as the father of the experience movement. (Source: Harvard Business Review) His 1994 Marketing Management magazine article titled “Engineering Customer Experiences” is seen as the beginning of the customer experience discipline. (Source: Marketing Management) Carbone’s work focused on the emotional and sensory aspects of the customer experience,

arguing that businesses needed to create experiences that engaged customers on an emotional level to build loyalty and drive revenue. (Source: Harvard Business Review). As more and more businesses became commoditized over the years; customer experience became the differentiating factor that made consumers choose one company over the other. (Source: Forbes). This has been borne out in research - for example, a report by PwC that surveyed 15,000 consumers found that 1 in 3 customers will leave a brand they love after just one bad experience, while 92% would completely abandon a company after two or three negative interactions. (Source: PwC). The years between 1990-2010 were a turning point for customer experience. (Source: Harvard Business Review) This period is often referred to as the Information Age, as new technologies such as the internet gave consumers the ability to find whatever they were looking for online. (Source: Forbes). This created a role reversal for businesses and customers.

However, the rise of social media platforms such as Facebook and Twitter in the mid-2000s changed everything. These platforms gave consumers a way to talk to each other about their experiences with different brands, as well as reply to marketing messages in real-time and post their own content on a brand's social media page. This leveled the playing field, as customers could now openly share their experiences for everyone else to see. Even if just one customer received a bad experience, other people could share it until it became viral, which could place companies in a difficult spot based on one opinion. (Song, M., Park, E., Yoo, B., & Jeon, S)

According to two studies regarding technology management and competitive strategy that Forrester published in 2013, we've entered a new age of business called "The Age of the Customer." Even business leaders, researchers, and marketers dubbed 2010 as the end of the "Age of Information" and the beginning of the "Age of the Customer."(Forrester).

Since the start of the Information Age, people have digitized nearly every aspect of the human experience, translating it into different media such as data, pictures, videos, and more. The advent of this new experience age focuses on the sum of these parts in building holistic digital experiences for all customers.

Today, due to new developments in technology, each customer action can be tracked, analyzed, and acted upon. Businesses need to make sure that they are staying up to date with the latest technology to deliver an enhanced customer experience. The use of big data and artificial intelligence can help companies gain insights into customer behavior, preferences, and pain points, allowing them to tailor their offerings and improve customer satisfaction. Moreover, businesses must recognize that customer experience goes beyond just the initial purchase. Every touchpoint a customer has with a brand, from browsing a website to interacting with customer service, can impact their overall experience. Therefore, companies

need to ensure that each touchpoint is optimized for customer satisfaction and engagement.

Finally, customer experience is not a one-time effort but an ongoing process that requires continuous improvement. Companies should regularly gather feedback from customers and use that feedback to identify areas of improvement and make changes accordingly. Customer experience has evolved significantly over the years and has become a key differentiator for businesses. Companies must prioritize delivering an enhanced customer experience by leveraging technology, personalizing their offerings, creating emotional connections with their customers, and continuously improving their approach. By doing so, they can build brand loyalty, increase customer satisfaction, and drive business growth.

Industry 5.0 impact in Customer Experience

Industry 5.0's focus on actively creating positive change and becoming part of the solution, rather than simply minimizing harm, is one of the trends likely to impact CX in the next decade alongside other important predictions for the future of CX.

In addition to these trends, there are several other areas that are likely to impact CX in the next decade. According to Fenwick (2018), one of these is hyper-personalization, which involves using data analytics and AI to deliver highly personalized experiences to customers based on their unique preferences, behaviors, and needs. This level of personalization will go beyond just product recommendations and marketing messages, but will extend to the entire customer journey, from discovery to post-purchase support.

Mobile-first is another important trend in CX, as more customers use their smartphones and tablets to interact with businesses. Companies will need to ensure that their digital experiences are mobile-friendly and optimized for smaller screens. Globalization is also a trend that will impact CX in the next decade. As businesses expand globally, they will need to tailor their CX strategies to meet the needs and expectations of customers in different regions and cultures. This will require a deep understanding of local markets and the ability to adapt to cultural differences. (Forrester) Conversational commerce is another trend that is likely to become more prevalent in the coming years, as customers prefer to communicate with businesses through messaging apps and social media platforms. This involves using chatbots and AI-powered messaging to facilitate transactions. Digital transformation will continue to be a critical part of CX strategies in the coming years, as companies invest in digital technologies to become more agile, efficient, and customer centric. This will require a rethink of processes, systems, and operations (Fenwick, N, 2018).

Overall, the future of CX will be shaped by a combination of technological advancements, changing customer expectations, and global trends. Companies that are able to stay ahead of these trends and deliver exceptional experiences to their customers will be well-positioned for success in the coming years.

New technologies that improve Customer Experience

Artificial Intelligence (AI) as part of CX

AI has become a game changer in CX. Using machine learning algorithms, businesses can analyze large data sets to better understand customer behavior and preferences. One aspect of AI in customer experience that has become increasingly important is personalization. Customers expect brands to understand their unique needs and preferences and offer customized experiences accordingly. This can include personalized recommendations, customized marketing messages, and tailored product offerings. In addition to personalization, businesses must also focus on creating emotional connections with their customers. Customers are more likely to remain loyal to a brand that they have an emotional attachment to, so it's crucial for businesses to understand the emotions associated with their brand and incorporate them into their customer experience strategy. AI-powered chatbots can provide instant responses to customer queries, improving response times and overall satisfaction. According to a report by Grand View Research, the global market for AI in the customer service industry is expected to reach \$23.6 billion by 2025 (Grand View Research, 2021).

Virtual Reality (VR) as part of CX

Virtual reality is another technology that is catching CX's attention. By creating virtual environments, businesses can bring experiences to life for their customers. Virtual reality can be used in a variety of industries, such as real estate, tourism, and retail. For example, IKEA created a VR app that allows customers to design and visualize their own living space. According to a report by Allied Market Research, the global virtual reality market is expected to reach \$57.55 billion by 2027 (Allied Market Research, 2021).

Internet of Things (IoT) as part of CX

IoT has also become an integral part of CX. By connecting devices and sensors, businesses can collect real-time data about customer behavior and preferences. This data can be used to personalize the customer experience and deliver targeted promotions. For example, Amazon's Echo device uses IoT to provide personalized music and voice shopping recommendations. According to a MarketsandMarkets report, the global IoT market is expected to reach \$1.3 trillion by 2026 (MarketsandMarkets, 2021).

Augmented Reality (AR) as part of CX

AR is another technology that is transforming CX. By overlaying digital information with the real world, businesses can create engaging and interactive experiences for their customers. AR can be used in a variety of industries, such as gaming, retail, and healthcare. For example, Sephora created an AR app that allows customers to try on virtual makeup before making a purchase. According to a report by Zion Market Research, the global AR market is expected to reach \$217.38 billion by 2026 (Zion Market Research, 2021).

Virtual reality technology has a significant impact on the luxury market, with the major effects being improved communication with consumers, created immersive experience and enhanced consumer loyalty. Prioritized recommendations are Customer-focused, prioritizing the physical and mental well-being of consumers, managing the customer experience and aiding with personalized engagement marketing (Wang, 2023).

In a nutshell, the latest technologies, such as AI, VR, IoT, and AR, are changing the CX landscape. With AI-powered chatbots, VR environments, IoT connected devices, and AR overlays, businesses can deliver personalized and engaging experiences for their customers. The global market for these technologies is expected to continue to grow, showing their growing importance to customer experience. By staying up to date with the latest technological advancements, businesses can stay ahead of the competition and deliver exceptional CX.

Data mining methods used in Customer Experience

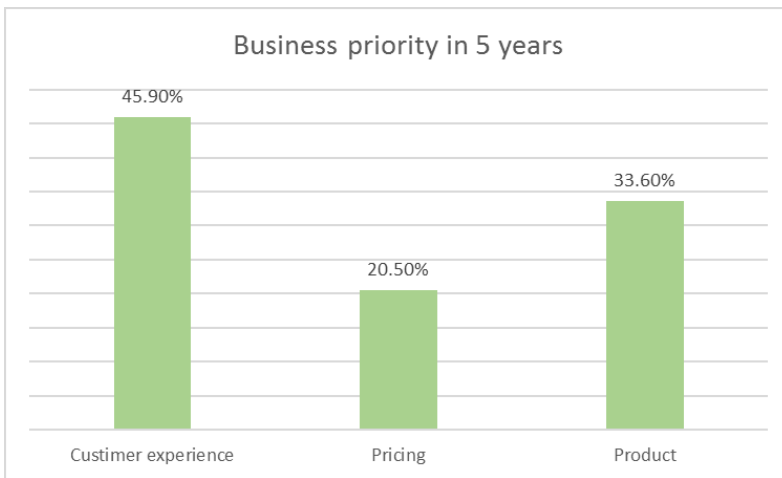
Information mining strategies have been utilized widely in client experience (CX) examination to acquire bits of knowledge into client conduct and inclinations. Association rule mining is a well-liked technique for finding patterns in customer actions and transactions that can be used to enhance customer experience. A study by Wang and Liang (2021) says that association rule mining can be used to look at customer feedback and find patterns in their preferences, which can help design products and services. Decision tree analysis, which is used to identify factors that influence customer behavior and preferences, is another data mining technique that is frequently utilized in CX research. Yao et al.'s study found that decision tree analysis was used to look at customer data and figure out what factors affect how satisfied customers are with online shopping (2020). Lastly, clustering analysis is a data mining technique that has been utilized in customer experience (CX) research to divide customers into groups based on their habits and preferences. Li et al. conducted a study (2020), clustering analysis was utilized to develop targeted marketing strategies for each segment of the customer base and to identify customer segments based on their preferences for online shopping. Overall, data mining techniques can be utilized to enhance customer experience and propel

business expansion. They are a potent instrument for comprehending customer behavior and preferences.

The future of Customer Experience

On a survey done at 1,920 individuals working in the business field to inquire about their top goal for the upcoming 5 years. The outcome indicated that for the third consecutive time, customer experience surpassed product and pricing and claimed the top spot.

GRAPH.1 THE priority of business in the next 5 years. Source: (Niklas Statin, SuperOffice)



The Temkin Group found that companies earning \$1 billion annually can earn an additional \$700 million within 3 years of investing in customer experience. SaaS companies can even increase their revenue by \$1 billion This revenue growth comes from customers spending more when they have a great experience 86% of buyers are willing to pay more for a good customer experience, and this willingness increases for more expensive items. For example, customers are willing to pay up to 13% more for luxury services if they have a great experience CX also influences on-the-spot purchasing, as 49% of buyers have made impulse purchases after receiving a more personalized experience. Additionally, CX is now a competitive differentiator for 81% of organizations (Morgan, 2019).

Some statistics prove that the value of customer experience for your business companies that believe in making customers happy also experience revenue growth 83% of the time. Brands with superior customer experience generate 5.7 times more revenue compared to competitors that lack good customer experience (Morgan, 2019).

Customer experience and technologies in Albania

Albania has seen critical development in its innovation industry in later a long time, with companies actualizing unused innovations to move forward their CX. This paper will investigate the current state of CX and innovation in Albania, counting the selection of computerized stages, chatbots, and portable apps, with supporting prove from industry reports and inquire about.

A survey conducted by Domi et.al. (2020) found a positive relationship between Customer orientation and tourism industry performance measured by financial indicator (profitability) and non-financial indicator (customer value and loyalty). Another study conducted in Albania in mobile industry concluded that there is a strong relationship between customer loyalty and satisfaction and service benefits, consisting of customer services, quality of service, competitive prices, variety of tariffs or tariff plans and unethical practices of service providers mobile (Gjoni, 2018).

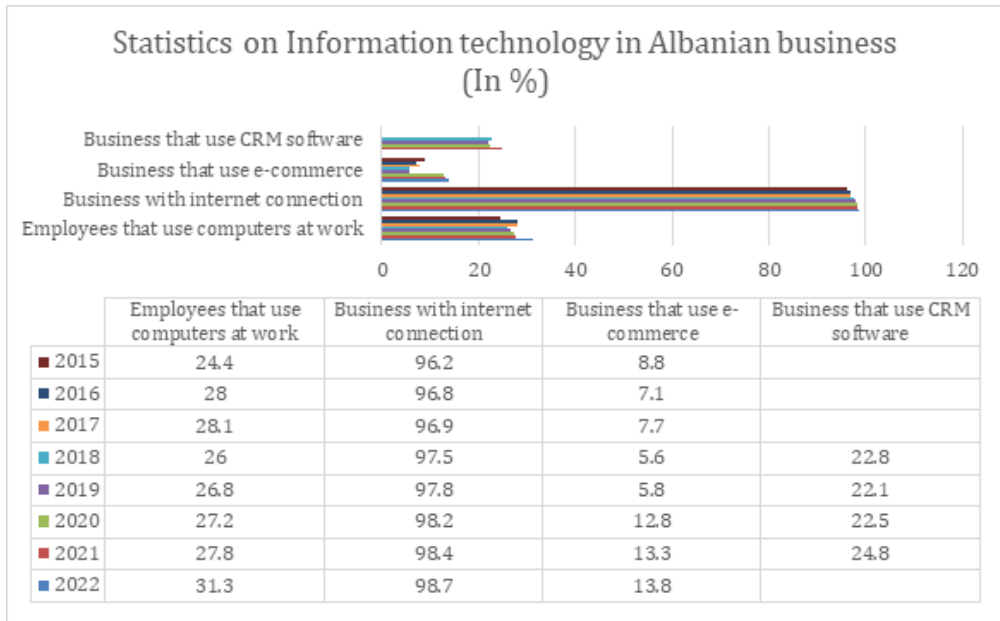
Development of technologies

The COVID-19 widespread has quickened the appropriation of computerized stages in Albania, with businesses progressively depending on e-commerce and online deals to reach their clients. Concurring to a report by the Albanian Broadcast communications Union (2020), the number of web clients in Albania expanded by 16.5% in 2020, coming to a add up to of 2.5 million. This development has driven to an increment in online deals, with e-commerce deals in Albania anticipated to reach €547 million by 2025 (Statista, 2021). By grasping computerized stages, companies in Albania can give clients with a consistent and helpful buying involvement, progressing CX.

Statistical data published by Instat, shows that there is an overall growth in internet use for commercial purposes by business. Also, Customer Relationship Management software are being used, although still on a low percentage.

Chatbots are getting to be progressively prevalent in Albania as a way to supply clients with prompt and personalized bolster. Chatbots can be coordinates into websites and social media stages, permitting clients to inquire questions and get moment reactions. Concurring to a report by ClickAttack (2020), 75% of companies in Albania arrange to contribute in chatbots within the coming a long time, with the essential objective of progressing client benefit. By actualizing chatbots, companies can decrease hold up times and give clients with 24/7 back, upgrading CX.

GRAPH 2. Statistics of Information Technology in Albanian business. Source: INSTAT



Mobile apps are moreover getting to be a basic apparatus for companies in Albania to move forward their CX. Concurring to a report by Vodafone Albania (2020), the number of smartphone clients in Albania expanded by 8.8% in 2020, coming to a add up to of 1.8 million. Portable apps can be utilized for an assortment of purposes, such as making buys, giving client back, and conveying personalized suggestions. By advertising a portable app, companies can give clients with a helpful and user-friendly way to connected with their brand, progressing CX.

No study is found regarding the use of Datamining techniques by Albanian business and the impact in their performance. Hence, the need for further study on the topic is a necessity for studying the marketing strategies based on customer behavior.

Conclusions

Over the past ten years, customer experience has undergone significant changes due to technological advancements, evolving consumer behavior, and growing competition. Companies have had to quickly adapt to meet changing customer expectations, including the adoption of digital channels and a focus on customer-centricity. The future of customer experience is likely to be shaped by trends such as personalization, data analytics, and the rise of artificial intelligence and automation.

Therefore, it is crucial for businesses to prioritize customer experience and invest in the necessary technologies and processes to stay ahead of the competition. By delivering personalized and efficient customer experiences, companies can position themselves for success in the future. The shift towards improving customer experience as a core goal in businesses is not only about utilizing technology but also creating emotional connections with customers, which goes beyond traditional goals of efficiency and productivity. This approach resonates with Industry 5.0, which emphasizes worker wellbeing and societal contribution, and promotes sustainable and human-centric industry growth. In this context, businesses that invest in improving customer experience can align themselves with Industry 5.0 goals and contribute to a more sustainable and prosperous future.

Furthermore, the study recommends Albanian business to apply Customer Experience strategies by making use of the latest technologies for improving their performance and being competitive.

This study is an overall study of the latest academic literature that have in focus Customer Experience and relates the later with the Industry 5.0 main objectives. Further studies should be done on this topic, by measuring the real influence, of the latest technologies related to customer experience, to the society and the human wellbeing.

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Designing to solve housing problems during communist regime. Tradition, adventure and inovations

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Abstract

The purpose of this paper is to define and evaluate architectural solutions from a typological point of view, about housing' construction in Albania during that period which signs the end of Second World War and the beginning of 1990s. This study points out some housing problems inherited from the late XX-th century, as well as influences and experiments that this typology endured during communist dictatorship regime. It gives some data of the mechanism that was created to develop construction of dwelling buildings, starting with creation of builders' schools, design institutes and up to the mechanism of implementation and distribution of houses. Summerises developments of that time in Europe and architectural styles that influenced designers and local builders. How architects and builders perceived housing and quality of construction during that time. What were the rates at which construction sector

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responded to housing needs, based on demographic developments that took place after the Second World War. In conclusion, this study draws a panorama about quality of life offered by these dwellings during communist dictatorship period, consequences that we inherit since then because of typological solutions and quality of buildings due to construction materials that have been used.

Key words: *architecture, housing typology, socialism, communism, building.*

Introduction

This paper aims to identify main facts about developments that housing typology has undergone during its fortyfive-year journey, in Albania of 1945-1990. These developments are seen in the prism of comparison with developments of the same period that happened in some of the countries with influence towards Albania. It also points out some of the key milestones, which had their impact on housing developments of that period and yet are impacting subsequent developments.

The shape of a building is one of the important components when architects design. Concepts about architectural shape have always been discussed by various philosophers, historians of architecture and art, constructors etc. This has always been a matter of aesthetics and construction, which are objective and subjective at the same time (Ahuja, Tatsutani and Schaffer, 2009). Constantly we may find new ways of thinking in architectural design, and we see this during different periods in the history of architecture. Architectural design has been constantly generated and driven by specific factors of history. Even though changes have occurred in our 21-st century' societies, we still lack modern energy services that developing economies demand. On the other hand, dramatic increase of energy prices, and awareness about limitations on energy souces, have encouraged generations of ideas in finding new solutions for construction industry (Sue & Nicol, 2017).

Meanwhile the milestones of architectural developments in Socialist Albania are certainly closely and directly related to the developments related to "great socialist revolution" that took place in several countries. According to their propaganda, revolution unfoldedwith the socialist construction that took place under the leadership of the so-called "great" leaders Lenin and Stalin (Kolli, 1937). According to this philosophy, this would have been achieved with a gigantic cultural upliftment, which would bring economic prosperity to the beautiful homeland. For the builders of that time, this was a new, never-before-seen stage, with complex tasks, up to significant grades of moralistic honesty. They named it construction of socialist architecture in the new Albania, based on communist ideals. Each phase of this revolution in communist-socialist camp, (this included:

war communism, the era of restoration, period of reconstruction and completion period of construction of socialism in the country, which was the era of great Stalinist constitution), became the starting point for every Albanian builder of that time, within the country.

Materials and methods

There are several methods and theories that architects use, but among the most important ones in these type of studies is firstly scientific research in history of architecture. The second is the method of finding contrasts to create a strategy and develop a critical view of a situation. This strategy is formed with specific techniques of data collection in scientific studies and books that are represented in technical manuals, research of projects in archives and observation of these constructions and developments in the field. Methodological practices of strategies and tactics are adapted from wider systems of scientific research and used by schools to stimulate the development of thinking (Groat & Wang, 2013).

The method and materials used to complete this study include three phases of work: first, the collection of data about projects of that time in Albania, using 'Construction Archive in Albania'; secondly is the direct observation of building examples belonging these years, within the country; in the east and west blocks; and last step is comparison of these data according to the respective building standards of different countries, belonging to the same periods.

Field of study: is the typology of apartment, design criterias used in Albania after the Second World War, until the change of systems in 1990's.

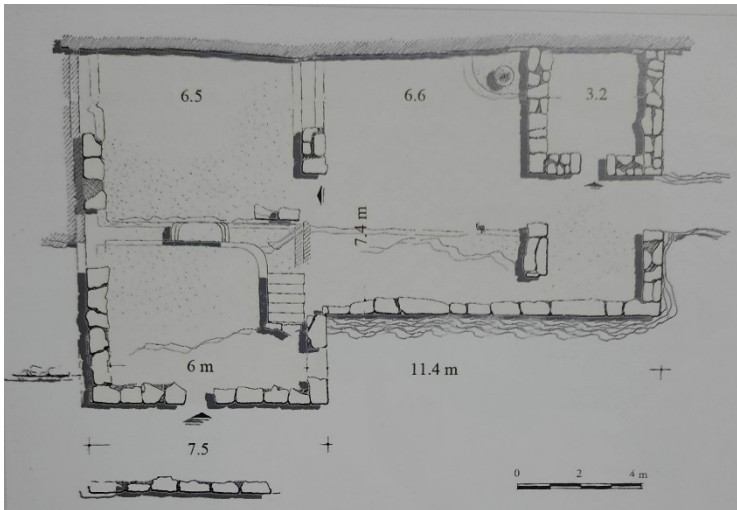
Dwelling presupposes a certain place in which the house is rooted in the earth. But precisely because of being stuck and staying in a certain location, dwelling is also the opposite of this. This is because city, territory, collective relations, random meetings and everything is the exchange of information and material goods between residents (Franchini & Righetti, 2003).

In Olympus, on the pedestal of the great statue of Zeus, there are seven couples who synthesize the basic myths of Greek culture. Zeus and Hera, Apollo and Artemis, Afrodite and Heracles, as well as other couples united by specific relationships. But, only one of these pairs, Hermes and Hestia, (Mercury and Vesta for the ancient Romans), presented a clear connection in terms of tradition transmitted from Ancient Greece to Rome (Ellen, 1908). This is because two deities were rarely depicted together, and Hestia barely appears in any mythic tales. And yet if this pair appears in the Greek pantheon of gods, it must surely have represented one of the central themes of human values. These are the gods of living together, or separated from the human dream, but who have their place

in the family, and coexist with it together with the desire for travel, movement and adventure (Vernant, 1969). According to Homer: “The two deities live in the beautiful abodes of men who live on the face of the earth, bound by feelings of mutual friendship.” But while Hestia stands still at the center of the earth, Hermes owns man’s space in the form of the traveling messenger (Vernant, 1969).

The deep structure of the myth helps us understand that the complexity of living moves between two polarities, which are at the same time complementary and opposite of each other. Between the house which is understood as the place of one’s privacy, and the city which is the place for social relations, there is a mutual relationship that is not so mechanical. The mutations that one undergoes are not transmitted directly to the form of the city, and vice versa. The house or the typology of the apartment, is more rigid in development, compared to urban developments and modifications. We notice this if we see developments that house has undergone by comparing it with the finds since antiquity, according to archaeological discoveries. It seems clear that we have no significant developments (Baçe, 2017). (Pic. 1)

PIC. 1: Floor plan of the apartment with fire house, in Çuka of Ajtoi



Studies on Modern style architectural movement in 20th century, show us that as far as it concerns the cell of apartment, the main focus was on problems of solar orientation; and also, in all hygienic-sanitary aspects that derive as well in aspects of distribution of indoor and outdoor areas. So the connections of these environments were made by the designer to create comfort. And these searches had led to some limited combination solutions: such as linear housing, tower housing, terraced housing, individual housing. The effort to classify different forms of living

and different objectives they support has represented a significant advance for recognition of dwelling typology (Franchini & Righetti, 2003).

Criticism related modern movement of the time has made a radical revision of the concept about this typology. Type of building that is no longer read as a fact in itself, but that enters within the urban laws, thus helping to define character of the city. At the same time, housing typology is inversely affected by the city. Urban rules encourage solutions that cannot be achieved within the given models. If we look very closely, the problem arises at the moment when, concept of using typology as an analytical-cognitive instrument, typology turns into an active design tool. Then analytical science of “typology” shows the needs, but is not sufficient to face complexity of spatial relations that come together to create between individual objects. This happens because the project is a synthetic process by nature, and requires presence of a higher theme or order, within which new parts of this game are located (Franchini & Righetti, 2003). The most important contemporary research on housing is no longer concerned with intervention in the consolidated city, nor with new urban additions, or historic areas, so much as with research of new territories created as a result of densities.

While in the eastern camp, from where the influence came towards Albania, criticism referred to modern developments as a result of capitalist relations system. According to that policy, the Russian architect or any other country, was seen as a designer whose duty was to satisfy orders of a private client. The architectural solutions that were made were to satisfy private financial interests, thus offering spectacular external solutions, obtaining architectural solutions with an aesthetic, but also economic effect, so that it became possible to use the building with an economic benefit.

The Russian architect and pedagogue Ivan Fomin, who started his career in early 1899 in Moscow and worked in the Art Nouveau style, once said: “Our architectural language is the decoration through which we convey ideology to the masses” (Kolli, 1937). After moving to St. Petersburg at the beginning of 20-th century, this architect became a master of Neoclassical Revival. Fomin developed a Soviet adaptation of Neoclassicism and became one of the key figures who contributed to early phase of Stalinist architecture, known as post-constructivism. According to critics of the former USSR, in pre-revolutionary Russia, activity of an architect was limited to the design and construction of private palaces and mainly so-called “profitable” houses. Only in very rare cases any designer was lucky enough to construct a building for a bank, or specific offices of private companies. As a result of the lack of creative perspective, due to the architect’s moral and material dependence on the arbitrariness and taste of a private client, they saw the activity of the architect as having degenerated into narrow professionalism, turning it into an “architectural business”, with inevitable and mutual cruel competition. Psychoanalytic methods

developed at the beginning of the 20-th century are considered pseudo-scientific, almost a part of didactic madness. The circles of architects of the time, state that this method used in architecture schools at the beginning of the twentieth century had a negative impact on practice. What was said in these methods, for example, was that it recommended “a special and continuous study of the formulation laws of artistic forms, of their elements, properties or qualities, based on the psychophysiology of perception. Architectural forms were created on the basis of imaginary relationships of psycho-technical and physical-mechanical factors. The avant-garde continued to develop in the early 1920s – despite everything and the revolution. Although a Latin proverb says: “When guns roar, the muses are silent”, in fact there was a powerful creative charge. Although it was an extremely destructive period with wars, creativity continued its course. This allowed the emergence of many new movements and schools (Kolli, 1937).

In this context, although there were no schools of scientific and critical thought for the field of construction, the data show us that, before 1945, Albania had a housing stock that recorded a figure of 40,438 registered residential buildings (Misja & Misja, 2004). This may have been less than 10% of those that may have actually existed, but it certainly testifies to construction diversity that existed at that time. There were still very early dwellings dating from the 16th-17th and 18th centuries mentioned and described by travelers of the time in these territories. The period from 1945 to 1990 is the time when Albania goes from a feudal economy to a centralized economy. This is the time when, of course, when the Italian-fascist ideological influence in urban planning and architecture comes to an end.

Architecture and construction in the period of recovery

The centralized economic system and communist dictatorial system do not consider private property, which they begin to eliminate through the nationalization process. The basic motive of life became the collective life, and this became the motive of creativity in architecture and urban planning. Construction specialists will be guided by principles of Russian school and by conditions of an economy that operated on the principle of ‘economic saving’ (Aliaj, Lulo & Myftiu, 2003). Materials were used sparingly and work was done under the motto that not even a brick or a spoonful of cement was wasted. These crises that were propagandized as victories, and impossibility to build individually, consequently lead to the construction of the village, or the new socialist city, which in Albania was borrowed from the countries of the communist bloc. The projects that were imported from abroad, mainly from the former USSR, were projects of the type-model, communal houses, projects in urban planning were the type of cities-

gardens, cities-combinations, industrial-cities. Models of architecture, such as the avant-garde of the 1930s or others like these, were forbidden ideas for designers, and each project was processed and issued by the Institute of Designs. (Pic. 2)

PIC. 2: Apartment-type project, in the USSR



And yet one of the important sectors of the national economy was country building. Housing problems were sensitive and inherited also as a result of continuous and successive policy changes in the Albanian territories, since the beginning of the 20th century. These problems are highlighted by adventurous experiments, especially the cloned borrowings of the so-called political-economic system, which differed according to the constantly changing positions and diplomatic relations. This is where the agrarian reform of the time came in, which caused fundamental changes in housing from rural areas to important city centers. The only ones that remain intact in structure are the tower apartments (Thomo, 2021), while the largest Elbasançe-type apartment, 1-story, with two rooms and a kitchen, was proposed and became the typology of the village apartment. The privacy of living is destroyed along with the right to own private property. Collective life appears and along with it appear new rules and relationships, previously unknown by a large part of the population. In this period, construction of studio-type apartment, inside the dormitory, also appears newly. Almost all residential areas underwent changes in the organization of their existing zoning that they had in the cities, as well as in the villages. Meanwhile, new residential centers were also built from scratch. Farm-type villages were created because of the economy of cooperatives, or farms which were inherited from the Italo-fascist period. These farms also had some temporary dwellings, that were built for farmworkers (as an example we can remember those of Sukthi village), which continued to be used even afterwards and residents settled down to live there eventually. New cities were built, where new industrial constructions were concentrated, which are of interest for study. The construction of housing was very important and based on the socialist principles

of the time in study. Housing construction was mainly carried out by the state, but there was also a small percentage of housing construction with private funds, on land provided by the state, which the resident paid based on loans provided by the state bank, which they paid in installments that were withheld from their salaries.

Inherited from earlier times, in some cities existed apartments with gazebo and tower type. These were adapted to the villa style creating civic dwellings, which still exists in some neighborhoods (Misja & Misja, 2004). This apartment has a symmetrical floor plan. In the center there is a wide hall from which the interior rooms are connected. This salon has an aesthetic staircase that connects the floors between them. On the upper floor there are wide verandas overlooking a small courtyard surrounded by railings that allow decorated facades to be viewed from the street. This was a sign of prosperity and emancipation for the citizens of that time. Until the dictatorial system, this house-type was built as a result of influences and developments of Italian architecture. As a result of neoclassicism and rationalism, individual villa-type dwellings were built, and with the opening of new plots and new roads, housing for employees also appeared. These will be the first constructions that would undergo adoptions and changes as a result of the housing crisis, which the new Albanian state is facing after the Second World War. Nearly 62,000 homes destroyed by the war were rebuilt again; new homes were built, and from a fund of 187,610 homes in 1930, 185,000 new homes were built in the year 1970 (Aliaj, Lulo & Myftiu, 2003). Again, individual villas undergo transformations as a result of their nationalization. These dwellings undergo deformations of spaces, adapting them to accommodate two and sometimes even more unrelated families. (Pic. 3)

PIC. 3: View from villa of the Theodhosi family, Tirana 2013.

Before reconstruction, this villa was adapted to be inhabited by two or three families.

(View during the survey of the building by Ark. E. Prifti)

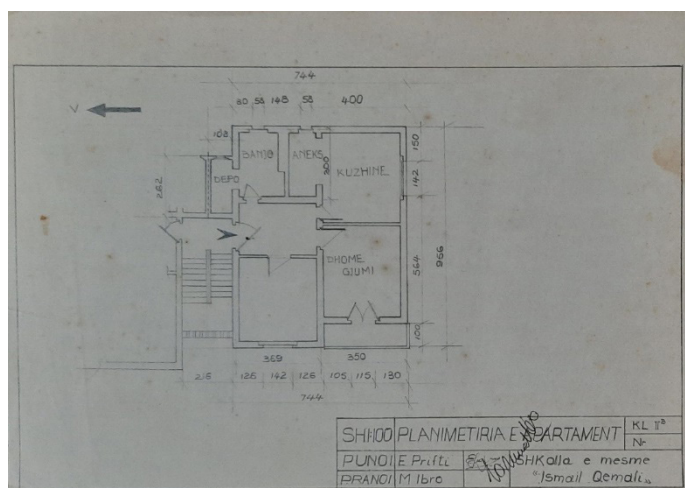


The first specialists of the 1950s-1960s educated in Eastern Europe tried to introduce spirit of modern architecture. They designed and built service areas for the community inside apartment building, bringing these with lower construction costs (Misja & Misja, 2004). The first social housing first appeared in Germany as a solution to social problems, that came as a result of political changes, but also technology and new industry that was emerging. A scheme that will influence Europe until the 60s, are 'apartments with balator' (with entrance from the balcony), or with gardens and terraces, illuminated sanitary services, which were built at low costs for the residents.

The first architects to graduate from the Polytechnic University of Tirana can also be called those who mark a new stage in Albanian architectural style and construction. The housing types actually come from design institutes of architects' association from the USSR. But even these very quickly suffer truncations in terms of spaces and functions. Some of the services inapplicable to the conditions of our weak economy are deleted from these projects.

The typology of Albanian dwelling within a century suffers big minuses in the typology. Functional environments that transform, as a result of the philosophy of a life as simple as possible. The prototype of the Frankfurt kitchen, designed by the Austrian architect Margarete Schutte-Lihotzky in 1928, was directly embraced by the socialist system as very compatible with their ideology. The author designed the kitchen keeping in mind the fact that the woman works many hours outside the home, and she has a social activity, and works in industry, etc. In this frame, there is not much time for a woman to waste inside a kitchen. This model was adopted, but even more truncated than the original; it comes in the form of an annex that was added to the living room. We do not have a central gas supply for cooking in the kitchen, electricity was not an allowed option, and the only option was a stove with a fireplace that was supplied with wood in winter and summer. The apartment has no dark storage for food. The sanitary node is only one and often with minimal equipment. Concept of a washrooms no longer exists, and certainly not for washing machines. There is no central heating in the bedrooms. Central heating was only in some cities with cold and long winters, such as in Korça. 'Musëndrat' (Thomo, 2012) (which are large closets in the walls, part of former Albanian dwellings), are no longer there, because one closet would have been enough for the whole family at that time, which did not have many clothes. Only in some apartments there is a laundry room, but it is often transformed into a storage function. (Pic. 4)

PIC. 4: Apartment layout; Silicate brick building, unplastered (four floors; with 8 apartments); Built in 1971, Laç-Kruje



Although not exact-copy, the Russian model of the apartment – communal was applied. This kind of apartment, where the apartment-room located inside a dormitory, and there are kitchens, bathrooms and showers shared with the community inside the dormitory.

The materials used reduced the quality and comfort inside these apartments. Communication in the transitional area does not include an elevator service or other services, which will continue to be missing in these apartments to these days. It was built mainly using ceramic bricks, silicate bricks and prefabricated panels. But external plastering was often missing due to the low cost with which it was built (Decision of Council of Ministers, Number 38).

Conclusion and recommendations

It seems that today it is almost impossible to say something new about the history of Albanian architecture during the years of communist dictatorship and rather strange existence of socialist realism in architecture. But today, in construction and architecture, we still have traces of this period. One cannot speak of formation of an architectural style, nor of profound scientific thoughts. There was some experimentation with seismic shaking and for this purpose some populist houses and even some low-rise social buildings were built. Construction, as the part of the industry that carries the largest weight of the economy, in today's market needs improvements and developments in typology and technologies. Developments

of last century often prove to be an obstacle to development of innovative and ultimately more resilient construction solutions. Investment priorities must change and be modified to reward approaches that create a better climate design for new buildings. At the heart of new architecture should be the concept of important issues about climate and environment. The client must be aware of these contemporary issues, but also make efforts to improve legacy constructions, which can be intervened for improvements (Hellas, 2012). Consequently, studies in this field will also bring improvements to programs in architecture and builders' schools, providing information and results of scientific research, as well as improvement of research laboratories, investments that will be also valid for professional architects and engineers.

A problem still unsolved to this day is precisely population of the territory up to the most extreme borders of the country. The policies of populating these villages and new cities through propaganda in the name of the party in dictatorial system, proved to be ineffective and did not pass the test when country was opened for free movement of population. If more effort had been put into the idea of improving typology and materials, to really improve living outside the Capital, we would not have today these critical social and urban situations. Instead of oppressing population for military threats from outside and wasting reinforced concrete materials for prefabricated bunkers, we could have built better houses for living, better urban infrastructures, better interurban communication links could have

PIC. 5: Apartment in Stëblevë, Librazhd - inhabited until the beginning of 1992. Photographed in 2019.



been built. (Pic. 5) The population invested energy in work which was unpaid or underpaid, that was called voluntary work, in order to keep them busy and to not give them time to think about a better life, or privacy (let's not forget that in the 80s several families lived inside one flat, which was actually only for a small family with two or three members). Some of the families spent their whole lives living in wooden shacks, which served as housing while they moved from construction site to another construction site, building the 'new socialism'. These shack-dwellings did not offer even the minimum of thermal comfort in winter. Let's not forget that even the internees of the communist regime spent their whole lives in such barracks. All these testify to a form of persecution that was used against the population, but that was disguised as a sacrifice in the name of the party's ideals and for the construction of the homeland.

Lack of contacts with the world due to the isolation, left people without models to compare and understand if there was room for improvements in the dwelling, the conditions inside them, or even engineering achievements in their construction.

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Demographic Dynamics and Characteristics of Urbanization in Albania in the First Decade of Transition: The first steps in shaping the demographic-territorial model of transition

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Abstract

The population of Albania in the decade 1989-2001 decreased to about 282 thousand inhabitants, as a result of two phenomena: (i) external migration; and (ii) lowering the fertility rate. Albanian society was also affected by the phenomenon of internal migration that produced: (i) the increase in the level of urbanization of the country; and (ii) demographic imbalance in the territory. Two main trends of internal emigration were distinguished: (i) rural-rural; and (ii) rural-urban. Both of these contributed to the increase in the level of urbanization of the country, and to the imbalance of regions

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of the country. There were four internal migration trends, of which: (i) three towards the central area of the country; and (ii) one towards the Western Lowlands. All four of these trends (lines) created the imbalance of population distribution, creating: (i) the concentrated region of Tirana-Durres; (ii) the non-partisan Fier-Vlora region; and (iii) the abandoned region that included the other eight counties of the country. The districts of Tirana, Durrës, Vlora and Fier dominate in the attraction of internal migrants, which reached 252,700 people. Only 9 out of 36 districts of the country or 25% of them had a positive demographic balance, while 27 districts or 75% of them suffered a negative balance. The phenomenon of population concentration in large urban centers is present in large cities, but it is especially noticeable in the capital, which grew (i) four times more than the total physical development of 40 years during 1945-1985, as well as (ii) with 151.500 new residents.

Keywords: *demography, external migration, internal migration, fertility rate, urbanization level, demographic-territorial model, population concentration, population abandonment*

Introduction

This paper aims to present and analyze the demographic structure, the level of urbanization and the demographic-territorial model of Albania in the first decade of transition. It tries to put together all the information collected by other researchers regarding demography, external and internal migration, population distribution and inhabited centers throughout the National territory. The paper aims to analyze these data, to understand and present the level of urbanization of the country and the characteristics of the urban-spatial structure, in the period studied.

The article starts with an overview of the level of demography, in the period between 1989-2001. Referring to the population and housing census in 2001, the population number was 3,069,275 inhabitants (INSTAT, 2001), with a significant decrease from 3,282,417 inhabitants in 1989 (INSTAT, 2004: 31, 2014). The decreased level of demography came as a result of two demographic and social phenomena: (i) external migration, according to which approximately 710,000 Albanians left the country (INSTAT, 2004: 10), and (ii) the decrease of the fertility rate from 3.3 in 1990 to 2.2 in 2000 (INSTAT, 2004: 32), as the first contributor to the reduction of natural population growth.

The Albanian society of the first decade of transition was also affected by the phenomenon of internal migration that produced an increase in the level of urbanization in the country. In this sense, the paper continues with the presentation of the increase in the housing stock as an indicator for the increased

level of urbanization. In 2001 compared to 1989, the number of new residential buildings in the urban area increased almost 2 times, while in the countryside this rate was almost 4 times lower, or 87.4% in urban areas, against 19.4% in rural areas (INSTAT, 2014: 10; Misja and Misja, 2004).

There are two characteristics of urbanization in relation to the housing stock: (i) an average of 6.4 dwellings per 1000 inhabitants were built, this indicator is higher than the average of 4.1 in the European Union (Misja and Misja, 2004); (ii) the creation of the stock of unoccupied housing (INSTAT, 2014), to the extent of 9.7% in rural areas compared to 13.1% in urban areas.” (INSTAT, 2014: 13).

Further, the paper focuses on the two basic trends of internal migration (rural-rural, rural-urban) as an indicator of the increased level of urbanization. One of the important phenomena in the early 90s was the migration of about 1 million Albanians, mainly from rural areas (INSTAT, 2014: 9). As a logical consequence, the citizen population increased from 32% to 42% of the country’s total population (Faja, 2008: 18; INSTAT, 2004: 9-10, 2001).

There were two main trends: (i) rural-rural migration, which included about 64% of immigrants and was destined mainly to the peri-urban areas of large cities (Vullnetari, 2007: 61; INSTAT, 2004: 14; King and Vullnetari, 2003; King, 2010) and produced the “urbanization of the rural” (Fuga, 2012: 51); as well as (ii) rural-urban migration that was expressed in the amount of 36% of immigrants and increased the level and density of the population in the existing urban centers (Vullnetari, 2007: 61, 2012; INSTAT, 2014: 10)

The presentation and analysis of internal migration from the inter-regional approach as an indicator for the increased level of urbanization, will be the further aim of the paper. 182.600 – 355.230 people moved from the region of their original residence to another, between 1989-2001 (INSTAT, 2004: 12; Vullnetari, 2007: 61). Observed from the regional approach: (i) about 91% of inter-regional migrants have moved towards the center and the coast (INSTAT, 2004: 12; Vullnetari, 2007: 61-63); and (ii) about 60% of migrants lived in the north, 32% in the south and 8% in the central coast. (INSTAT, 2004: 12).

Further, the paper will present the four trends of internal migration, of which three in the direction of the central area of the country and specifically in the counties of Tirana and Durrës, and one in the direction of the Western Lowlands and especially in the counties of Vlorë and Fier (Vullnetari, 2007: 62, 2010; INSTAT, 2004: 24-25). The origin of the four lines comes to the extent of 60% from the North, 30% from the South and the rest from the Central/Coastal regions (Vullnetari, 2007: 62).

An essential characteristic of this period, taken in the study, was the internal migration within the region, which also contributed to the increase in the level of urbanization. While 182,600 people moved from one region to another, the

migration between counties numbers 252,700 people (INSTAT, 2004: 12). This phenomenon will introduce population concentration not only according to the three regions of the country, but also among different districts of the same region. The four counties that are included in the Great Region and the Middle Region of the country, the counties of Tirana, Durrës, Vlora and Fier dominate in the attraction of internal migrants (INSTAT, 2004: 13; BB, 2007: 4).

The paper continues with the presentation of internal migration within the county as an indicator of the increased level of urbanization and especially the concentration-abandonment of the population. Internal migratory movements were not only between counties, but also between districts of the same prefecture, between municipalities and between villages and the city (INSTAT, 2004: 12). Observed from this approach, it can be said that in the period 1989-2001, only 9 out of 36 districts of the country or 25% of them have a positive balance, while 27 districts or 75% of them have a negative balance in terms of internal migration (INSTAT, 2004).

The phenomenon of population concentration in large urban centers is particularly noticeable in the capital. Only during the period 1990-1994, the population of Tirana increased from 374,500 to 475,000 inhabitants. In physical terms, the city has grown four times more than the total physical development of 40 years during 1945-1985. Whereas for the period 1990-2001, the population of Tirana [city 42 km²] increased by 151,500 inhabitants, that is (41%) and 2/3 of these internal migrants, that is, (105,000 individuals) live today inside city, 1/3 lives in the rural areas of the district of Tirana (IHS alumni, et al., 1998: 102; INSTAT, 2004: 40).

The paper closes with some findings and conclusions, as well as some modest recommendations.

Purpose and methodology of the paper

The first goal of this paper is the collection of data regarding the population level (demography), the housing stock, the level of urbanization and internal demographic movements during the period 1989-2001 (the first decade of transition). In this sense, the study, first, aims to contribute to the expansion of knowledge on these demographic and urban/territorial aspects, which is also its first contribution.

The purpose of the paper is to analyze these data to understand the way of development of the country, throughout the period under study, in the aspects of: (i) the urban-rural ratio; (ii) the way of development and growth of residential centers, focusing on the city as the essence of urbanization; (iii) the characteristics

of the Albanian city; (iv) of the urban-spatial structure of the country and its characteristics. The conclusions of this analysis, within the scope of this paper, will contribute to a wider understanding of the urban phenomena of the period under study and the contextual reasons of the subsequent urban-territorial development.

The methodology of this work is based on the analytical one, which is seen as the most suitable in this work, as it explains in a systematic and detailed way the phenomenon taken in the study, throughout the time that the study includes.

The methods used in this paper are qualitative. This paper theoretically evaluates demography, the level of urbanization, the urban-spatial structure, the characteristics of the urban-spatial structure of the country, and the characteristics of the Albanian city in the period studied. This is done by using secondary sources of Albanian authors who have spoken on these topics.

Overview of the level of demography, 1989-2001

The population level of Albania has been measured in several ways, but the most serious way remains through general censuses. From the 10 general population and housing censuses conducted in Albania, during the period 1923-2001, it results that only for the last three censuses (1979, 1989, 2001), there are published and relatively complete data to estimate the number of population and their distribution across the territory of Albania (Misja and Misja, 2004; Vullnetari, 2007, 2012; INSTAT, 2001, 2004, 2014).

Referring to the population and housing census in 2001, the population number was 3,069,275 inhabitants (INSTAT, 2001), which means that the demography has suffered a significant decrease from 3,282,417 inhabitants in 1989 (INSTAT, 2004: 31, 2014) or from about 3.2 million in 1991 (Bërxfholi, 2000; INSTAT, 2014). This decrease in the country's population level has been presented in the amount of about 7% for this first decade of transition.

The population decline in the first years of transition has been addressed by many authors and institutions, such as IHS Alumni in 1998, Misja and Misja in 2004, Aliaj in 2008, Faja in 2008, Fuga in 2004, 2012 and 2019, Gjuraj in 2015, INSTAT in 2004, 2014, etc. These, but also other authors, assessed the level of demography in the country as a result of two demographic and social phenomena. According to them, they are: (i) external migration and (ii) the decrease in the fertility rate.

Migration, in its entirety (external and internal), was a forgotten phenomenon for Albanians under the communist regime (Misja and Misja, 2004; Kotmilo and Kotmilo, 2017; Kaprata, 2018, 2019, 2020, 2021, 2023). If we refer to INSTAT, "With the establishment of the communist regime, after the second world war,

immigration from Albania was prohibited, while internal migration was limited” (INSTAT, 2004: 9). This phenomenon would be considered ‘national treason’ and according to Article 47 of the Penal Code of 1977, it was punishable by no less than 10 years to death, while other family members were usually exiled (Idrizi, et al, 2018: 97). But with the fall of the monist system, many social balances changed, including the practice of migration.

If we focus only on external migration, as the first contributor to the country’s population level, we can say that “During the period 1989-2001, approximately 700,000 Albanians left the country” (INSTAT, 2004: 10). Of this, about “220,000 immigrants left Albania between 1989 and March 1992 and 300,000 between 1989 and December 1992” (INSTAT, 2004: 34).

The positive balances of population growth also faltered in terms of the decrease in the fertility rate, as the main contributor to the natural increase of demography. If we refer to INSTAT “in 1989, the population was very young with “high growth potential”, in the demographic sense, as a result of the higher fertility rate, compared to other regions of Europe” (INSTAT, 2004: 32), but in this decade “... the child per woman index speaks of a downward trend from 3.3 in 1990 to 2.2 in 2000” (INSTAT, 2004: 32).

This would mean that “The demographic trend observed during the 1990s has led to the acceleration of the phenomenon of population aging.” (INSTAT, 2004: 32). As a result of the aging of the population, “the number of persons aged 0-9 fell by 21% compared to the total number, and for the age group 20-34, the number fell by 26%”, as well as “The ratio of aged residents over 60 years old has increased from 8% to 11% in a period of time between two “Population Censuses”. (INSTAT, 2004: 32).

The Albanian society of the first decade of transition was not only affected by the phenomenon of decreasing demographics, but also by the phenomenon of strong demographic movements. Presented and analyzed by several authors and institutions, such as Vullnetari (2003, 2007, 2010, 2012), King (2003, 2010), Faja (2003, 2008), Aliaj (2003, 2008), Imami (2008), INSTAT (2004), they are: (i) external migration that reduced the overall national population and has a close relationship with internal migration; and (ii) internal migration that produced an increase in the country’s level of urbanization and changed its urban structure.

We will not delve into the phenomenon of external migration, the decrease in the fertility rate and the aging of the population, because it does not directly affect the level of urbanization. However, it should be emphasized that the phenomenon of external migration has a symbiotic relationship with the phenomenon of internal migration (INSTAT, 2004: 63-64, 2014; Vullnetari, 2007), which is the only contributor to the urbanization process of the country.

The increase in housing stock as a contributor to the increased level of urbanization and demographic concentration

We can identify the rapid increase in the level of urbanization first from the housing stock statistics. The analysis of housing registration data shows that, in 2001 compared to 1989, the number of new residential buildings in the urban area has increased nearly 2 times, while in the countryside this rate has been nearly 4 times lower (Misja and Misja, 2004). Ça emphasizes the thesis of internal migration from rural and suburban areas to urban areas of Albania, increasing the level of urbanization of the country.

INSTAT, in its report “*Housing and living conditions*”, in 2014, would support this thesis. According to this study:

“In 2001, a clear trend of population decrease in rural areas and population increase in urban areas was observed, accompanied by a greater increase in the building stock in urban areas (87.4% in urban areas, against 19.4% in rural areas). This was also the first indicator of the change in settlement patterns in Albania.” (INSTAT, 2014: 10).

In the same report, INSTAT would underline that “The reduction of the rural population by 26.7% and the increase of the urban population by 15.8% confirm the process of urbanization, while the urban-rural comparison regarding the stock of buildings gives an increase of 54.4% in urban areas compared to only 2.2% in rural areas” (INSTAT, 2014: 10).

Another perspective regarding the dynamics of urbanization in reference to the housing and building stock created in the first decade of transition is given by Misja and Misja in 2004. Based on the data of the general population and housing census 2001, Misja and Misja would refer us that during the period 1991-2001, an average of 19,560 new apartments were built every year or 6.4 apartments per 1000 inhabitants. During the period 1991-1995, this indicator was 5.2 per 1000 inhabitants, while during the period 1996-2001 this indicator increased to 7.5 new dwellings built every year per 1000 inhabitants (Misja and Misja 2004).

To better understand this construction phenomenon that reflects the high dynamics of urbanization, we can say that this Albanian indicator is higher than the European Union average of 4.1. The European countries that have the highest level of housing investment are: Switzerland 1.7 and Denmark 2.9. Comparing the level of new housing completed every year per 1000 inhabitants in Eastern European countries, we notice that Albania has the highest level of this indicator, which speaks of a high increase in the level of urbanization (Misja and Misja, 2004).

But there is another phenomenon that starts in this urbanization period and is further reinforced in the other two phases of urbanization, which is the stock of unoccupied housing (INSTAT, 2014). This stock proves that the urbanization process has progressed even faster than the needs of the population for housing with the aim of housing. Referring to INSTAT, at the end of this urbanization phase, “the number of unoccupied dwellings was 9.7% in rural areas compared to 13.1% in urban areas.” (INSTAT, 2014: 13). These numbers prove the above argument, but also emphasize the dominance of urban areas in terms of unoccupied housing stock.

The two basic trends of internal migration (rural-rural, rural-urban) as a contributor to the increased level of urbanization and demographic concentration

The abandonment of the countryside by the population (decline of the rural population) would be one of the main demographic and urban characteristics in the first decade of the transition. This would not only come as a result of external migration but also as a result of internal migration. This phenomenon would be determined quantitatively by the INSTAT study “*Housing and living conditions*” in 2014. According to this study “One of the important phenomena in the early 90s was the migration of about 1,000,000 Albanians, mainly young people from rural areas” (INSTAT, 2014: 9).

Such figures would also come from the report ‘Migration in Albania; The Population and Housing Census 2001’ of INSTAT, which for its time limits, 1998-2001 would underline that “From rural areas, approximately 900,000 people migrated to urban areas in the interior of the country as well as to other countries.” (INSTAT, 2004: 10).

What stands out in this phase of the country’s urbanization is the fact that the level of urbanization increased significantly, and the ratio of the population in urban areas to the population in rural areas changed rapidly in favor of urban areas. As if Faja would notice:

“The citizen population increased from 32% to 42% of the country’s total population. Internal emigration was mainly concentrated in big cities, especially where the number of inhabitants tripled from 250,000 inhabitants in 1990 to 750,000 inhabitants in 2000. (Faja, 2008: 18).

This definition of Guilt, although in generalized terms and not as quantitative as those given by the specialized institutions that we will refer to later, defines the main contributors from which the urbanization of the first decade of transition developed.

During the period 1992-2000, internal migration involved, on an annual average, about 150,750 people (Vullnetari, 2007: 61, 2010; King and Vullnetari, 2003). As a result of this massive population displacement, the level of urbanization of the country increased from 34% in 1989 (Misja and Misja, 2004) to 42% in 2001 (INSTAT, 2004: 9-10).

Observed in the relationship between urban areas and rural areas, the trend of internal migration went mainly from rural areas to other rural areas (Vullnetari, 2007, 2010, 2012; INSTAT, 2004). About 64% of this internal migration was rural-rural, and was destined mainly to the peri-urban areas of big cities, such as Tirana, Durrës, Shkodër, Korçë (Vullnetari, 2007: 61; King and Vullnetari, 2003; King, 2010) and Fier, Vlora (INSTAT, 2004: 14).

This finding is consistent with the phenomenon of informal construction of the first two phases of urbanization, (Kaprata, 2020, 2021, 2023) because this migratory flow settled in the peripheral territories of large cities where the control of the authorities was lower than in urban areas (Aliaj, 2008; Imami, 2008). If we refer to Aliaj and Aliaj “Since 1990, the population of Tirana and its surrounding suburbs has had an alarming average growth of 7% per year” (IHS alumni, et al., 1998: 102).

Rural-rural migration would affect the increase in the level of urbanization of the country, as a result of the further densification of rural areas that produced the phenomenon of “rural urbanization”. As Fuga would say, “In two decades, the former rural area, especially the one located on the main communication routes between the two big metropolises [Tirana, Durres], has become excessively urbanized” (Fuga, 2012: 51).

But rural-urban migration was also present in this time period, and according to INSTAT “The process of urbanization, ascertained in Albania by the Census of 2001, continues to exist and progress, mainly due to internal migration towards urban areas .” (INSTAT, 2014: 10). It was expressed at the rate of 36% of the total internal migration (Vullnetari, 2007: 61, 2012). Referring to INSTAT, this phenomenon brought about a “decrease of the population in rural areas [to the extent of] 13% compared to the data of the 1989 Census” (INSTAT, 2004: 10).

Internal migration from the inter-regional approach as a contributor to the increased level of urbanization and demographic concentration

The phenomenon of urbanization can also be analyzed by directly observing the dynamics and currents of internal migration. It has turned out to be a very massive and very complicated internal displacement of the Albanian population across the national territory (INSTAT, 2004; King and Vullnetari, 2003; Vullnetari, 2007, 2010, 2012).

According to INSTAT, about 182,600 people living in Albania in 2001 undertook internal migration and moved from their region of origin to another between 1989-2001. These internal migrants represent 5.7% of the total national population in 1989 (INSTAT, 2004: 12). These INSTAT figures for internal migration, in general terms, reconcile the figure of 900 thousand inhabitants who have abandoned their place of origin and the figure of 710 thousand citizens who have left Albania, presented above.

Whereas the Volunteer in 2007 gives us totally different figures, while distinguishing the low figures presented by INSTAT in 2004. Referring to the Volunteer, internal migration for the period 1992-2000 was expressed as “1,357,750 internal migrants in 9 years, or almost 40 % of the population of the year 2000”, of which 355.230 thousand only from one region to another region (Vullnetari, 2007: 61).

To understand this dynamic, we will first focus on the first trend of internal migration, that from one county to another county, observed from the regional approach. Referred INSTAT:

“Analyzing the table of migration from prefecture to prefecture during the 12-year period 1989-2001, we distinguish two different types of migration: the first, long-distance migration, directed to the main economic poles in the center of the country; second, migration over somewhat short distances towards the coast, which is a region of immigration and emigration.” (INSTAT, 2004: 13)

Observed from the regional approach “Internal migration in Albania is clearly a one-way migration: about 91% of inter-regional migrants have moved towards the center and the coast [of the country]” (INSTAT, 2004: 12). Therefore, both the central region (which includes the counties of Tirana and Durrës), and the coastal region (which includes the counties of Vlora, Fier and Lezha), in the first decade of the transition, have a high population growth (Vullnetari, 2007: 61 -63).

This would come as a result of inter-regional internal migration, where the immigrant population in the central and coastal region has been 44 times greater than that in the northeast region and 13 times greater than that in the southeast region. Referred to INSTAT “About 60% of migrants lived in the north in 1989, 32% in the south and 8% in the center of the coast. (INSTAT, 2004: 12).

The four trends of internal migration as a contributor to the increased level of urbanization and demographic concentration

Internal migration is recorded in four lines of population displacement, of which three towards the center of the country and specifically in the districts of Tirana and Durrës, and one towards the Western Lowlands and especially in the districts

of Vlorë and Fier. If we refer to Fuga “the entire “periphery” has been poured into the main urban areas of the country” (Fuga, 2004: 12).

Fuga would identify this migration process as “Hundreds of thousands of people or even families [who] went down from the higher altitude areas to the lowlands” (Fuga, 2012: 9). Whereas, according to INSTAT, “Migrants who come from the highlands and the eastern areas of Kukës and Dibra and head for the center of the country.” (INSTAT, 2004: 24).

This is the first line of population displacement towards the center of the country, and specifically in the counties of Tirana and Durrës (Vullnetari, 2007: 62, 2010). These central counties attract migrants, who come from all over the country, but most of the migrants come from the north-east. If we refer to INSTAT, “Kukës and Dibër counties [contribute respectively] to 47% and 40% of immigrants in Tirana and Durrës [counties]” (INSTAT, 2004: 25).

Whereas the second line of displacement starts from the internal regions that include the districts of “Berat, Korçë, Elbasan, Gjirokastër and Shkodër” (INSTAT, 2004: 24) and ends, also towards the center of the country, specifically in the districts of Tirana and Durrës (Vullnetari, 2007, 2012).

The same target towards the area that includes the counties of Tirana and Durrës also has the third line of population displacement that originates from the secondary centers located on the coast that include “Vlorë, Fier, Lezhë” (INSTAT, 2004: 24, Vullnetari, 2007, 2010). These three lines of population displacement from the eastern, interior and coastal regions of the country towards its central region will mark the beginnings of overpopulation in the Tirana-Durra Region.

The demographic and urban empowerment, in this decade, of the Fier-Vlora Region will be created by the fourth line of population displacement, which according to INSTAT in 2004 consists of migrants coming “from the internal areas [counties of Berat, Korçë, Elbasan, Gjirokastër and Shkodër] that go to the secondary centers of the coast of the country [Fier-Vlorë]” (INSTAT, 2004: 24).

Vullnetari would present us the areas of origin of this internal migration, of the four lines, which according to her “slightly more than 60% comes from the North, 30% from the South and the rest from the Central/Coastal regions”, while 90 % of it was aimed at the Central/Coastal region (Vullnetari, 2007: 62).

Observed in the inter-regional approach, we can also identify the depopulation of eight other regions of the country. But even these would have different dynamics of population abandonment, which are expressed in “relative values, the prefectures that had the highest number of the general population that emigrated are: first Dibra, followed by Kukësi, Elbasan and Berat “ (INSTAT, 2004: 13), while only the counties of Kukes and Dibra would contribute with about 37% of the migrated population, or “92,300 immigrants” (INSTAT, 2004: 14).

Internal migration within the region as a contributor to the increased level of urbanization and demographic concentration

Internal migration and the increase in the level of urbanization of Albania in the first decade of transition becomes more evident if we observe the trend from one county to another in the same region. Referred to INSTAT in 2004 “While 182,600 people moved from one region to another, migration between prefectures [counties] numbers 252,700 people” (INSTAT, 2004: 12).

This phenomenon will introduce demographic concentration and abandonment, not only according to the three regions of the country, but also among different districts of the same region. The four counties that are included in the Great Region and the Middle Region of the country, the counties of Tirana, Durrës, Vlora and Fier dominate in the attraction of internal migrants. INSTAT presents this to us when it underlines that “As far as the host prefectures are concerned, Tirana ranks first, followed by Durrës, Fieri and Vlora” (INSTAT, 2004: 13).

The growth of these counties is also presented by the fact that it is precisely these counties that are also ranked with the lowest level of population loss. As INSTAT would present it “Vlora, Tirana and Durrës have the lowest level of internal outbound migration which represents less than 7% of the total national migration (INSTAT, 2004: 13).

In fact, we can see that there are big growth differences between the Tirana-Durres Region and the Fier-Vlora Region, because “72% of the total number of immigrants live in Tirana and Durrës” (INSTAT, 2004: 13). This dynamic would also be recognized by the World Bank, when it would underline that “Between 1989 and 2001, Tirana and Durrës topped the list of the most populous prefectures/regions that receive migrants, absorbing approximately three quarters of the total flows of internal migration.” (BB, 2007: 4).

And INSTAT would give us more quantitative information about this dominance of Tirana and Durrës counties in relation to the whole country. According to her, between the years 1989-2001, Tirana included more than half of inter-county displacements, or “136,600 migrants from other prefectures”, while Durrës is the second most attractive area and included more than 18% of migrants, or “44,900 immigrants” (INSTAT, 2004: 13-14).

As can be seen from these INSTAT figures, even within the Tirana-Durres Region, Tirana dominates in terms of population growth, because “70% of migrants from Kukësi and Dibra went to Tirana and 20% to Durrës” and that 10% of migrants with residence in Korça district would go to Tirana and only 8% of those who went to Durrës (INSTAT, 2004: 14).

Internal migration within the county as a contributor to the increased level of urbanization and demographic concentration

In the urbanization process of this phase, the tendency of population concentration in the big cities of the country is noticed. According to INSTAT, “Internal migratory movements did not only take place between prefectures [districts], but also between districts of the same prefecture, between municipalities and between villages and the city.” (INSTAT, 2004: 12).

This would produce the result that even within the region, the big cities would be further differentiated from the smaller cities of the same region, in terms of population (Vullnetari, 2007, 2010, 2012). If we refer to Misja and Misja, this phenomenon is presented with population growth in cities with over 50,000 inhabitants, in which 53.6% of the country’s urban population was concentrated in 1989, and at the same time there has been a population decrease in small towns, up to 5,000 inhabitants, where 7.5% of the country’s urban population is concentrated (Misja and Misja, 2004).

In conclusion, it can be said that in the period 1989-2001, only 9 out of 36 districts of the country or 25% of them have a positive balance, while 27 districts or 75% of them have a negative balance in terms of internal migration (INSTAT, 2004). According to INSTAT “in terms of urban migration, Tirana and Durrës received approximately 74% of the total number of migrants.” (INSTAT, 2004: 16) and about 62% of immigrants destined for Durrës and the same number destined for Elbasan have settled in urban areas. (INSTAT, 2004: 15).

But also, another phenomenon that started in this phase of the country’s urbanization from internal migration was the concentration of the population in the centers of the main cities that experienced growth (Faja, 2008; Misja and Misja 2004). INSTAT also recognizes this phenomenon, when it underlines that 252,700 people who have emigrated in their entirety, about 58% or over 146,000 have left rural areas for urban areas (INSTAT, 2004), which has resulted in the densification of the population in cities of host areas.

The phenomenon of population concentration in large urban centers is particularly noticeable in the capital. If we refer to INSTAT “The population of Tirana [city 42 km²] currently increased by 151,500 inhabitants between the two Censuses, that is (41%)” and “2/3 of these internal migrants, that is, (105,000 individuals) live today inside in the city, 1/3 lives in the rural areas of the district of Tirana.” (INSTAT, 2004: 40)

An even earlier definition comes to us from Aliaj and Aliaj in 1998, who would express themselves especially for Tirana, underlining “Only during the period 1990-

1994, the population of Tirana increased from 374,500 to 475,000 inhabitants. In physical terms the city has grown four times more than the total physical development of 40 years during 1945-1985” (IHS alumni, et al., 1998: 102).

Findings and conclusions

In 2001, the number of the population of Albania was 3,069,275 inhabitants, with a significant decrease from 3,282,417 inhabitants in 1989. The water level of demography came as a result of two demographic and social phenomena: (i) external migration, according to which approximately 710,000 Albanians left the country and (ii) the decrease in the fertility rate from 3.3 in 1990 to 2.2 in 2000, as the first contributor to the decrease in natural population growth.

The Albanian society of the first decade of transition was also affected by the phenomenon of internal migration that produced an increase in the level of urbanization in the country. In 2001, compared to 1989, the number of new residential buildings in the urban area increased nearly 2 times, while in the countryside this rate was nearly 4 times lower. This can also be expressed as a percentage, where in urban areas the increase was 87.4%, while in rural areas only 19.4%.

There are two characteristics of urbanization in relation to the housing stock: (i) an average of 6.4 dwellings per 1,000 inhabitants were built, this indicator being higher than the average of 4.1 in the European Union; (ii) the creation of the stock of unoccupied dwellings, to the extent of 9.7% in rural areas compared to 13.1% in urban areas.

One of the important phenomena in the early 90s was the migration of about 1 million Albanians, mainly from rural areas. As a logical consequence, the citizen population increased from 32% to 42% of the country’s total population.

There were two main trends of internal immigration: (i) rural-rural migration that included about 64% of immigrants and was destined mainly to the peri-urban areas of big cities and produced the phenomenon of “rural urbanization”; as well as (ii) rural-urban migration which was expressed in the amount of 36% of immigrants and increased the level and density of the population in the existing urban centers. Both of these contributed to the increase in the level of urbanization of the country, and to the concentration-abandonment imbalance of different regions of the country.

Internal migration will affect the increased level of urbanization and the imbalance of demographic distribution across the national territory, also observed from the inter-regional approach. 182,600 – 355,230 people moved from their region of origin to another, between 1989-2001. Observed from the regional approach: (i) about 91% of inter-regional migrants have moved towards the central

area and the coastal area of the country; and (ii) about 60% of migrants originated in the northern region, 32% in the southern region, and 8% in the central and coastal region.

There were four internal migration trends, of which three in the direction of the central area of the country and specifically in the districts of Tirana and Durrës, and one in the direction of the Western Lowlands and especially in the districts of Vlorë and Fier. The origin of the four lines comes to the extent of 60% from the North, 30% from the South and the rest from the Central/Coastal regions of the country. All four of these lines will further emphasize the imbalance of population distribution, creating: (i) the concentrated region of Tirana-Durres; (ii) the non-partisan Fier-Vlora region; and (iii) the abandoned region that included the other eight districts of the country.

An essential characteristic of this period was internal migration within the region, which also contributed to the increase in the level of urbanization. While 182,600 people moved from one region to another, migration between counties numbers 252,700 people. This phenomenon will introduce population concentration not only according to the three regions of the country, but also among different districts of the same region. The four counties that are included in the Great Region and the Middle Region of the country, the counties of Tirana, Durrës, Vlora and Fier dominate in the attraction of internal migrants.

Internal migration within the county was another characteristic of this period under study. Internal migratory movements did not only take place between counties, but also between cities of the same county, between municipalities and between villages and the city. In the period 1989-2001, in terms of internal migration, only 9 out of 36 districts of the country or 25% of them have a positive balance, while 27 districts or 75% of them have a negative balance.

The phenomenon of population concentration in large urban centers is particularly noticeable in the capital. Only during the period 1990-1994, the population of Tirana increased from 374 thousand to 475 thousand inhabitants. In physical terms, the city has grown four times more than the total physical development of 40 years during 1945-1985. However, for the period 1990-2001, the population of Tirana [city 42 km²]: (i) increased by 151,500 inhabitants (41%); and (ii) 2/3 of these internal migrants, that is, (105,000 individuals) live inside the city, while 1/3 lives in the rural areas of the district of Tirana.

Recommendations

Within its modest limits, the paper recommends more detailed studies on this topic, in the same time period or in other periods along the Albanian transition.

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Security in Computer Networks: Threats, Challenges, and Protection _____

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Abstract

This scientific article aims to examine the issue of security in computer networks, highlighting the threats, challenges, and methods of protection. With the development of technology and the increased use of the internet, security in computer networks has become a critical issue for individuals, organizations, and society as a whole. In this article, we will discuss how attackers can infiltrate communication systems and compromise the integrity, confidentiality, and availability of data. The techniques used by attackers to achieve their malicious goals will also be described.

Furthermore, the main challenges faced by computer network security specialists will be discussed. These challenges include identifying potential threats, assessing the risk level, developing defense strategies, implementing security policies, and continuous monitoring of network activity. Additionally, legal aspects of network security will be addressed, including current legislation and regulations that impact information security management.

In the next section of the article, protective measures to prevent attacks on computer networks will be examined. These measures include implementing strict

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security policies, utilizing advanced firewall technologies, data encryption, two-factor authentication, and monitoring suspicious events. The role of user education in network security and the need for ongoing awareness of new threats and best security practices will also be discussed.

Finally, this article will provide an overview of various studies and research conducted in the field of computer network security. Key findings and recommendations for further development of security in computer networks will be discussed.

Keywords: *Security in computer networks, threats, challenges, protection, security policy, firewall, data encryption, two-factor authentication, user education.*

Introduction

The aim of this research is to explore the topic of security in computer networks, focusing on various aspects such as threats, challenges, protection measures, security policies, firewalls, data encryption, two-factor authentication, and user education. The objective is to gain a comprehensive understanding of the current state of security in computer networks and identify effective strategies for ensuring the safety and integrity of networked systems.

To achieve these objectives, a multi-method research approach will be employed. Firstly, an extensive literature review will be conducted to examine existing studies, frameworks, and best practices related to security in computer networks. This will provide a theoretical foundation and help identify key concepts, emerging trends, and gaps in knowledge. Additionally, empirical research will be conducted, including surveys, interviews, and case studies, to gather insights from IT professionals, network administrators, and users regarding their experiences, challenges, and perspectives on network security.

The research methodology will also involve analyzing real-world examples of security breaches and successful defense mechanisms to extract valuable lessons and practical recommendations. Furthermore, industry standards, regulations, and guidelines related to network security will be reviewed to understand their impact on security policy development and implementation.

By combining both theoretical and empirical research approaches, this study aims to contribute to the existing body of knowledge on security in computer networks. The findings and recommendations will assist organizations and individuals in enhancing their understanding of threats, implementing robust protection measures, developing effective security policies, and fostering a culture of user education and awareness to mitigate risks and ensure secure network environments.

Research Aim

The aim of this research is to investigate and analyze the security aspects of computer networks, with a focus on understanding the challenges, threats, and protective measures involved.

Legal aspects of network security are important to guarantee the protection of data and activity across computer networks. Some legal aspects related to network security are:

Law on the protection of personal data: Most countries have specific laws governing the protection of personal data. These laws define obligations and limitations for organizations that store and process personal data of individuals, ensuring transparency, integrity and confidentiality of personal data.

Network tort law: Network tort laws prohibit illegal access to computer networks. They criminalize hacking, the unauthorized use of network systems and the destruction of data or network infrastructure. These laws help prevent and punish illegal online crimes.

Security Incident Reporting Law: In some jurisdictions, there are laws that require organizations to report security incidents that could have a significant impact. These laws take into account obligations for reporting data breaches, mass computer attacks and other incidents that have an impact on network security.

The Law of Contracts and Agreements Related to Network Security: Contracts and agreements governing network security help define the obligations and responsibilities of parties participating in a computer network. These agreements include terms for data protection, authorized access and the handling of security incidents.

Sector-specific regulations: In some industries, such as financial and health services, there are specific regulations that define the security measures needed to protect data and network systems. These regulations are put in place to ensure the protection of sensitive information and to minimize the risk of data misuse or loss.

To ensure that the legal aspects of network security are followed, organizations should consult with legal experts and comply with applicable laws and regulations in the country in which they operate. It is also important to keep organizations aware of new legislative changes in the field of network security and to use certain best practices to guarantee network and data protection.

Protecting against cyberattacks in computer networks is a critical aspect of information security and operational continuity for organizations. There are

several steps and measures that can be taken to protect the computer network from attacks:

Firewall: A firewall helps prevent unauthorized access to the network by allowing or blocking traffic based on defined rules. By configuring and monitoring the firewall, known patterns of malicious traffic can be prevented.

Intrusion Detection and Prevention Systems (IDS/IPS): IDS and IPS systems identify and take action against suspicious activity in the network. IDS detects possible security incidents by analyzing network traffic, while IPS actively acts to prevent attacks by blocking or disrupting connections to problematic sources.

Data Encryption: Using encryption technology helps maintain the privacy and integrity of data in the network. Encrypted traffic provides protection against communication interception and ensures that only authorized recipients have access to the encrypted data.

Security Policies: Establishing network security policies is crucial. These policies should include access restrictions, password management, internet usage rules, and secure programming practices. Ensure that security policies are known and implemented by all network users.

Two-Factor Authentication: Two-factor authentication adds an extra layer of security by requiring additional information for identification. This may involve combining a password with another factor like a verification code sent to a mobile device or a physical security token.

Network Monitoring: Using network monitoring technologies helps identify and respond to suspicious activity. By implementing specialized systems for log monitoring and traffic analysis, security breaches can be detected, and appropriate measures can be taken to prevent further damage.

User Education and Training: Users are a weak point in network security, so it is important to educate and train them about secure practices. This includes identifying phishing attempts, safe internet behavior, and raising awareness about the risks of clicking on suspicious links or opening unauthorized files.

System Updates and Patches: Ensure that systems and devices in the network are up-to-date with the latest software versions and patches. Regularly applying updates helps address vulnerabilities and strengthen network security.

It's important to note that these steps and measures are general recommendations. The specific network security requirements may vary depending on the organization's size, industry, and risk profile.

Recommendations and Future Perspectives

Take a proactive approach to security: Network security should not be just a passive addition but should include a proactive and incisive approach. Identify potential

threat habits and locations in your network and implement mechanisms to address them before they cause damage.

Update and monitor your environment: Computer networks are constantly evolving, expanding, and changing their structure. Make sure you have procedures in place to identify and monitor the compatibility of devices and applications on your network. Update your defense tools and stay current with security codes and latest patches.

Protect privacy and personal data: Protecting privacy and personal data is a major challenge in computer networks. Ensure that you have clear policies and procedures for storing and processing personal data. Use encryption technology to protect your information from unauthorized access.

User training and awareness: Ensure that network users are informed and trained about computer security practices. Organize training sessions and provide educational materials to help users identify and prevent potential risks.

Use a combination of technology and security policies: Network security is not just about technology but also about policies and procedures. Combine security technologies with defined policies and choose a strategic approach to risk management in the network.

Segment the network into separate segments: Use the concept of network segmentation to isolate individual segments and reduce the impact of a potential incident on the entire network. This will help limit damage and the spread of attacks across the network.

Monitor and identify attacks: Implement monitoring and detection mechanisms to identify active attacks on your network. Use specialized systems to analyze traffic loads and detect suspicious activities or attacks that may have bypassed defense barriers.

Collaborate with the security community: Engaging in the network security community is important for sharing information, experiences, and learning from field experts. Participate in conferences, seminars, and online discussions to stay connected with current developments and best practices in computer network security.

Key Findings Reported

DDoS Mitigation Services: There are specialized services offered by dedicated companies that provide active protection and mitigation of DDoS attacks using their distributed infrastructure.

Precaution and advance planning are essential in securing the network against DDoS attacks. Organizations need to develop network security policies and plans,

test their resilience against DDoS attacks, and have mechanisms in place to respond to and mitigate attacks if they occur.

Rise of Zero-Day Attacks: Zero-day attacks are attacks that exploit unknown vulnerabilities in applications or operating systems. Findings in this field have shown the persistence of these attacks and the need to identify and address potential weaknesses. Zero-day attacks exploit a known vulnerability in a specific operating system, application, or device, for which there is no general solution or patch available yet. These attacks are called “zero-day” because they occur before developers are aware of the vulnerability and provide a fix (patch) for it. Increase in Information Value: Zero-day vulnerability information is highly valuable in underground markets and the world of cybercrime. Cybersecurity groups and advanced attackers are interested in exploiting Zero-day vulnerabilities to gain financial benefits, hack into organizations, or disrupt critical infrastructure.

Lack of Intervention from Vendors: After the discovery of a zero-day vulnerability, there is a need for effective coordination between security researchers, security firms, and software vendors to develop and deploy security solutions. During this period, attackers can exploit the vulnerability without hindrance.

Advancement of Attack Techniques: Sophisticated attackers use advanced techniques to discover and exploit Zero-day vulnerabilities. This includes code analysis, reverse engineering, and the use of emerging technologies like Artificial Intelligence to efficiently identify and exploit vulnerabilities.

To prevent and detect Zero-day attacks, some key steps are:

- **Security Updates Solution:** Implementing security updates provided by software vendors is crucial. Users should have regular policies to update their systems with the latest patches and software versions to eliminate potential Zero-day vulnerabilities.
- **Active Monitoring and Detection:** Implement specialized tools and technologies for monitoring and detecting suspicious and anomalous activities in the network. This includes analyzing traffic payloads, log monitoring, and utilizing Security Information and Event Management (SIEM) technologies.
- **Research and Collaboration:** Close collaboration between the security community, security researchers, and software vendors is essential. Researchers should report discovered vulnerabilities to vendors and assist in developing security solutions as quickly as possible.

To enhance security against Zero-day attacks, it is important to have a proactive strategy for system protection and stay informed about current developments and new attack methods.

Wireless Network Security: Wireless networks are a concern due to the risk of unauthorized access and potential attacks. Studies have focused on implementing security protocols such as WPA2 and WPA3 to prevent unauthorized access and privacy breaches. Wireless network security is an important aspect of information security that includes measures and practices to prevent attacks and breaches in such networks. In wireless networks, information is transmitted through radio signals, making it more vulnerable to potential attacks.

Encryption: Using encryption protocols like WPA2 (Wi-Fi Protected Access 2) or WPA3 to protect network traffic. Encrypting the information makes it unreadable to potential attackers and ensures the integrity of the data sent over the network.

Identification and Authentication: Utilizing identification and authentication mechanisms such as security keys or digital certificates to verify the identity of authorized devices and users before connecting them to the wireless network.

SSID Hiding: Hiding the network's name (SSID) makes it invisible to unauthorized devices. This provides a small additional layer of security, making it harder for attackers to find and connect to the network.

Firewall: Using a firewall to filter traffic and allow only authorized communication. A firewall helps prevent unauthorized access and attacks on the wireless network.

Firmware Updates: Regularly update the firmware of your wireless network devices, such as the router or access points. Firmware updates often include new security fixes and address identified vulnerabilities.

Physical Access Control: Control physical access to your wireless network devices and ensure they are placed in secure and inaccessible locations for unauthorized individuals.

Isolation Technology: Sometimes it is beneficial to use isolation between wireless network clients, not allowing direct communication between them. This reduces the risk of attacks within the network.

Monitoring and Intrusion Detection: Utilize monitoring and intrusion detection tools to identify suspicious activity, potential attacks, and breaches in the wireless network.

User Education: Training users about wireless network security practices is crucial. Users should be aware of the risks of attacks and take measures to protect their wireless networks by following recommended security practices.

Data Protection and Security in Cloud Computing: With the increasing adoption of cloud computing, data protection and security of cloud infrastructures are important topics. Studies have advanced in the development of encryption technologies and control mechanisms to ensure the integrity and fortification

of data security in cloud environments. Data protection and security in cloud computing are highly significant aspects for organizations using cloud services. Cloud computing provides the ability to store, process, and remotely access data through off-site infrastructures. Here are some key steps and concepts to protect data and ensure security in cloud computing:

Encryption: Data encryption is an effective way to protect against unauthorized access in the cloud. Ensure that your data is encrypted at all stages, including transmission, storage, and processing. Use security protocols such as SSL/TLS for encrypted communication between clients and servers in the cloud.

Access Control: Privilege management and access control are crucial to ensure that only authorized individuals have access to data in the cloud. Use strong identification and authentication policies, multifactor authentication mechanisms, and separate roles and privileges of users to ensure they have only the necessary access.

Password Protection: Ensure that you use strong passwords and change them regularly. Using a password manager and implementing strict password protection policies is important to prevent unauthorized access to your cloud accounts.

Backup and Data Recovery: Establish an effective backup strategy for your data in the cloud. Ensure that you have copies stored in different locations and regularly test data recovery procedures to ensure they can be restored in case of incidents or data loss.

Monitoring and Intrusion Detection: Implementing tools and technologies for monitoring and intrusion detection in your cloud infrastructure is essential. Monitoring the flow of activity in the cloud and identifying suspicious activities or potential attacks can help detect and respond quickly to security incidents.

Auditing and Security Assessment: Conduct regular security audits and proactive evaluation of your cloud infrastructure to identify vulnerabilities and take corrective measures. Take advantage of services offered by specialized auditors or automated tools that can assist in detecting and addressing security risks.

Contracts and Agreements with Cloud Providers: Ensure that you have clear and reviewable contracts and agreements with your cloud providers. Include terms for data security and privacy policies.

User Identification and Authentication

User Identification and Authentication in computer networks is an important process to ensure that only authorized users have access to network resources. These two concepts are essential to guarantee the security and privacy of data and network systems. Here are some common methods for user identification and authentication:

Username: Users are typically identified by a unique username, which can be a combination of their real name and specified characters. The username is used to differentiate users on the network and associate activities and accesses with the correct user.

Password: Passwords are commonly used for user authentication. These are secret words or strings that only the user should know and provide to verify their identity. It is important to use strong passwords and change them regularly to prevent unauthorized access to the network.

Security Keys: In some cases, such as wireless networks, security keys are used for authentication. These keys are long strings similar to passwords that are used to ensure that only authorized devices or users have access.

Digital Certificates: Digital certificates are secure electronic documents that verify the identity of a user or an organization on the network. The use of digital certificates allows authentication and verification of user identities by trusted authorities (Certificate Authorities - CAs).

Two-Factor Authentication (2FA): Two-factor authentication requires users to provide two different forms of identification as part of the authentication process. These can be something they know (e.g., a password) and something they possess (e.g., a verification code sent to their mobile phone). The combination of both factors makes authentication more secure and harder for attackers.

Utilizing Security Protocols: Security protocols such as SSL/TLS can be used to secure the transmission of passwords and identities in computer networks. These protocols provide encryption and integrity to ensure that information is not susceptible to attacks and breaches.

To enhance security, it is recommended to use a combination of these methods of identification and authentication, according to the needs and security level of the organization and network infrastructure.

Conclusions

Securing computer networks is a crucial aspect to protect data and systems from potential attacks and breaches. User identification and authentication are key processes to ensure that only authorized users have access to the network. Usernames, passwords, security keys, digital certificates, and two-factor authentication are common methods for user identification and authentication.

To ensure data integrity in the network, cryptography plays a vital role. Cryptography uses different algorithms to encrypt data and ensure that it remains unreadable to unauthorized parties. Symmetric and asymmetric encryption, as well as hash functions, are cryptographic techniques used to protect data in the network.

Data integrity aims to ensure that data does not change or get manipulated during transmission or storage. Hash functions and digital signatures are used to verify and maintain data integrity.

To achieve a high level of security in the network, it is recommended to use security protocols such as SSL/TLS, which provide encryption and integrity to protect data between the client and server.

In conclusion, network security is an important challenge for organizations and individuals. User identification and authentication, along with cryptography and data integrity, are the primary means to ensure the security and privacy of data in computer networks.

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Personal Life Signaling Device for Weather or War Disasters

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Abstract

Day after day we are facing with new challenges created by natural or man-made factors. In the first group we can mention earthquakes, heavy storms, earth slides etc, and in the second are wars that unfortunately are taking way people lives even though we live in 21st century. During and especially after every disaster the most difficult moments are to check for survivors under the ruins. In this work we propose a personal and easy to use device based in sensors technology that would make it possible to signal the presence of life signs from persons under the ruins such as pulse or oxygen level. The wireless network created from those devices would make it possible to transmit the signal even in long distances to reach the help emergency teams. To optimize the transmission distance and quality, we propose a new communication protocol for ad-hoc wireless networks. We can consider the network created by the sensors used for personal devices installed in patient wrists. The sensors communicate through a virtual infrastructure that helps to collect the data from the personal devices in an efficient way even in the areas affected by disasters where no wireless infrastructure can function. The communication scheme proposed here ensures a hierarchy of nodes that gives the possibility of saving by using simple devices for most of the population

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and more expensive and sophisticated ones only for the higher hierarchy rank nodes represented by prechosen individuals. For this reason, the protocol that we propose is a hierarchical protocol. The critical condition area, might be a city or village, is divided into virtual cells where each cell is represented from one main node that holds the communication for all the surrounded nodes and forwards its information towards the next cell main node found in the direction of the sink. This protocol gives the possibility to communicate even in the areas without any wireless infrastructure. The life signals collected from people leaving under ruins in the critical condition areas such as earthquakes, wars etc,

Keywords; *Wireless sensors networks, virtual infrastructure, wireless sensors protocols, nanotechnology, personal life signaling device.*

Introduction

Even though we live in the 21st century the horrible wars continue to take way the life of many people. Natural disasters such as earthquakes, earth slides or floods continue to be a big threat for millions of people. The Personal Life Signaling device that we propose here will be a big help to ease the horrible anxiety and to give a chance to live to people under ruins.

The research community always has works toward finding new practical and not expensive solutions to help people. The work in this direction has multiplied, especially during Covid 19. Here we propose a new communication protocol to be used in the critical condition areas. This is a hierarchical protocol LifeSignalsComm as an advancement of our previous work related to communication protocol used in the case of patient monitoring System,

In this paper we study and design a new ad hoc communication protocol that makes possible to have personal life signaling devices sense the need for emergency assistance by comparing the life sign data with the threshold registered ones and communicate with the nearest health or emergency management services even in disaster affected areas.

Internet of Things (IoT)

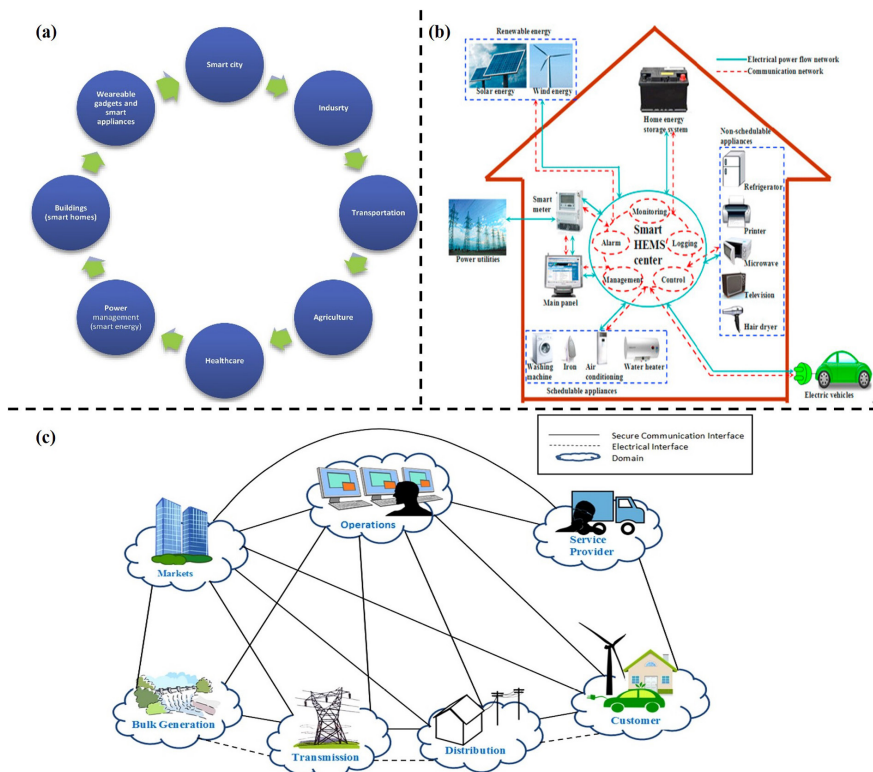
Internet of Things is one of the newest technologies with a fast advancement and infinite applications that have opened up many new possibilities in technical developments in all areas of life (Zheng et al., 2020). This is one of the so called “smart” technologies as the digitalization represents the core center of all previously not

imaginable applications. This technology completes the connection of the physical devices that might be industrial equipment or home device so called “things”. As a result, the cities will be called “smart cities” but at the same time are most likely to face tremendous infrastructure pressure due to increased urbanization. The IoT applications represent a very wide range of smart applications, being those devices or networking services. Those applications are from different fields such as construction, logistics, medicine, transportation, and manufacturing.

3. IOTs in healthcare

One of the main applications directions is medicine as it is directly related to people’s life and their well-being. This technology brings the high possibility for various applications. The new characteristic of those applications is that patients are getting more involved in their treatment due to the IoT invasion, which would allow them to reach their doctors, organize appointments, and access their health records via a portal. The hospital or medical center’s staff could also access real-

FIG. 4. (a) Application areas of IoT technologies; (b) Schematic representation of a smart home system using smart home management system (HEMS) (c) Smart grids



time patient information using the home monitoring systems, providing benefits for even non-hospitalized patients.

Smart devices used in health care are infinite, but we can mention only the portable ones as those are related to the objective of our work such as portable devices including body clothes (pants, underwear, and coats), heads (helmets and glasses), wrists (gloves, bracelets, and watches), somatosensory modulators, like, body and feet sensory control devices. The blooming of those applications creates a big challenge especially in security. This brings the risk of harming the IoT, because when every piece of data and gadget is connected to the network, hackers may access it and use it for various frauds. The other new advancement in healthcare is Artificial intelligence (AI). This is applied to improve the quality of life in various ways through wearables. Recently AI has become quite popular for transforming computers into logical human beings, making it possible to enhance picture analysis, diagnosis, patient care, and staff efficiency.

Wrist mounted wearables

The wrist-wearable devices are usually used to monitor, because of the minimized dimensions as well as the recent increase in battery life for converting the raw signals to real-time interpretable information. Those devices have been used for decades, from the old primitive versions to the most modern and recent ones such as: Screening of hypertension or high blood pressure which is a major, crucial, and important variable risk cause for investigations. As a matter of fact, blood pressure monitoring has become one of the essential physiological measures for monitoring an individual's health condition. Not only that, but wrist-based wearables can be used to monitor even other health related data such as sports and entertainment. Here we can mention wrist-based devices such as smartwatches or fitness bands, that are used to track daily activities.

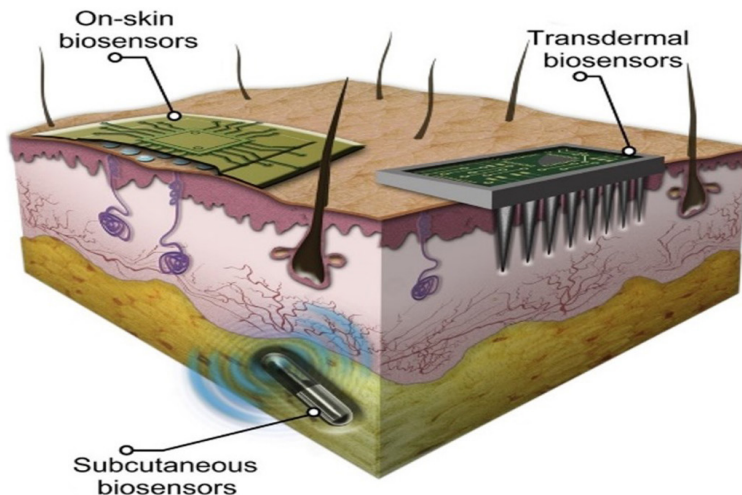
Fitness bands or wristbands can be used to measure fitness activities monitoring continuously and recording data related with different health requirements. Commercially are many well-known brands such as prHuawei Talkband B3, Fitbit, and the UP4 band (“UP by Jawbone”). Some of those are designed to measure and monitor walking, or to record the sleeping cycle. This can be achieved by using sensors mounted inside the band that are able to capture data generated by the skin reaction such as body temperature, heart rate etc.

Nano-integrated based wearable biosensors Nanotechnology is one of the most recent and advantageous technologies leading to innumerous existent and futuristic applications. This success is completely related to the possibility to reach where the

human hand or eye can't be due to the very small size of the nano sensors. Besides the possibility of recording the data, the nanoparticles act as a theragnostic agent in the biomedical field, which means they can be used as both therapeutic and diagnostic methods. (Nayak et al., 2021). Besides that, the nano sensors are used as wearable biosensors creating this way futuristic devices able to monitor personal or public health and are widely recommended by health experts and physicians. Today, various types of biosensors are available in the market, which are used to monitor heart rate, sleep time, temperature, stress management, oxygen level, steps, voice, breath, motion, humidity, pressure, force, voice, etc. The infinite applications and wide range of nano biosensors utilization in smart wearable devices has been highly advanced and will reach \$97.8 billion in the upcoming five years. Those devices are becoming more practical every day having very easy to use and functional characteristics by using flexible, stretchable, non-invasive, and high-performance biosensors.

Epidermal based wearable biosensors Those represent a very useful category of biosensors related to the fact that epidermis covers most parts of our body. As a result, the skin-based wearable biosensors are being successfully for so many applications. The epidermal wearable biosensor can detect the biomarkers present in the epidermal fluids like sweat, interstitial fluid (ISF), blood, etc., which facilitates real-time analysis of an individual's fitness and health parameter monitoring. The very specific epidermal-based biosensor works by detecting the biomarkers present in the sweat and ISF from the skin surface and transporting it to the transducer

FIG. 5. Schematic illustration of different skin-based biosensors embedded in skin layers (reproduced with permission from (Dervisevic et al., 2020)).



surface, as shown in Fig. 5. The transducer can be electrochemical, optical, or mechanical, combined with either bio-catalytic or ion-recognition receptors, that convert the chemical signals into detectable signals and process the obtained data into a readable format. In recent years this kind of biosensor is used in two main ways such as: either directly transferred onto the skin in temporary tattoos, as printed e-skin, or in the form of patches and wristbands. Besides that, many of those biosensors are integrated in smartwatches and are in direct contact with the epidermis allowing the sensor to detect the physical activities and mechanical stress that occurs due to the physical movements. The epidermis-based wearable biosensors have already started to rule the market by exceeding their value of USD 1 billion.

Previous research

The challenges are those who give the highest incentives and create new objectives for everyone, especially for the scientific researchers. Many studies have been developed, especially in the past three years regarding the possibility of using wearable equipment to function as Personal Signaling Device that can monitor life signs in people under critical conditions and save lives. Here following we analyze the most recent research published in this direction. The main challenge faced in all those publications is that there are two main issues: the communication protocol and the individual sensing equipment. The system needs to ensure an efficient communication protocol for having the quickest possible notification of critical health conditions toward the nearest health services. Also, it is important to develop a low-cost wearable equipment that would sense the vital parameters as pulse, oxygen levels, blood pressure etc.

The Personal Life Signaling Device system involves the integration of many personal wearable equipment distributed over a large geographical area that would serve as nodes of an ad-hoc network, capable to communicate with each other according to a specific communication protocol. The people in critical situations can be not only in large distance but even under ruins and it's not possible to communicate through their phones with the members of the nearest emergency centers. As a result this communication protocol between the nodes of the virtual sensor network need to fulfill the following requirements: long communication distance between even in very difficult situations of the critical health condition patient and the local emergency teams, good communication quality even in rural areas; high integration range of wireless sensors as part of the personal life signaling devices distributed over a large geographical area; immune to radio interference; the same technology distributed and implemented by many under critical conditions

local municipalities; ensuring continuous monitoring service for all the populated areas; practical wearable equipment and low-power consumption for ensuring long life battery usage, providing a good ratio cost performance solution.

The abovementioned challenges are critical considering the small communication distance capability of the Personal Life Signaling devices due to the limited access resources of sensors like processing capabilities, available data storage or limited power sources. Those are the main judging criteria of previous work analyzed here following.

Previous research in the field

Advancement in the health monitoring services has always been of great interest from research communities all over world, especially in the past three years. As a matter of fact, we must note that there exists a lot of work previously done in the field of health monitoring of patients not hospitalized. Here following we mention several of them: 1)The research work presented from collaborative work of Nanoscience Institute and Indira Gandhi University in presented in (Verma et al., 2022).Their solution is very interesting but it is considered as a stand-alone device that would need high processing power and battery to communicate in distance, not considering the traffic and QoS problems caused by simultaneously messages send to the same destination point. In the research work presented from the collaboration of Shanghai Universities (Zhang et al.,2021) is presented a device for COVID-19 prevention that monitors and records continuously the important health data of a patient. According to their solution the equipment installed in the patient's wrist records two main parameters: the patient's body movements and the patient's body temperature. The data collected is transmitted to a computer using Bluetooth. The main problem with this solution is the short range of communication, about 10m. This solution is to be used in urban areas where the wireless infrastructure will support the data transmission from the PC to the local Health Services. This requirement makes it difficult to be used in emergency and war situations.

The second work to be mentioned is the research done from the collaboration of Islamabad, Pakistan-Aerospace University and South Korea (Ullah et al., 2021). According to their solution they propose a patient quarantine monitoring system using multiple sensors distributed over patient's body that will measure temperature, respiratory, accelerometer, pulse, SpO2 and the patient's location data given by GPS (global positioning system). As in the previous work the data are transmitted by using the Bluetooth towards the microcontroller and then toward the local server by using the Internet connection.

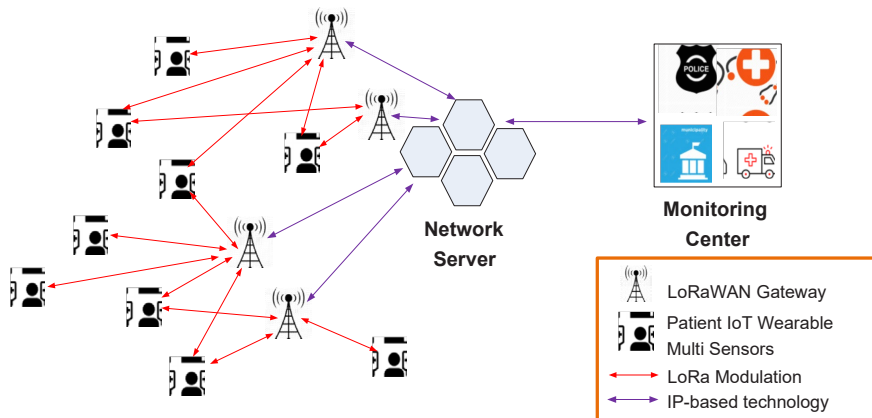
The system monitors the patient's health and his location to notify the services in the case that the patient would break the quarantine rules. As in the previous work mentioned the system works only in the presence of the Internet which means it doesn't support the use in the absence of the wired or wireless infrastructure as it can be in emergency and war regions. The other disadvantage is the complexity of the system as the sensors are distributed over the patient's body which means that will be very uncomfortable and prone to technical defects.

The other solution that we studied is proposed by the research developed at (Mukhtar et al.,2021) which is very similar to the previous one and has the same disadvantage of using sensors distributed over patient's body and not practical equipment. Regarding data communication their solution is based to the use e of the wireless infrastructure as the data collected are sent and processed to the Cloud even though they use the IEEE 802.11 protocol only at the first hop.

Similar problems are related to the work from Salerno University presented in (Hoang at al., 2021) where they propose the use of a similar patient monitoring system. They use an accelerometer for recording the patient's movements and two temperature sensors (a contact one and an IR—infrared sensor) for recording the patient's temperature. In addition, their solution includes two sensors to monitor the ambient condition such as temperature and humidity which are positive additions especially in the case of patients living alone. The data collected are transmitted toward a web-based application by using the Bluetooth which means that the system can't be used in the absence of the internet connection.

The work done by a group of researchers from University of Sucieva, Rumenia, (Lavric, at al., 2022) lead to the development of the system showed in Fig.1. Their Health Monitoring System uses LoRaWAN, which means that their solution provides a better solution regarding the absence of the infrastructure, but still only in the first hop.

FIG 1: LoRaWAN multi-sensor patient monitoring architecture.



By analyzing the previous research and the specific condition of the Personal Signaling Device we conclude that a combination of the first wearable device or skin installed patches with the ad hoc communications protocol would bring the best results/

As mentioned before there are two challenges for Personal Signaling Devices, the distance to reach the gateway and the convenience of the device. LoraWan has the possibility to communicate in longer distances than other protocols, but still considering the rural areas this isn't sufficient. On the other hand, the data rate is too low and the traffic toward the gateway, is high which causes extra delays and low signal quality.

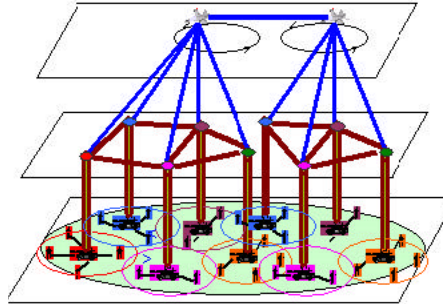
To have a better and longer communication distance in the absence of any infrastructure we develop a new communication protocol presented here as LifeSignalsComm protocol. This protocol creates a new virtual infrastructure by the specific communications of Ad Hoc network Cell nodes represented by the wearable devices of all population living under the critical conditions. This would enhance the communication distance range in the absence of any fixed or wireless infrastructure and overcome the main challenges of previous systems.

LifeSignalsComm Protocol

Our approach is based on our previous work on intervehicle communication protocols further developed for health monitoring systems. The population under critical conditions in the neighborhood area is divided into virtual cells. Everyone's device is considered as a node inside a certain virtual cell. The density of the nodes inside a cell is changeable, depending on the populations' density and the neighborhood architecture.

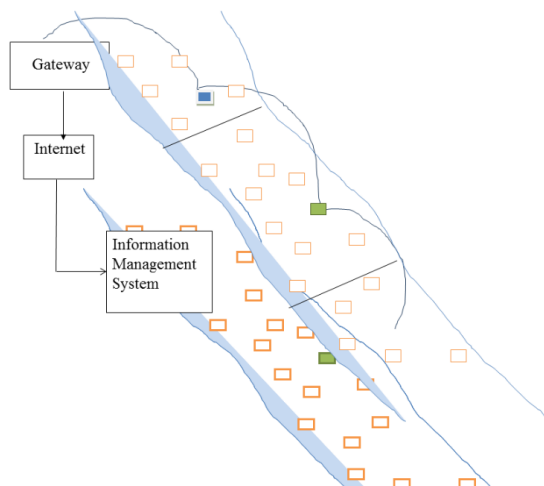
In this work we propose a virtual infrastructure created from distributed Personal Signaling Devices which will be considered as nodes of an ad-hoc network. To have a low cost and controlled signal quality according to our approach the communication scheme will be a hierarchical one using up to three levels of hierarchy (only 2 levels for rural areas). (Fig.2) The first level represents by a simple personal signaling device monitoring unit (PSD) that transmits to the PSD's neighbor with a higher scale of hierarchy. The second level of the hierarchy is the PSD that has a certain number of neighbors (less than N), is located somewhere in the center of the cluster and will be considered as a Main Cell Node. The second level of the hierarchy when the PSD that has several neighbors $> N$, is found near the center of the cluster and will be considered as a MainSubCell Node. The third level of hierarchy in the most populated areas will be created by the MainSubCell nodes that are neighbors and will be considered as simple Cell Nodes, by transmitting their data to the Cell Main Node located at the center of the considered area.

FIGURE 2: Multi-level Virtual hierarchical ad hoc infrastructure



Using hierarchical communication scheme is very beneficial as makes it possible to communicate through larger distances between the personal signaling devices centers, emergency teams working to save people's life even in rural areas. The other benefit brought using the Hierarchical scheme is the low network load. According to this solution less traffic will be generated between the individuals suffering critical conditions and the local emergency service as only the MainCell nodes will be transmitting the data of all the nodes in their respective cell in a certain moment of time. This can be clear if we consider for example as the Main Cell node the wearable device worn from one person living in a group of apartments. The other benefit is the low cost of the hardware. Only the MainCell device needs to have more complex design such as memory, and transmission power. Also, it is important to note that only the high hierarchy nodes (devices) will have a higher consumed power which means that for the rest of the personal devices the battery will have a longer life.

FIG. 3: Communication between Main Cell devices using the Virtual Infrastructure



Depending on the severity of the critical situation that is created by natural or human factors the functionality of PSD can be altered in time which means not all devices will be sensing and transmitting at the same rate and all the time. This can be completed by using the sleep-awake scheme for certain nodes in the case of people moving away from the area or no longer under critical conditions.

According to LifeSignalsComm protocol a flexible Virtual Infrastructure is created and maintained to enable scalable and effective communications (Fig 3). The number of nodes inside a cell can be modified. In each cell only one node (PSD) will be pre- or self-chosen as a Main Cell Node according to its location being approximately at the geographical center of the Virtual Cell. This node will behave as a Base Station for a certain period. The hierarchical distribution of Cell Main nodes will be transferred to the hierarchy of their costs, which means that only the devices corresponding to the cell main nodes need to have larger memory, processing power and battery consumption. The Hierarchical Virtual infrastructure created enables the optimization of the routing process.

At a certain rate each node updates the data from the GPS, which gives the Coordinates (x,y) for each node at a certain moment. Every node has its geographical position given by Global Positioning System (GPS). Then the higher ranked nodes transmit the data along each-other using the sequential Cell main Nodes as intermediate communications points and finally transmit the data to the Gateway when it reaches an infrastructure covered area as in Fig 3. The Information Management System might be a server or the smart equipment used by the emergency team or Local Emergency Services Center that will do the process of analyzing the data collected from all the population living in a certain area and decide about a certain action to be taken accordingly.

The device we propose to be used is similar to the wrist wearable device used in (Mishra, R, K et al., 2018) combined with a microcontroller board with add-on sensors that will sense the patients vital signs such as temperature, oxygen levels, blood pressure etc. It will include a peripheral GPS receiver and a cellular modem. It can be in a more sophisticated and practical form especially for those that don't have the function as Cell Main Nodes, such as patches or tattoos being installed previously or in an appropriate moment.

LifeSignalsComm Benefits

As a conclusion this protocol will benefit and can be used everywhere even in the absence of wired or wireless infrastructure, especially in natural emergency such as earthquakes or under war areas. The protocol to be used gives the possibility of using tunable fine-grained sensing regarding the Data acquisition rate, threshold

health alert values or node activity status. This system gives the possibility of using a mixed protocol routing scheme such as ZigBee for inside cell communication, and IEEE802.11 for intracell centers communication. As we explained above the other benefit is that the hierarchical levels are tunable too, depending on the severity of the situation, complexity of the device used, neighborhood architecture and population density ensuring good communication quality, low latency, and low power consumption but at all moments giving the possibility to save people life by looking in the data and giving the right help to the people under critical conditions.

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