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GAMIFICATION METHODS IN HACKATHONS AS A TOOL FOR INCREASING STATE RESILIENCE

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Abstract. *This study examines the application of gamification methods in hackathons as a strategic tool for enhancing state resilience and security. Hackathons serve as platforms for innovation, technological solutions, where gamification elements - such as point systems, levels, rewards, also challenges enhance participant motivation, creativity and teamwork. The research was conducted using qualitative methods, including semi-structured interviews with 15 hackathon participants and 5 organizers, to assess the impact of gamification on innovation generation and its practical application in the context of national security. The study highlights the significance of hackathons in fostering the startup ecosystem, encouraging young innovators and technology developers to contribute to strengthening state security. Prototypes developed in hackathons often serve as the foundation for new business initiatives that can be applied in real-world national security scenarios - ranging from artificial intelligence solutions for cyber threat management to decentralized infrastructure protection systems. However, findings indicate that while gamification enhances engagement and efficiency, evaluation systems may sometimes prioritize pragmatic, competition-driven solutions over truly innovative approaches. Practical insights from the study suggest that to maximize the effectiveness of gamification in hackathons, it is essential to balance competition with collaboration, provide more space for experimentation and incorporate broader mechanisms for innovation commercialization. The research findings are valuable for policymakers, national security strategists, innovation ecosystem developers, hackathon organizers seeking to effectively integrate gamified mechanisms into state resilience and technological sovereignty strategies.*

Keywords: *state resilience, gamification, hackathons, motivation, innovation, startups.*

Introduction

In today's world, where geopolitical challenges, economic crises, cyberattacks and climate change pose constant threats, the issue of state resilience has become increasingly critical. Wars, energy crises, pandemics and information warfare highlight the necessity for states to quickly adapt to ever-changing environments. Resilience encompasses not only the ability to withstand crises but also strategic preparedness, the implementation of innovations, the development of startups, and the active involvement of society in decision-making processes (Adeyeri & Abroshan, 2024).

According to Lahm and Duffield (2023), one of the key factors in resilience is the ability to generate innovative solutions in critical situations. In this context, hackathons have emerged as an effective means of rapidly assembling experts, developing solutions and testing them under real-world conditions. These events play a crucial role in strengthening national security and crisis management by incorporating interactive and gamified methods that foster creativity, teamwork, and prototype development. Notably, startups serve as natural engines of innovation, often introducing novel approaches to traditional challenges. Through hackathons, startups can create and test prototypes that are highly valuable in crisis management. For instance, cybersecurity solutions, energy independence strategies, crisis communication systems and even defense technologies can be optimized through innovations developed by startups. Given their dynamic nature and capacity for rapid innovation, startups can swiftly adapt to evolving

security needs, providing states with new tools to address emerging threats (Lahm & Duffield, 2023).

Gamification - the application of game elements in non-game contexts has been recognized as an effective strategy for enhancing motivation, productivity and engagement (Almeida et al., 2023). When applied in hackathons, gamification can more effectively simulate real-world scenarios and prepare participants for rapid response situations. Point systems, levels, challenges and rewards encourage active participation and improved problem-solving capabilities. Research indicates that specialists who engage in gamified hackathons are better prepared to tackle crises, making this approach a valuable tool for enhancing state resilience.

By incorporating gamification into hackathons, resilience is no longer just a matter of innovation and economic stability but also a direct instrument for ensuring national security. Gamification elements enhance creativity and adaptability, which are crucial for developing efficient crisis management solutions, whether for cybersecurity challenges or defense reinforcement. Innovative solutions generated in hackathons can become essential mechanisms in national security strategies, enabling rapid responses to emerging threats.

Given the complexity of contemporary challenges, it is essential to explore innovative and rapidly adaptable approaches to strengthening state resilience. Traditional methods are often insufficient in addressing dynamic threats, making hackathons and gamification valuable tools for fostering innovative solutions in a time-efficient manner. The aim of this study is to assess how the application of gamification methods in hackathons contributes to strengthening state resilience through economic and technological advancements.

Theoretical approach

The concept of state resilience

The concept of state resilience is discussed in various disciplines, including sociology, economics and environmental sciences. Interest in this topic has increased after significant natural and human-induced hazards around the world. Until now, a comprehensive model of state resilience that covers both physical and social-economic aspects, from direct impact to recovery stages, has not been developed. To achieve a better understanding of resilience, national/international initiatives are being analyzed and it is suggested to develop integrated modeling approaches that can help policymakers prepare for future challenges (Koliou et al., 2020).

According to Iskajyan et al. (2022), the concept of state resilience includes the implementation of balanced economic policies to ensure security, independence and flexibility in a modern market economy. Economic security is a crucial condition for realizing national interests - it helps improve the standard of living, promote economic modernization and strengthen a country's competitiveness in international markets. Based on Novak et al. (2021), the concept of state resilience also covers issues of supply chain resilience, which are often analyzed from the perspective of companies or industries. Traditionally, resilience is understood as the ability to respond to disruptions and return to a previous or better equilibrium at the lowest cost. Startups hold a special significance in this paradigm - their mission to create innovative, competitive businesses not only generates income but also contributes to social stability by creating jobs and training skilled professionals. Thus, strengthening state resilience can be based on the development of the startup ecosystem, promoting technological innovation and local economic growth (Iskajyan et al., 2022).

The scientific literature on state resilience covers a range of topics that are typically analyzed according to specific disciplines and perspectives. The main topics of this field - the concept of state resilience, economic security, strengthening innovation ecosystems, cybersecurity and supply chain resilience - have been extensively explored over the past decades. However, although most of these topics have been evaluated and analyzed, certain areas still have significant research gaps. The concept of state resilience is most often defined as the ability to respond to disruptions and recover, but scholars agree that this concept is not one-dimensional and is often difficult to define clearly. According to Smith and Brown (2021), different perspectives on this concept may cause interpretational challenges, which hinder its consistent application in practice. For this reason, a universal resilience model that encompasses all aspects of this concept has not yet been developed. This creates a gap that this study aims to fill, emphasizing methods for enhancing resilience and integrating innovation ecosystems.

It is important to note that, according to Koliou et al. (2020), economic security is one of the most widely discussed components of state resilience. Research mainly focuses on financial stability and managing global challenges, but aspects of social stability, such as job creation and social welfare, remain less explored. There is a gap here that can be filled by analyzing how innovation and startup ecosystems can contribute to social stability and economic growth beyond just financial aspects. According to Smith and Brown (2021), although many key aspects of state resilience have already been widely analyzed, gaps still exist, particularly regarding practical solutions and methods for enhancing resilience using innovations and technological solutions. At the same time, little research has been dedicated to the analysis of the impact of hackathons and gamification methods as tools that could improve a country's ability to adapt and recover from crises. Therefore, this research aims to fill this gap by analyzing the innovation ecosystem, the application of gamification methods, and their contribution to enhancing state resilience (Alothman, 2024).

Gamification defined as the use of game-like elements such as points, rewards, storytelling, feedback, and competition in non-game contexts has emerged as a practical and scalable tool to foster civic engagement, enhance learning, improve decision-making processes in complex systems. In the context of state resilience, gamification serves not only as a motivational mechanism but also as a simulation tool that enables training, prototyping and systems testing in areas such as crisis response, urban planning and cyber defense. By incorporating gamified structures into hackathons or public decision-making platforms, governments, institutions can foster inclusive collaboration, increase civic trust and co-create innovative responses to security, economic, or infrastructural threats (Pahlavanpour ir Gao, 2024).

For example, gamified participatory urban planning initiatives in various European cities have helped overcome public distrust and low engagement by turning complex planning decisions into interactive and transparent processes. Likewise, national defense-related hackathons with gamified environments have facilitated the development of AI-based threat detection systems, emergency communication tools and decentralized energy management prototypes. These examples illustrate how gamification is not merely a tool for engagement but a strategic component in building institutional flexibility, public participation and technological adaptability - all key dimensions of national resilience (Alothman, 2024).

Economic security issues related to the information environment are widely analyzed in the works of various researchers. A great deal of attention has been given to this issue in the works of Kiseleva and Simonovich (2014), Loginov (2015), Uskova and Kondakov (2011), which provide important studies. Regarding security issues in the information environment at the macro level, especially the development of critical infrastructure protection at the state level,

research has been conducted by Hausken (2019), Solms and van Niekerk (2013). Furthermore, researchers such as Freedman et al. (2015), Kiseleva et al. (2019) analyze complex security level evaluation systems in the cultural information environment and at the level of individual business entities, as well as integrated approaches to combating information threats and ensuring an adequate security level, which were discussed by Gerber and von Solms (2005), Mustonen-Ollila et al. (2020).

According to Smith and Brown (2021), one of the key components of state resilience is strengthening the innovation ecosystem, as innovations drive economic growth, job creation and technological competitiveness. It has been observed that the application of gamification methods in hackathons can have a significant impact not only on state resilience but also on economic strengthening (Johnson and Lee, 2024). For example, gamification stimulates creativity and the applicability of technological solutions in practice, leading to the creation of new products and services. Hackathons become not only laboratories for technological innovations but also platforms that promote strategic thinking and collaboration between the public and private sectors, contributing to overall state resilience. According to Reznikova (2022), the concept of resilience and its practical application are often not clearly defined, and various definitions are based on different assumptions. This causes problems, as it allows for different interpretations and applications of the resilience concept. For this reason, it is difficult to precisely assess its impact on development processes, especially when it comes to enhancing state resilience and creating innovations. However, this terminological ambiguity also provides an opportunity to rethink more deeply what is truly important in strengthening state resilience as a complex and dynamic process. Due to changing perspectives on national security and the development of resilience thinking, the concept of resilience has expanded and gained broader application in security studies, leading to the emergence of the concept of "national resilience" (Reznikova, 2022).

According to Sutton and Arku (2022), despite the progress made in resilience literature over the past few decades, resilience has yet to become a fully developed theory. Resilience is most often understood as a conceptual system that helps to think about regions in new, dynamic and holistic ways. However, this system still poses challenges, as it can become a vague concept lacking clarity and consistency. Therefore, it is necessary to continue developing the concept of resilience to address existing shortcomings and clarify its application. In this context, especially when applying gamification methods in hackathons, it is important to define precisely how resilience-enhancing methods can contribute to more effective crisis management and innovation creation (Sutton and Arku, 2022).

Considering these studies and analyses, it can be argued that state resilience is a multifaceted and dynamic concept, encompassing various aspects - from economic security, supply chain stability, information environment protection, to strengthening innovation ecosystems. Further research should focus on the development of an integrated resilience model that would allow a clearer understanding of the interaction between these areas and help make more effective decisions to strengthen a country's ability to withstand and adapt to various challenges.

The concept and elements of gamification

Gamification is a relatively new phenomenon that has emerged with technological advancements and increasing digital literacy. Over the past decade, the integration of game elements into various fields has gained widespread recognition. This approach extends beyond

entertainment, incorporating game design mechanics into different processes and concepts to enhance engagement and encourage participation (Al-Rayes et al., 2022).

Gamification involves embedding game elements into non-gaming contexts, such as education, business, healthcare, employee motivation, marketing, technology development and social initiatives. It encompasses the application of game mechanics, aesthetics, and game-like thinking to various activities, aiming to engage participants, incentivize action, facilitate learning, improve problem-solving. Depending on how and where they are applied, gamification methods can either enhance or diminish intrinsic motivation. However, it remains unclear which gamification elements are most effective and which may fail to drive engagement (Aguado-Linares & Sendra-Portero, 2023).

According to Al-Rayes et al. (2022), changes in motivation through gamification are linked to factors such as autonomy, perceived competence and intrinsic drive. The concept of gamification is closely associated with self-determination theory, which suggests that individuals are more likely to engage in activities that provide both internal satisfaction and external rewards. Various motivational elements are commonly implemented in gamified systems, including real-time feedback, point systems, badges, certificates, leaderboards, challenges, tasks, customization options, levels, avatars, unlockable content and virtual currencies - all of which help sustain interest and motivation.

Both businesses and researchers are increasingly interested in applying gamification. In today's oversaturated and highly competitive markets, companies constantly seek innovative ways to enhance operational efficiency and expand their reach. Advances in technology have opened new avenues for engaging with consumers and one of the most effective tools in achieving this is gamification. By integrating game mechanics into business processes, organizations can boost customer engagement, foster brand loyalty, enhance the appeal of their products and services (Sharma et al., 2024).

According to Schöbel et al. (2020), the structure of gamification consists of three main components: **structural elements, dynamics, and motivational factors** (see table 1).

Table 1. Elements of gamification structure
(compiled by the author, based on Schöbel et al., 2020)

Structural elements	Description
Points	• **Experience points (XP)** – reflect the user's activity and experience within the system. • **Loyalty points –** often used in business to encourage customer engagement. • **Reputation points –** indicate the user's reliability within the community. • **Points and credits –** can be accumulated and spent in certain systems, for example, when purchasing virtual goods.
Badges	• **Trophies –** for example, awarded when reaching a certain level or completing a challenge. • **Medals –** awarded for specific tasks or achievements. • **Stamps –** used to certify achievements or competencies.
Feedback	• **Sound signals** – used to encourage positive behavior or warn about mistakes. • **Visual notifications** – for example, color changes or effects displayed on the screen. • **Statistical data** – detailed analysis of the user's activity.
Time pressure	• **Time limit** – tasks must be completed by a certain date or time.

	• **Time accumulation** – users can accumulate time reserves to use later. • **Time constraint** – tasks must be completed within a certain time frame.
Leaderboard	• **Ranking systems –** for example, a top 1-10 leaderboard. • **High score tables –** recording the best achievements in a specific activity.
Progress bar	• **Charts** – display progress achieved in percentages. • **Stars** – awarded for successfully completing tasks. • **Achievement notifications –** the system notifies users about their progress.
Tasks	• **Missions and challenges** – encourage users to complete more difficult tasks. • **Daily tasks** – short-term goals that help maintain continuous engagement.
Virtual goods	• **Digital gifts** – items that can be purchased, earned, or exchanged with other users.
Avatar	• **Users can create their own virtual persona** that reflects their activity within the system.
Narratives	• **Meaningful stories** that help create an engaging experience and provide context for actions.

Gamification elements are essential mechanisms used to create systems and encourage user engagement. One of the main elements is ***points***, which allow users to track their progress. These can include experience points, loyalty points, reputation scores or even virtual currency used within the system. Points often form the basis for other features, such as ***badges***, which provide a visual reward for achievements. ***Trophies***, ***medals*** and ***stamps*** not only encourage users to aim for higher results but also help shape their social status within the community (Schöbel et al., 2020).

According to Iruela and Neira (2020), a key part of gamification is ***feedback***, which provides users with information about their actions. This can include ***sound signals***, ***visual effects*** or even detailed analysis of the user's progress. ***Time pressure*** also plays an important role – deadlines, time limits or the ability to accumulate time reserves create additional motivation to act more quickly. Since people tend to compare their achievements with others, ***leaderboards*** offer them the opportunity to compete and achieve higher rankings based on points or results. No less important in gamification are ***avatars***, which allow users to create a virtual identity that reflects their activities within the system. This helps to establish a stronger emotional connection with the platform. ***Stories*** or ***narratives*** provide additional context to user actions, immersing them in a meaningful story where every action matters. ***Collecting systems***, such as point collection, badge accumulation or rating systems, encourage users to stay engaged long-term (Iruela and Neira, 2020).

In addition to the structural elements, dynamic aspects are also important in the gamification process, as they determine how users experience the system (see table 2).

Table 2. Dynamic elements applied in gamification
(compiled by the author, based on Schöbel et al., 2020)

Dynamic elements	Description
Rewards	• Financial rewards – monetary bonuses or discounts. • Virtual prizes – additional privileges within the system.

Cooperation	• Users can collaborate in teams, share experiences and pursue common goals.
Competition	• Competition encourages users to strive to outperform others and achieve better results.
Challenge	• Challenges provide additional motivation to improve and reach higher levels.

Rewards, such as financial incentives, virtual prizes or additional privileges, motivate users to strive for better results. ***Collaboration*** is another key aspect – in some gamification models, users are encouraged to work together in teams, share experiences, and help each other achieve common goals. However, ***competition*** is equally important, as users compete against each other to achieve higher positions or better results. ***Challenges*** create additional motivation to improve, as they require effort and provide satisfaction when completed (Schöbel et al., 2020). It is also important to note that the success of gamification depends on ***motivational factors. Social encouragement*** motivates users to perform more efficiently when they see others' ***achievements*** or feel community pressure. A sense of ***ownership*** emerges when users invest time and effort into the system, making them more engaged. Achievements provide satisfaction when a user completes important tasks and receives recognition. ***Self-expression*** allows users to personalize their experience, create a unique virtual identity, and feel special. ***Altruism***, or the desire to help others, can also be a strong motivator, fostering community spirit and knowledge sharing (Iruela and Neira, 2020).

In summary, gamification is a complex system that encompasses a variety of elements to create a motivating and engaging experience. It can be applied across various fields – from education and business to healthcare and social networks, helping to increase engagement, promote learning and address business challenges.

The role of hackathons in the context of national resilience

Hackathons are rapidly gaining popularity as innovation competitions that initially emerged within the information technology (IT) community and have since spread to various other fields (Endrissat & Islam, 2022). They have become a widely practiced activity due to their versatility and ability to adapt to different goals and domains. While this phenomenon is still relatively new, research on hackathons is mostly descriptive and exploratory. Many studies review the specifics of organizing individual hackathons but often fail to provide a clear and general definition of what a hackathon truly is (Halvari et al., 2020).

The concept and name of a hackathon originated from the words "hack" and "marathon." While "hack" is often associated with cybercrime, in this context, it refers to exploratory programming and "marathon" refers to a long-term, intense event resembling a race. This perfectly captures the essence of a hackathon technology, rapid creative processes, problem-solving through intense work. The term "hackathon" was first used in 1999 to describe such events, but since then, hackathons have rapidly spread worldwide and their popularity continues to grow (Rys, 2023). Oyetade (2024) adds that hackathons are intense collaborative events in which participants have the opportunity to demonstrate their skills, creativity and problem-solving abilities to find innovative solutions within a limited time. These events can cover various topics, such as programming, data analysis and artificial intelligence. Hackathons encourage teamwork, creativity, experimentation and the application of practical knowledge in real-world situations, helping participants create functioning prototypes. This environment not only inspires the generation of new ideas but also motivates teams to achieve fast and efficient results (Oyetade, 2024).

Typically, a hackathon begins with an introduction outlining the event's goals, design challenges, sponsors, schedule, prizes. The theme may be announced in advance or at the start of the event and it can either be general or focused on a specific task. Team formation can start before the event, with participants connecting and sharing ideas through collaboration channels or it can happen during the event itself, with teams forming based on common interests, skills and project ideas. Once teams are formed, intense work begins. In traditional hackathons, participants often work through the night, using brainstorming methods, creating prototypes and at the end of the event, presenting their work while competing for prizes (Flus & Hurst, 2021).

The hackathon process consists of three main stages: the preparation phase, the event itself and post-hackathon activities. A successful hackathon often depends on a carefully planned event structure, so it is crucial to thoughtfully design and prepare the elements of the hackathon in advance. These elements are determined before the event and include key details such as the invitation, which must attract participants with the right skills and the formulation of goals and expectations for both organizers and participants (Khan et al., 2021). After the event, an awards ceremony is often held, during which team presentations are evaluated and decisions are made regarding the next steps. The post-hackathon phase includes the ideas, concepts, knowledge generated during the event, as well as ways these ideas can be implemented in the real world (Halvari et al., 2020).

Hackathons are characterized by several distinct features that consistently appear in the literature. By identifying these characteristics, eight important qualities can be defined that describe a hackathon as an innovation event. These include: short duration, teams, challenge, creation process, ceremonial flow, collaboration, location and consistency (Flus & Hurst, 2021). Although hackathons are not always clearly presented as design events, they provide participants with the opportunity to familiarize themselves with design principles and gain practical experience in the field. Due to their intense and creative work environment, hackathons become a unique and authentic context in which design activities can be explored and developed. This not only promotes innovation but also allows participants to deepen their understanding of design processes, their application to solving real-world problems and the development of technological solutions (Rys, 2023).

Hackathons, due to their intense and creative work environment, have a significant impact on state resilience, especially in addressing urgent and complex challenges that states face in both internal and external environments. State resilience includes the ability to adapt and recover from various crises - both natural and man-made, such as climate change, economic shocks, technological problems, or political crises. Hackathons, as innovation drivers, help states create new solutions and strengthen their ability to respond to these challenges. According to Endrissat and Islam (2022), hackathons have become valuable tools in the business world as they provide an opportunity to test new ideas and convert them into final products that can be commercialized, thus creating added value for companies. This process, when applied in the context of the state, can not only encourage economic development but also be crucial in addressing state challenges such as crisis management, digital transformation and social change.

Engaging citizens in public decision-making has become an essential dimension of strengthening national resilience, particularly in areas such as urban planning, infrastructure development and crisis response. In many countries - especially those with post-authoritarian or post-socialist legacies civic participation remains low due to widespread public distrust in institutions and a lack of active engagement culture. Gamification provides a promising strategy to address these challenges by transforming formal, often inaccessible planning or decision-

making processes into interactive and appealing experiences. Game-like elements such as storytelling, real-time feedback, rewards and challenge-based participation increase citizen motivation, reduce apathy, help reestablish trust between the public and decision-makers (Tóbiás ir Boros, 2025).

Evidence from multiple urban planning contexts shows that while there is growing interest among public sector actors in adopting participatory and gamified approaches, implementation is often hindered by limited resources, the absence of practical guidelines and persistent public disengagement. Despite these barriers, gamification can serve as a catalyst for inclusive governance by offering structured, yet dynamic platforms where citizens, experts and institutions co-create solutions. When used strategically in hackathons and civic innovation events, gamification fosters collaboration and transparency, contributing to more adaptive and democratically resilient systems (Gheorghe ir Katina, 2023).

The application of gamification methods in hackathons contributes directly to strengthening national resilience and security. Game-based structures enable realistic simulations of crisis scenarios, such as cyberattacks, infrastructure failures, or coordinated emergency responses. Participants develop critical skills needed to operate under pressure, make rapid decisions, and collaborate across multidisciplinary teams. These competencies are essential for building institutional and societal capacity to withstand and adapt to emerging threats (Tóbiás ir Boros, 2025).

Prototypes developed during gamified hackathons often serve as the basis for technological tools applied in national security contexts. These include AI-driven cyber threat monitoring systems, decentralized infrastructure protection mechanisms and predictive analytics for crisis management. Gamification supports experimentation by encouraging creative risk-taking, which fosters not only technological but also organizational innovations with potential integration into national emergency frameworks. Gamified hackathons become strategic environments where civil society, the tech sector, and public institutions converge to co-create solutions that enhance crisis preparedness and systemic resilience (Gheorghe ir Katina, 2023).

According to Szymańska et al. (2020), the structure and intensity of hackathons allow for a quick evaluation of the solutions created and provide an opportunity to test their practicality and feasibility. This feature is especially important for state resilience, as it allows for rapid responses to sudden emerging challenges. For example, during a pandemic, hackathons can be used to create innovative solutions for optimizing healthcare systems, medical equipment supply or data analysis. In this way, rapid prototype creation and testing enable the quick discovery of effective solutions during a crisis. Hackathons also contribute to strengthening teamwork and collaboration, which is an essential part of state resilience. States facing crises often need to collaborate with various sectors - public, private and academic. Hackathons provide a platform for this collaboration, allowing participants to combine their knowledge and skills to create solutions that can be applied in real crisis situations, such as optimizing supply chains or creating effective communication channels (Szymańska et al., 2020).

It is important to note that, according to Hussain et al. (2021), hackathons provide an excellent environment for digital innovations, which are essential for strengthening state resilience. Digital infrastructure, cybersecurity, data analysis and artificial intelligence are key elements that help states withstand various challenges. Hackathons focused on these issues can create new tools and solutions that improve state resilience both during a crisis and in preparation for it. For example, hackathons dedicated to cybersecurity could help create advanced tools to protect state infrastructure from cyberattacks. Additionally, hackathons can be used to address social and economic challenges, which also contribute to state resilience.

For instance, hackathons can promote solutions to reduce social inequality, combat unemployment or provide services to vulnerable groups. These solutions, created in an atmosphere of intense collaboration and creativity, can help strengthen social resilience and prepare communities to better cope with various economic shocks (Hussain et al., 2021).

Surendran et al. (2023) argue that participation in hackathon-type projects not only contributes to innovation creation but also helps develop crucial skills that employers highly value, such as communication, problem-solving and teamwork skills. These skills, while challenging, are essential for achieving success in the workplace and other professional fields. The practical experience gained from participating in hackathons helps students and professionals acquire not only theoretical knowledge but also the ability to apply it in real-world situations, which is highly valued in the job market. Skills like effective communication, the ability to solve problems in teams and the ability to adapt to rapidly changing situations are essential for making a positive impact in any professional field (Surendran et al., 2023). Hackathons can be considered an excellent example of problem-based learning.

According to Szymańska et al. (2020), problem-based learning is a pedagogical tool that allows learners to integrate theory and practice, conduct research and apply knowledge and skills to find solutions to complex, real-world problems. The authors argue that problem-based learning can have a positive impact on knowledge acquisition, problem-solving skills, critical thinking, teamwork abilities and independent learning outcomes (Szymańska et al., 2020).

According to Čović and Manojlović (2020), six key competencies are developed during hackathons (see figure 1).

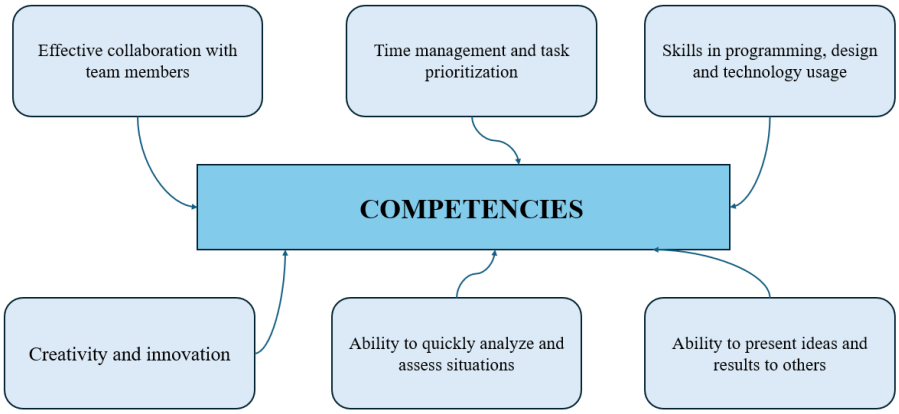

Fig. 1. Competencies developed during hackathons
(compiled by the author, based on Čović and Manojlović, 2020).

These competencies encompass a wide range of skills essential for success in modern work environments. Creativity and innovation are demonstrated through the ability to generate new ideas and solutions, as well as innovation creation skills that allow for offering practical and innovative approaches to problem-solving. Effective use of teamwork skills, the ability to collaborate with specialists from various fields, such as programmers, designers and entrepreneurs, is crucial for achieving the best results. Integrating different opinions and perspectives into solutions enables more comprehensive and better outcomes (Čović and Manojlović, 2020). Project management skills involve time management, task prioritization, team coordination, workload distribution, as well as the ability to solve problems in real-time. The development of technological skills includes programming, design, other technology-related skills, as well as the practical application of the latest tools and platforms. This allows

for writing, testing, developing programs while ensuring their quality and functionality. Critical thinking and decision-making help analyze situations quickly, make decisions under pressure and argue effectively. Finally, presentation, communication skills enable the delivery of ideas and results to others, public speaking, teamwork and the clear and convincing explanation of prototypes, solutions (Čović and Manojlović, 2020).

In summary, hackathons are innovative, intensive events that not only promote creativity and collaboration but also provide participants with opportunities for personal development, achievement, contributions to solving national problems. Although the concept of hackathons originated in the field of information technology, this practice has expanded to other sectors, where it has become an important tool for innovation creation and community strengthening. Hackathons are unique in their structure, where the focus is on short-term, intensive teamwork, tackling challenges and generating creative ideas. It is important to emphasize that hackathons are becoming a valuable platform that fosters digital innovation, which is crucial for strengthening the resilience of a state, especially in addressing crises or complex situations. These events not only help develop technological solutions but also strengthen teamwork and collaboration across different sectors, which is essential for effective crisis management. Hackathons are also an important tool in addressing various social and economic challenges, such as unemployment, social inequality and other structural changes, contributing to the enhancement of social resilience. Participation in hackathons develops valuable skills, such as creativity, teamwork, decision-making, critical thinking, which are highly valued in the labor market and help individuals grow both professionally and personally. Hackathons have great potential not only in the fields of innovation and technological progress but can also become an essential tool for states, organizations, communities in addressing global problems, thereby contributing to social and economic development and resilience in various crisis situations.

The application of gamification elements in hackathons

Hackathons are intense events designed to foster innovation and creativity, where participants often face challenges that are addressed in team-based competitions. According to Clary (2020), hackathons can be considered gamified events because they incorporate game elements to encourage participants to actively engage and strive for the best results. The gamified structure allows the events to become effective tools for both business and the academic community, as they help achieve desired outcomes and create a creative environment (Clary, 2020).

Competition is one of the main manifestations of gamification in hackathons. According to Juraschek et al. (2020), teams compete in these events by creating innovative products, programs, or business proposals within a limited time. Each hackathon is designed with specific challenges, which are often kept hidden until the start of the event. This ensures that all teams begin under equal conditions, without any prior advantage. The hidden challenge element acts as a tool for randomness, preventing pre-planned strategies and leveling the playing field for all teams. In this way, hackathons become a platform where gamified elements help maintain a high level of competition and motivation (Juraschek et al., 2020).

According to Clary (2020), gamification as a concept is not limited to hackathons or technology events – it is increasingly being integrated into work culture, especially in privileged workplaces. Gamification elements have become an inseparable part of the modern work environment, encouraging employees to compete, achieve high performance and constantly face challenges. As noted by Lombard et al. (2024), metrics, quotas and other game principles are often used in hackathons to help maintain participant engagement, activity. Such practices

are beneficial both in the technology sector and more broadly – gamification becomes a tool for motivation, engagement used by businesses and academic communities. This trend is not limited to the workplace. Even in personal life, gamification is increasingly becoming a part of daily life, as various apps and platforms encourage constant participation and engagement with game elements. Even employees who maintain a clear work-life balance may experience the influence of gamification, as this strategy is increasingly integrated into everyday processes (Lombard et al., 2024).

Iruela and Neira (2020) add that six commonly recurring gamification elements are often applied in hackathons (see figure. 2).

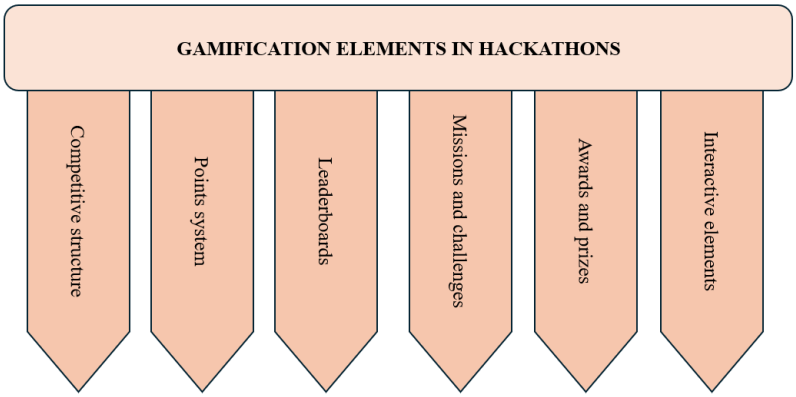

Fig. 2. Gamification elements applied in hackathons
(compiled by the author, based on Iruela and Neira, 2020).

One of the main gamification elements is the competitive structure, where teams compete against each other to find the best solution within a limited time. A points system is also commonly used, where participants receive ratings for achieved results or completed tasks, which helps maintain the competitive spirit. Leaderboards allow participants to track their progress and compare it with other teams, encouraging greater involvement and effort. Another important element is missions and challenges, which provide additional motivating goals, such as creating the most innovative solution or integrating certain technologies into a prototype. Hackathons also often feature awards and prizes, which can be either material (money, equipment, scholarships) or intangible (mentorship, opportunities to work with investors or companies). Additionally, organizers often incorporate interactive elements, such as mini-games, prototype demonstrations, or even creative challenges, to reduce stress and promote teamwork. All these gamification elements help create a dynamic, motivating and engaging hackathon environment in which participants can fully leverage their potential (Iruela and Neira, 2020).

As Clary (2020) notes, hackathon participants and technology professionals must adapt to constantly changing game rules and work models based on gamification principles. These processes not only help attract users but also keep them engaged, creating loyalty and long-term involvement. In hackathons, participants engage in a creative and dynamic process, experimenting with various tasks to generate innovative solutions. Gamification elements create a motivating environment that encourages creativity, collaboration, problem-solving. Increasingly, hackathons are organized not only by technology companies but also by educational and non-profit organizations aiming to foster self-organization and innovation (Clary, 2020).

According to Lombard et al. (2024), gamification in hackathons offers numerous benefits for both personal and professional growth. One of the main advantages is career opportunities and networking. Participating in hackathons allows direct communication with potential employers, investors and other professionals, opening up opportunities for job offers or involvement in exciting projects. It also creates a valuable network that can become a key support point in the future, expanding professional connections and collaboration opportunities. Furthermore, hackathons provide the chance to gain real experience, as participants work with actual technological solutions and encounter real customer needs. Working on prototype development, from concept to final product, allows participants to acquire practical knowledge that is valuable for personal growth and career advancement. This process also encourages the development of innovation and entrepreneurship skills, as participants have the opportunity to create business models, assess the potential of ideas and apply them in the real market (Iruela and Neira, 2020).

In conclusion, it can be stated that the application of gamification in hackathons demonstrates how this method can be used to foster innovation and creativity while ensuring active participation and high motivation. Hackathons serve as an excellent example of how game elements can be integrated into non-game contexts, allowing both business and academic goals to be achieved. However, this gamified management model also raises questions about commercial interests and the potential for exploitation. Despite this, gamification, as a design strategy, has become a fundamental tool in the modern work and creative environment, where technology professionals and creators must adapt to an increasingly gamified work model. Also the application of gamification methods in hackathons contributes directly to strengthening national resilience and security. Game-based structures enable realistic simulations of crisis scenarios, such as cyberattacks, infrastructure failures, or coordinated emergency responses. Participants develop critical skills needed to operate under pressure, make rapid decisions and collaborate across multidisciplinary teams. These competencies are essential for building institutional and societal capacity to withstand and adapt to emerging threats.

Prototypes developed during gamified hackathons often serve as the basis for technological tools applied in national security contexts. These include AI-driven cyber threat monitoring systems, decentralized infrastructure protection mechanisms and predictive analytics for crisis management. Gamification supports experimentation by encouraging creative risk-taking, which fosters not only technological but also organizational innovations with potential integration into national emergency frameworks.

Gamified hackathons become strategic environments where civil society, the tech sector and public institutions converge to co-create solutions that enhance crisis preparedness and systemic resilience.

Qualitative research

Methodology

Research methodology involves a qualitative research strategy aimed at exploring the application of gamification methods in hackathons and their impact on participants' motivation and creativity. The chosen research strategy allows for a deeper investigation into the influence of gamification elements on participants in natural environments. The research methods include semi-structured interviews, which provide the opportunity to gather detailed data from both participants and organizers. This method also allows for a broader range of respondents and ensures flexibility for both the researcher and participants. Although direct interviews would

be more suitable for the qualitative research goals, technological capabilities allowed for the effective use of remote communication tools. The research instrument was prepared in the form of semi-structured interview questions, focusing on key research topics - how gamification elements (points systems, levels, rewards) influence hackathon participants' motivation, engagement and creativity. The study sample consisted of 15 hackathon participants and 5 organizers, selected through purposive sampling.

The research participants were required to meet the following criteria: 1) have participated in at least one hackathon; 2) have experience with gamification elements in hackathons; 3) be familiar with collaborative team-based work in hackathon settings; 4) have experience using digital tools or platforms commonly employed during hackathons (e.g., project management tools, version control systems); 5) have been involved in at least one project that reached completion or a presentable prototype during a hackathon;

The chosen sample (15 participants and 5 organizers) allows for a deeper understanding of both participant and organizer perspectives and experiences, ensuring the authenticity and representativeness of the research results for this target group. Each respondent's answer enriches the study, making this sample appropriate and justified to gather the necessary data on the impact of gamification methods in hackathon activities. The study was conducted following ethical principles, ensuring respondent confidentiality and voluntary participation.

The research process included transcribing the interviews, analyzing the data and describing the results (see figure. 3). The reliability and validity of the study were ensured by selecting appropriate participants with experience in hackathons and the application of gamification methods.

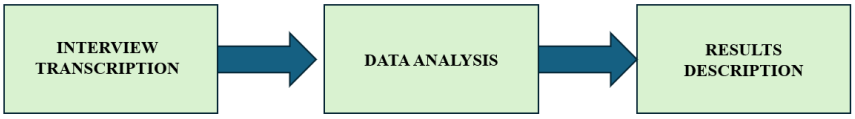

Fig. 3. Stages of the qualitative research process (created by the author)

The reliability and validity of the study were ensured by selecting appropriate participants with experience in hackathons and the application of gamification methods.

Limitations

The limitations of the qualitative research and the possibilities for future research can be seen as recommendations that allow for a better understanding of the impact of gamification methods on the effectiveness of hackathons in the context of national resilience. To gain a more comprehensive perspective, it would be beneficial to conduct larger quantitative studies that include a broader range of respondents, which would allow for generalized conclusions about the entire population of hackathon participants and their impact on national resilience. Future research should focus on investigating in greater detail how various gamification elements, such as point systems, rewards and levels, affect participants' motivation and creativity, as well as their impact on team dynamics and the ability to respond quickly to emerging threats. Such studies could focus on the application of new gamification technologies, their effectiveness and their impact on team performance, which is especially important for modern organizations organizing hackathons. This would enable a better understanding of how gamification methods can contribute to increasing national resilience by fostering the creation of innovative solutions and ensuring rapid responses to changing security challenges.

Results of the study

The impact of gamification methods on motivation

The research results show that gamification methods – point systems, levels, rewards and challenges – significantly increased the motivation of hackathon participants. All informants (A1–A15) unanimously acknowledged that the point system provided clear progress and encouraged continuous engagement and the desire to improve results. Individual achievements, as well as the competitive environment, had a major impact on participants' motivation and creativity. Organizers (B1–B5) also confirmed that gamification activated participants and increased their involvement.

Table 3. The impact of gamification methods on participants' motivation
(compiled by the author)

Informant	Quote
A1	*"Each achievement was rewarded with points, which motivated me to try harder than usual".*
A2	*"The point system and leaderboards created a competitive yet motivating environment".*
A3	*"Prizes and privileges during the event were a pleasant incentive".*
A11, A12 and A13	*"I valued the process itself, but I acknowledge that rewards can be a strong motivation".*

The insights from the informants, presented in the table above (see table 3), reveal various aspects of the impact of gamification methods, particularly in terms of their influence on the motivation of hackathon participants. It was observed that the point system, levels, rewards and challenges significantly increase participant engagement and the desire to improve their performance. The point system provided clear progress, motivating participants to achieve higher accomplishments. Each goal reached was rewarded with points, which created additional motivation to strive more than usual.

It is important to note that the point system and leaderboards created a competitive yet motivating environment, where participants could feel that their efforts were visible and valued. This increased their involvement in the activities and encouraged them to pursue even higher results. Prizes and privileges offered during the event were an additional source of motivation, further enhancing participants' enthusiasm and focus. While rewards were seen as an additional motivating factor, some participants indicated that their primary motivation stemmed not so much from the prizes but from the creative process itself and the opportunity for self-improvement.

From these insights, it is evident that gamification methods have a multifaceted impact, depending on the participants' perspectives and motivations. Some participants are more motivated by competition and rewards, while others value the creative process and personal growth as the main sources of motivation. This suggests that gamification methods need to be tailored to the diverse needs and motivations of participants in order to ensure optimal outcomes and engagement. In this context, it would be worthwhile to examine how to balance the elements of rewards and the creative process to work synergistically and foster motivation in all participants.

The impact of gamification methods on creativity

Gamification elements, **such as challenges, special awards for innovation, a point system for creative solutions and limited resources, encouraged creativity during the**

hackathons, but the established evaluation criteria sometimes limited complete creative freedom.

Table 4. The impact of gamification methods on creativity
(compiled by the author)

Informant	Quote
A1	*"It was encouraged to find the most interesting solutions".*
A11	*"Sometimes we focused more on how to collect more points than on being creative".*
B1	*"The participants created an innovative app that combines two different technologies".*
B3	*"Gamification encouraged participants to think outside the box and offer innovative solutions".*

Based on the insights from the informants presented in table 4, participants were encouraged to seek creative and interesting solutions, and some of them emphasized the desire to stand out from other teams. For example, an innovative solution was created that combined two different technologies. However, some participants noted that gamification sometimes encouraged them to choose safer solutions that better aligned with the evaluation criteria, rather than bolder, more creative solutions. This suggests that gamification can have a contradictory impact: while it encourages creativity, it can simultaneously lead to decisions focused solely on earning points, rather than fostering true innovation. Organizers agreed with the view that hackathons should offer more freedom in the creative process, allowing participants to fully express their ideas and achieve better creative outcomes.

Strengthening teamwork through gamification

Participants acknowledged that gamification elements improved teamwork. **The gamification elements that encouraged teamwork included shared team challenges, a point system for collective achievements, collaboration-based tasks, time constraints and special awards for effective teamwork.**

Table 5. Impact of gamification on team collaboration
(compiled by the author)

Informant	Quote
A1	*"The point system encouraged us to work together towards a common goal".*
A2	*"Everyone actively participated in decision-making, shared ideas, and helped each other".*
B1	*"Gamification not only helped team members collaborate better but also brought them closer together towards a common goal".*
A12	*"The desire to win was clearly visible, and at times it was difficult to maintain a balance between competition and collaboration".*

Based on the responses provided in the table (see table 5), participants noted that gamification encouraged active participation in decision-making, and the points system motivated teams to collaborate towards a common goal. Organizers also emphasized that gamification not only improved teamwork but also brought members closer together in pursuit of shared objectives. However, some participants mentioned that the competitive nature sometimes created tension and hindered collaboration. While participants tried to maintain a balance between competition and collaboration, some found it difficult to reconcile these two aspects. This suggests that gamification elements can have both positive and negative effects on team dynamics. While gamification encourages active participation and cooperation, it can

also exert competitive pressure, which does not always promote smooth collaboration. This situation reveals that, to achieve effectiveness and better results, it is crucial to find the right balance between competition and collaboration. For some participants, this balance may be difficult to achieve, which can present challenges in a team environment.

Based on all the informants' responses (see table 6), it can be concluded that the results of the study showed that gamification methods had a significant impact on participants' motivation, creativity, and teamwork during hackathons. Gamification elements such as points systems, leaderboards, rewards, and challenges significantly increased participants' motivation.

Table 6. Participants' opinions on the impact of gamification methods on hackathons
(compiled by the author)

Informant	Quote
A1	"Each achievement was rewarded with points, which motivated me to strive more than usual".
A2	"The points system and leaderboards created a competitive yet motivating environment".
A3	"Prizes and privileges during the event were a pleasant incentive".
A4	"Gamification elements helped maintain an intense pace and engaged participants from start to finish".
A5	"The leaderboard added extra excitement – when you see that you're close to the top positions, you feel motivated to try even harder".
A6	"Gamification encouraged us to experiment with ideas and look for innovative solutions".
A7	"I valued the process itself, but I admit that rewards can be a strong motivation".
A8	"The desire to win was clearly visible, and sometimes it was difficult to maintain a balance between competition and collaboration".
A9	"Gamification elements enriched the experience, but too much focus on results limited creativity".
A10	"The points system helped understand where we stood as a team and what still needed to be done".
A11	"I valued the creative process more than the competition, but I acknowledge that gamification was motivating".
A12	"It is important to maintain a balance between competition and collaboration so that participants do not feel too much pressure".
A13	"Gamification elements should be used carefully so that we do not lose the creative essence".
A14	"We wanted not only to complete the tasks but also to come up with a unique solution that would help us stand out from the other teams".
A15	"Gamification elements encouraged creativity, but at the same time forced us to choose solutions that best met the evaluation criteria".

The research conducted showed that gamification methods are an effective tool for motivating and engaging participants; however, their application should be balanced to avoid excessive competitive pressure and restriction of creativity.

The impact of gamification elements on organizers' perspectives on hackathon effectiveness and future improvement opportunities.

Based on the responses of all hackathon organizers (B1–B5) (see table 7), the research results indicate that gamification methods had a positive impact on hackathon effectiveness and participant engagement.

Table 7. Organizers' insights on the effectiveness of gamification methods in hackathons
(compiled by the author)

Informant	Quote
B1	"Gamification methods create a dynamic and engaging environment where participants constantly strive to achieve more".
B2	"The points system and challenges greatly energized the participants; they not only worked faster but also collaborated more".
B3	"Gamification encouraged participants to think outside the box and propose innovative solutions".
B4	"Gamification encouraged participants not only to quickly generate ideas but also to implement them practically".
B5	"The leveling system and rewards strengthened engagement and motivated participants to continuously improve".

The responses from the informants indicate that the gamification methods used in the hackathons created a dynamic and engaging environment, encouraging participants to pursue higher goals and continuously improve. All organizers (B1–B5) unanimously acknowledged that these methods not only increased participant engagement but also promoted creative thinking and innovative solutions. Gamification encouraged thinking outside the box, proposing new ideas and helped quickly generate and practically implement creative solutions.

However, while gamification methods were appreciated for their positive impact, both participants and organizers expressed concerns about excessive competition and pressure. Some participants emphasized that gamification elements should be used cautiously to avoid losing the creative essence, while organizers highlighted the importance of maintaining a balance between competition and collaboration. These observations suggest that gamification methods should be further developed to provide more freedom for the creative process, reducing the focus solely on the points system and shifting the focus toward participants' learning and innovation.

The study results also reveal that gamification can significantly improve hackathon effectiveness by encouraging participants to be more creative and engaged. To ensure healthy competition and maintain creativity, it is important to balance gamification elements, giving participants more freedom and focus on the process rather than just the outcomes.

Linking research insights to state resilience and security

The findings of this study offer more than just practical suggestions for hackathon organizers; they also contribute valuable theoretical insights into how gamification can serve broader national goals related to resilience and security. In the context of increasingly complex and unpredictable global threats, such as cyberattacks, climate-induced disasters, disinformation campaigns and hybrid warfare, the ability of a state to adapt, innovate and mobilize knowledge becomes a critical part of its security infrastructure. This research demonstrates that gamified environments promote key competencies such as motivation, creative problem-solving, rapid decision-making and collaborative work skills that are crucial for national security, especially in crisis scenarios. Gamification enables the simulation of real-world stress conditions. The structure of time-bound tasks, point-based evaluation, dynamic feedback and resource limitations closely mirrors the pressures faced during actual emergencies. Participants must work quickly, coordinate across disciplines and manage uncertainty precisely the type of capabilities that are essential in high-risk environments like cyber defense operations, emergency planning or strategic communication. Through this lens,

gamified hackathons can be seen as experimental laboratories where both individual and collective resilience is trained in a low-risk yet high-intensity setting.

Furthermore, the collaborative nature of hackathons promotes cross-sector communication and network building. When participants from diverse backgrounds such as technologists, public officials, academics and civic actors come together to solve complex problems, they create shared language, mutual trust and systems-thinking perspectives. These collaborative capacities are essential for whole-of-society responses to crises. Instead of operating in institutional silos, gamified environments encourage fluidity, flexibility and horizontal coordination, which are often lacking in traditional top-down governance models.

Civic participation is another important dimension linked to state resilience. In countries where trust in government is weak and citizen engagement is low, public decision-making processes tend to suffer from legitimacy deficits and reduced capacity for collective action. Gamification has the potential to re-engage citizens by transforming governance-related processes into more interactive and meaningful experiences. When citizens are invited to contribute to national or local challenges through gamified formats, such as open innovation contests or hackathons, they not only bring new ideas but also gain a stronger sense of ownership in the problem-solving process. This shift from passive observers to active co-creators supports the development of social capital and democratic resilience. Another key insight is the role of gamification in accelerating innovation. Many security challenges facing states today require fast and flexible technological responses that cannot be generated within the slow cycles of traditional public institutions. Hackathons powered by gamification offer a setting where early-stage prototypes can be developed and evaluated rapidly. Solutions developed in this format such as AI tools for cyber threat detection, emergency logistics dashboards or platforms for real-time public communication can be scaled or integrated into national resilience planning if institutional support is available after the event.

These findings highlight the importance of designing gamified systems that reward not only performance outcomes but also creativity, collaboration and long-term applicability. It is also essential to ensure that such hackathons are connected to follow-up mechanisms, such as funding programs, pilot testing opportunities or cross-sector partnerships, so that promising ideas can move beyond the concept phase and become part of real-world resilience infrastructure. In this broader view, gamified hackathons should be understood not as isolated events but as integral elements of a resilience-building ecosystem. They create spaces where innovation, civic engagement and strategic learning converge. As the threats facing states become more multifaceted and fast-moving, the ability to experiment, adapt and respond collectively will determine how effectively societies can protect themselves. Gamification, when applied thoughtfully, supports this adaptive capacity by aligning individual motivation with collective security needs.

Ultimately, this study confirms that gamification is not only an effective engagement strategy but also a valuable tool for developing state resilience. By enhancing both the technical and social dimensions of crisis preparedness, gamified hackathons contribute meaningfully to building a more flexible, innovative and secure society.

Conclusions

The theoretical analysis showed that gamification is an effective tool for increasing engagement, motivation and creativity in various fields, including hackathons. Gamification elements such as point systems, rewards, challenges, and competitive mechanisms create a structured yet motivating environment, encouraging participants to achieve better results.

However, the study also reveals that an excessive focus on gamification mechanisms can have negative effects, such as limiting creative freedom or increasing the pressure participants feel due to competition. Therefore, to maximize the benefits of gamification, it is essential to properly balance competition, collaboration and innovation-promotion elements. It is important to note that the theoretical analysis highlighted the significance of strengthening national resilience through hackathons. Gamification mechanisms can become a crucial tool in developing innovative and creative problem-solving strategies that enhance societal and national resilience to challenges. Hackathons, especially those focusing on national resilience themes, can foster collaboration across sectors and promote collective solutions that contribute to better preparedness for unpredictable challenges. Therefore, it is recommended that hackathon organizers integrate gamification elements that encourage innovation and creativity, focusing on long-term solutions for strengthening national resilience.

The qualitative research confirmed the insights discussed in the theoretical section regarding the effectiveness of gamification methods. The study data showed that participants, when faced with point systems, leaderboards and rewards, felt greater motivation and engagement, which boosted productivity and the search for creative solutions. However, some participants noted that in their pursuit of more points, they opted for more structured rather than experimental solutions and excessive competition sometimes weakened team collaboration. This supports the issue raised in the theoretical analysis, where it was noted that, while gamification can increase participant activity, an overemphasis on external incentives may suppress intrinsic motivation and creativity. Therefore, organizers need to consider how gamification elements shape participants' behavior and emotional responses, ensuring that motivation remains focused not only on winning but also on learning and the creative process.

Based on the qualitative research results, it is recommended to balance the gamification mechanisms of future hackathons, providing more space for creativity and collaboration. Instead of focusing solely on point systems or competition, it would be beneficial to incorporate elements that encourage experimentation, self-expression and long-term participant engagement. It is also recommended to review the evaluation criteria to promote not only the quick achievement of results but also the creation of innovative and original ideas that could contribute to strengthening national resilience. This would be crucial in developing sustainable and innovative solutions that address societal and national resilience challenges, especially those related to crisis situations and long-term changes. Future research could expand on this topic by conducting quantitative studies with a larger respondent sample to more accurately assess the long-term impact of gamification on hackathon participants and their creative abilities. Additionally, it would be useful to explore how different gamification methods can contribute to strengthening national resilience in various fields, such as technology, social innovation or education, to better understand which elements are effective in these areas and how they can help enhance a country's preparedness for unpredictable challenges.

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