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AGILE VALUES IN A MODERN ORGANIZATION

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Purpose: The reason for writing this paper was the growing popularity of the Agile concept in the IT environment. Since the Agile Manifesto, this concept has been used in project methodology as a substitute for Waterfall solutions, of course taking into account the specificity of IT projects.
Design/methodology/approach: This paper focuses on values of the Agile[1] in the context of changes in a modern organization. The basic features (distinguishers) of this concept, such as flexibility, decentralization and adaptability, are presented in this paper. The mentioned features are reflected in innovative solutions of Industry 4.0.
Findings: The work was based on a literature review, and its added value is the presentation of the framework of a new concept of project methodology, which is particularly useful in team work on IT projects.
Practical implications: The presented framework, supported by an analysis of the differences between the traditional Waterfall method and the Agile concept, may be useful for scientific and practical communities, especially in didactics in the education fields of business informatics.
Originality/value: The topic of research on the Agile concept is "fresh". "Agile Manifesto" or "Manifesto for Agile Software Development" - a declaration of common principles for agile software development methods, was developed at a meeting that took place on February 11-13, 2001 at Snowbird in the USA (Utah). The meeting was attended by representatives (17 people) of new software development methods, which are an alternative to the traditional approach based on the Waterfall.
Keywords: Agile, Waterfall, IT, project management, IT projects, AI.
Category of the paper: General review.

[1] The name of the concept so big letter.

1. Introduction

The steam engine revolutionized physical labour by overcoming previous limitations, driving significant industrial and societal advancements. Similarly, the second machine age—characterized by rapid progress in computing and digital technologies—is transforming cognitive capabilities. These technologies enhance ability to process information and shape the environment, allowing to transcend intellectual boundaries and unlock new opportunities for growth and innovation. In this context, cognitive power is emerging as equally critical to human progress and societal development as physical power once was. Just as the industrial revolution's advances in physical capabilities led to profound progress, the current expansion of cognitive capacities is expected to drive equally significant advancements (Brynjolfsson, McAfee, 2014).

To navigate this new landscape effectively, organizations must adopt methodologies that support flexibility and responsiveness. Agile serves as an umbrella term for various approaches that embody these principles. The concept of Agile" has no universally accepted meaning. Agile is a way of thinking and a set of principles that puts an emphasis on adaptability, teamwork, and ongoing project improvement. It places a strong emphasis on providing clients with value promptly and adjusting to change (Żółkiewicz et al., 2022).

Agile development methodologies gain recognition for their ability to manage time-to-market constraints while accommodating changes throughout the software development life cycle. However, these approaches require adaptation to the specific conditions of various contexts to ensure optimal outcomes. Customizing agile practices enables teams to maximize the benefits of agility while simultaneously aligning with project objectives, thereby facilitating the efficient delivery of high-quality software (Cao et al., 2009).

There was a period when the concept of "agile" had yet to be formally named. It originated from the need to move away from traditional, cumbersome software development methodologies that often-required years to deliver a complete product. The origins of this approach can be traced to the Japanese movement for improving production quality and the pioneering efforts of Toyota. At Toyota, a team of Japanese engineers developed the Toyota Production System (TPS), which is rooted in the principles of complete waste elimination, including Just-in-Time and Autonomation (“automation with human touch”) with the tool Kanban (Ohno, 1988).

In 1986, an article titled *The New New Product Development Game* was published in *Harvard Business Review* (Takeuchi, Nonaka, 1986). Although initially limited in popularity, it later inspired the pioneers of the Agile methodology in the United States, who became interested in the practices of leading Japanese companies described in the publication. From that point on, an increasing number of companies in Japan, and later in the United States

and the rest of the world, began striving to improve both people and processes (Żółkiewicz et al., 2022).

Several approaches, including Scrum, Extreme Programming (XP), Dynamic Systems Development Method (DSDM), Adaptive Software Development (ASD), Crystal, Feature-Driven Development, and Pragmatic Programming were developed to reduce time-to-market and enhance value delivery to customers in a more efficient manner (Flewelling, 2018). However, there remained a gap that none of the existing methodologies had fully addressed.

The turning point occurred in February 2001, when seventeen individuals from diverse software development communities convened at a ski resort in Utah to discuss how software development could better adapt to the evolving needs of users. The outcome of this summit was not a new framework, but rather the formalization of a set of values and principles, which emphasized the recognition of people as the most critical element in the development process (Flewelling, 2018).

Today, agile is regarded as a continuously evolving philosophy that has given rise to a wide range of frameworks and methodologies, all aimed at improving the dynamics of modern work environments.

The aim of the paper was a presentation of framework of agile based on main features such as flexibility, decentralization and adaptability. The article is structured into five sections: Introduction, Background of analysis, From Waterfall to Agile, From machine to brain in modern organizations, Conclusions and Discussion.

2. Background of analysis

Radical changes in the way organizations operate have been proposed in management, with a focus on customer satisfaction, team collaboration, and continuous improvement. The key is to shift away from traditional management methods, aiming for higher productivity and innovation while ensuring deep job satisfaction. It emphasizes the importance of open communication, working in short, customer-centric cycles, and transparency, creating a work environment that fosters the full realization of human potential and leads to above-average results (Denning, 2010).

To adapt to the dynamics of change, business practitioners and scholars have proposed agile solutions as a contrast to the waterfall approach. Craig Smith described forty variants of the Agile methodology. Moreover, there are more than seventy different Agile practices (Denning, 2010).

The Agile methodology is based on a customer-oriented approach that includes key actions such as adaptation, delivery, and inspection. Agile requires a focus on iterative and incremental

change. The iterative approach is suitable when the final product is not fully defined, and the emphasis is on its functionality and usability—on its effect. After each iteration, the product should be functional in some way, with subsequent stages improving it. This process reflects an incremental model, where each stage enhances the product's functionality or quality (Krzystek, 2021).

Unlike the waterfall method, which follows a predictive approach, Agile adopts an adaptive, empirical framework focused on experience (Alsaqqa et al., 2020). The predictive approach is suitable when the desired outcome is well-defined, the process is clear, and the product becomes functional only after all components are integrated at the end of the process. This distinction highlights how Agile methodologies address diverse project needs: iterative development fosters adaptability in environments marked by uncertainty, enabling ongoing refinement as understanding evolves. Incremental development, by contrast, focuses on delivering smaller, functional components over time, making it particularly effective in contexts where delivering value early and iteratively building towards a final product is advantageous (Făgărășan et al., 2021).

3. From Waterfall to Agile

The Agile approach is replacing the Waterfall model due to the development of digital technologies, remote work, and the increasing demand for IT projects (intangible assets) (Gajdzik, Kopeć, 2022). The advancement of digital technologies has been accelerated by the concept of Industry 4.0, which is based on the following technologies: big data, artificial intelligence, cloud computing, Internet of Things (IoT), additive manufacturing (3D printing), autonomous robots, cybersecurity, augmented reality (AR), and simulations and digital twins (Erboz, 2017). Since this concept is strongly promoted in EU countries, there is a need to present the Agile framework.

Table 1.
Agile and Waterfall: comparison analysis in IT projects

Waterfall	**pros**	used in a low-complexity, repetitive environment, such as HR and payroll; used for projects with easy-to-understand requirements; defined results and review process; the method is easy to adapt, even if teams change; the process and results are well documented; easy management
	cons	not effective when unclear requirements; lack of involvement of the customers; uneven loading of the resources; going back to a previous phase to make changes is difficult (difficult “last minute” correction); less time for testing; no time to fix test defects; lot of documentation; schedule and cost overruns; customers is not a member of team project; full financial security for the execution of the project is needed

Cont. table 1.

Agile	**pros**	customer is engaged in the development process all the time; agile method of software development; maintains the quality of development; process is completely based on continuous progress; minimalization uncertainty and mitigation of potential risks by ensuring both the customer and the team have a clear understanding of what is completed and what remains unfinished; budget divided into stages
	cons	limited documentation; fluctuate, flexible project costs; uncertain project end; difficulty in scaling in large, complex projects with multiple teams

Source: own elaboration based on (Rasmusson, 2010; Mokhtar, Khayyat, 2022).

Agile frameworks are not absolute. The application of Agile frameworks alone does not make an organization truly Agile. Some organizations simulate the use of Agile by dividing work into smaller portions while applying a Waterfall approach to each segment. Others limit Agile frameworks to a single department or specific projects, resulting in a hybrid model of Waterfall and Agile, often referred to as „WAgile". For an organization to genuinely identify as Agile, it must undergo a fundamental shift in mindset that permeates the entire organization at the operational level, guided by three core principles (Denning, 2018):

- The Law of Small Teams: while some Agile frameworks, such as Scrum, suggest that a team should consist of 3 to 9 members (Theobald, Schmitt, 2020), the appropriate team size for an organization depends on factors like project scope, organizational scale, and the specific characteristics of the industry or sector;
- The Law of the Customer: in the context of Industry 4.0, this principle is grounded in product customization and personalization to meet individual customer needs (Samita et al., 2024). With the development of the internet and the exchange of information, access to products has transformed, and competition among enterprises has significantly intensified. This shift has led to a departure from mass production in favour of a more individualized approach that considers the needs and preferences of individual customers;
- The Law of Networks – The entire enterprise operates as part of an interactive network, where ideas can emerge from any point within the system, leading to innovative solutions (business networking). Network-based solutions are founded on the principles of decentralization, fostering collaborative competition (coopetition) in business (Sroka et al., 2014). The exchange of information and consumer feedback positions the customer as an integral part of this interactive network.

Based on the aforementioned laws and the analysis presented in the table (Table 1) forms the foundation for identifying three core values that underpin the Agile framework:

- decentralization,
- flexibility,
- adaptability.

These values, discussed in detail in this section, find direct application in modern Industry 4.0 technologies and are crucial characteristics of modern organizations.

Decentralization encompasses various aspects and implications. From a technological perspective, it primarily relies on blockchain technologies and emphasizes the necessity of transparency (Tonkykh, 2023). From an economic perspective, it is closely linked to the sharing economy, API economy driving platform ecosystems, and network information economy (Kaal, 2021). From a financial perspective, decentralization supports financial inclusion by ensuring access to financial services globally, regardless of location. Moreover, it fosters greater trust and operational efficiency within the financial sector (Sharma, 2024). Finally, from an informational technology perspective, Distributed Ledger Technology (DLT) enhances data integrity, reduces costs, and optimizes processes through IT systems (Jiang, 2022).

Decentralization also extends to the diversification of sources for the supply of various types of goods. By reducing dependency on centralized supply networks, this approach enhances resilience to disruptions in supply chains, a challenge that national economies faced during the Covid-19 pandemic. This diversification not only mitigates risks associated with global crises but also fosters greater adaptability in dynamic market environments. Moreover, such an approach promotes anti-monopolistic market dynamics by encouraging competition and reducing the concentration of power among a few dominant entities. ICT tools play a key role in this process, enabling the rapid flow of information and seamless communication, which are essential for maintaining decentralized and resilient systems.

At the same time, it is essential to examine the role of Big Tech companies within the broader context. While these corporations provide valuable services and technologies, there has been a public backlash regarding their growing influence on the global economy. Their business practices have raised concerns about market monopolization, stifled competition, and the erosion of the tax base through aggressive accounting strategies and tax evasion. This dominance extends beyond their core sectors, such as IT and digital media, to influence both private and public platform technologies (Conyon et al., 2022).

Decentralization enhances flexibility, enabling systems and organizations to adapt swiftly to changing circumstances and address immediate challenges effectively. Flexibility in business decision-making processes enables organizations to effectively coordinate actions, particularly at the operational level, where a prompt response to both predictable workflow changes and sudden disruptions is crucial. (Cognini et al., 2018). Modern organizations operate in an environment characterized by rapid and dynamic changes. Flexibility is a critical prerequisite for mitigating decision-making risks, supported by advanced autonomous computer systems and AI-driven (machine learning) technologies (Jain et al., 2023).

Flexibility is closely linked to adaptability and the resilience of systems to changing processes within enterprises. These concepts are often mutually interrelated. Adaptability, in this context, is understood as the organization's ability to adjust to market conditions, whereas flexibility is more associated with the speed and capability of response. At the same time, the way an organization is adapted to its operating environment directly influences the assessment of its flexibility.

Viewing an organization as a living organism, flexibility could be likened to a personality trait or character attribute, while adaptability corresponds more to the skills and competencies it possesses. These cultivated skills impact how the organization functions, affecting its responsiveness, risk management approach, and overall flexibility. Consequently, this has further implications for the organization's ability to achieve "deeper" adaptation over time.

Flexibility often pertains to short-term reactions to both predictable and unpredictable factors. In contrast, adaptability is a continuous process grounded in foresight and strategy. This process must be preceded and supported by thorough market and industry research as well as the ongoing collection of information from both internal and external sources.

Adaptability encompasses development in both tangible and intangible assets. It pertains to areas such as intellectual capital associated with a company’s employees. An organization’s adaptability is enhanced by the development of organizational competencies (Bohashko, Bohashko, 2024). These include not only the individual skills and capabilities of employees but also the way they are managed, coordinated, aligned for complementarity, and effectively utilized to deliver value to both the customer and the company. Adaptability also involves a comprehensive system for acquiring new competencies and improving existing ones. This can be achieved through effective recruitment, education, training organization, and career development (Elgezabal et al., 2023).

Competencies are not the only intangible assets within an enterprise that contribute to enhancing its adaptability. Modern IT systems and business applications, when combined with the appropriate human skills, form complementary resources. In the context of Industry 4.0, keeping pace with developments in information technology and leveraging technological advantages are critical. This includes the implementation of new technologies and ensuring their proper integration across all operational areas of the organization. Neglecting this integration may undermine the potential benefits that advanced technologies can bring to the enterprise.

In their pursuit of ever-evolving IT solutions, organizations may overlook the importance of tangible resources, such as physical infrastructure and access to essential utilities like electricity—particularly given the increasing energy demands of advanced technologies. Furthermore, outdated hardware, such as inadequate processors, can pose significant challenges. Adaptability must therefore also address the risks associated with technical debt, which emerges when new solutions are implemented without properly upgrading the underlying hardware or software infrastructure (Patterson, 2023). This debt can hinder the efficient utilization of innovations, ultimately reducing the enterprise's ability to maintain competitiveness.

4. From machine to brain in modern organizations

Agile frameworks are grounded in the premise that cognitive capabilities (such as reasoning and processes inspired by brain functionality) should take precedence over physical labour and motion-based operations, which were central to earlier methodologies like Waterfall. While Waterfall emphasized the optimization of physical strength and sequential workflows, Agile prioritizes intellectual capabilities and adaptability.

Moreover, the human brain's structure and functionality have provided inspiration for advancements in neural networks, critical thinking methodologies, and decentralized systems (see Table 2). This paradigm shift reflects the broader transformation from physical to cognitive drivers of innovation in the context of Industry 4.0.

Flexibility, adaptability, and decentralization in Agile methodology are modelled after the structure and properties of the human brain (e.g., neural signals, pathways, and networks of neurons). Modern technologies such as blockchain, microservices, and increasingly advanced artificial intelligence reflect similar structural principles, characterized by distributed systems, interconnectivity, and adaptive behaviours. These features inherently resonate with Agile principles, as these technologies strive for flexibility, decentralization, and adaptability—core values embedded in the Agile philosophy.

The evolution of project methodology has been influenced by advancements in information and computer technology, as well as the increasing demand for IT-based projects. In table (Table 2), an attempt has been made to detail the specific characteristics of methodology evolution along the transformation path from "machine" to "brain." The terminology "machine" and "brain" is used conventionally, reflecting the nature of work and the structural comparison to machines, often associated with the Waterfall model, and to the brain, representing the structure and function of cognitive processes. Furthermore, technological progress has driven the transition from traditional manufacturing enterprises to smart factories.

Table 2.
From legacy systems to modern Agile architectures

Stage of development	Legacy (machine)	Connectivity	Modern (brain)
Metodology	Waterfall	„WAgile" (Waterfall & Agile)	Agile (from small teams + client to network organisation)
Architecture	Monoliths	SOA (Service oriented architecture)	Micro-services (decentralization)
Infrastructure	Physical servers	(VMs) Virtual machines	Cloud and IoE (Internet of Everything) including IoT and edge computing (decentralization)
Software	Embedded aplications	Separated applications	Containerization
Databases	Closed systems and proprietary databases (closed – trade secret protected)	Comunication Systems (ICTs), Open data and Big Data	Distributed Ledger Technology Cloud native, AI, Blockchain (resilient, flexibility, decentralization)

Cont. table 2.

Integrated systems	H2M (Human to Machines Systems)	Human+ Machines + Technology (communication, integration, networking)	
Team&work	Departments, plans, tasks, documents, centralization	Modules, projects, reports, acts and testing (development, refinement)	DevOps, networking, scrum, design thinking, extreme programming, kanban, lean, problem solving, digital literacy, etc.

Source: own elaboration: based on (Denning, 2018; Elgezabal et al., 2023; Reznik et al., 2020; Bashir, 2018).

In table (Table 2), the key levels of the evolution of design methodologies are presented, highlighting the following areas of change: methodology, architecture, infrastructure, software, databases, integrated systems, and team&work (team dynamics).

The methodology section emphasizes the concept of "WAgile", which combines elements of both Waterfall and Agile approaches. Typically, a project team may work exclusively with Agile while the entire organization follows Waterfall, or only selected principles of Agile methodology may be applied. At the same time, there is an increasing awareness of the benefits offered by Agile methodologies.

The transition from monolithic technology, represented by a monolithic system, involves moving from a structure where the failure of a single component disrupts the entire system. Such systems operate as indivisible units without partitioning. The next step is the adoption of Service-Oriented Architecture (SOA), which is based on consuming discrete services. This progression ultimately leads to microservices, which are distinguished by their modular design, enabling independent development, deployment, and scaling of individual components.

The infrastructure is based on the transition from the organization as a machine to the organization as a brain (the organization understood as a system according to R. Griffin's principles (2004), but nowadays conceptualized as a thinking system (Jung, 2017)). In thinking systems, Industry 4.0 technologies (e.g., VMs, Cloud Computing) play a crucial role. The cloud, initially centralized, is evolving into a decentralized model (Edge Computing), supported by the significant development of Cloud-native solutions. Additionally, machine technologies are achieving greater decision-making autonomy and enhanced collaboration capabilities (M2M).

Software is closely tied to the evolution of architecture, as software cannot exist without an underlying computing infrastructure. This infrastructure has evolved into containerized structures, which are agile, self-contained environments for running applications. Containers enable applications to operate in isolated boxes, enhancing operational security and minimizing the risk of system-wide failures. Due to their increased efficiency, containers often replace virtual machines (VMs).

Integrated systems are embedded within the principles of Industry 4.0 through vertical and horizontal integration, with a strong emphasis on the autonomy of systems in decision-making processes independent of human intervention.

Team & Work – within project methodologies, humans occupy a central position, as even in the case of AI, they oversee algorithms based on machine learning principles (ranging from deterministic algorithms to machine learning). A key assumption in this context is the effort to eliminate the so-called "black boxes" in AI, ensuring transparency and interpretability of algorithmic decisions, which are essential for maintaining human oversight and accountability. Moreover, the relationships between employees are also evolving, transitioning from a traditional hierarchical system to a cooperative and networked approach. In this model, individuals function akin to neurons in the brain, each performing specialized tasks while interacting and influencing one another to collectively achieve project goals.

The above considerations regarding the Waterfall and Agile concepts are presented in two organizational models: "organization as a machine" and "organization as a brain," respectively, as shown in the table (Table 3).

Table 3.
The structure of organization in two approach Waterfall and Agile

Organisation as a machine	Organisation as a brain
Rigid structure with predominantly vertical communication flows	Flexible structure with feedback loops
Task-oriented organization	Project-oriented organization focused on continuous improvement
Tasks divided into stages	Simultaneous execution of multiple task segments
Each subsequent task is executed only after the previous one is completed	Continuous customer-centric improvement
Bureaucracy and task-based reporting	Minimization of documentation to the essentials
Tasks imposed according to the plan	Creativity and creative freedom
Lack of involvement and decision-making autonomy (centralized decision-making)	Employee engagement and decision-making autonomy
Blindness, avoidance of problems	Creative problem-solving
Problems limit development – they are barriers or obstacles	Problems are challenges, solved in real time or incorporated into event scenarios (event prediction)
Detailed instructions, procedures, methodologies, and task execution techniques	Know-how and systems thinking

Source: own elaboration: based on: (Denning, 2018; Mokhtar, Khayyat, 2022).

5. Discussion

New organizational models, systems, and modes of collaboration emerge because earlier approaches fail to adequately address the challenges of a rapidly changing world. Continuously improving existing concepts does not always yield the desired results. At the same time, the implementation of relatively new approaches, such as Agile, can also lead to challenges and introduce chaos.

The transition from hierarchical to networked, decentralized organizations, due to its specific nature, heavily relies on mutual trust among team members and employees within the organization. Treating each unit as a node within a distributed network requires caution regarding Byzantine nodes. Consequently, the concept of resilient organizations has been increasingly discussed in the literature.

The main theoretical contribution of this study is the detailed categorization of the features of the Agile concept within modern organizational contexts. This categorization serves as a foundation for developing a robust methodology tailored to Smart Manufacturing (SM) industrial projects, facilitating the implementation of Industry 4.0 in the industrial sector (Gajdzik, Wolniak, 2022a; Biały et al., 2023).

Agile design aligns closely with the principles of Kaizen, emphasizing continuous improvement through incremental steps. In the context of SM projects, effective teamwork necessitates a strong collaboration between IT specialists and technology experts and machine operators (Gajdzik, 2023).

From a practical perspective, this study highlights the substantial benefits organizations can gain by adopting the Agile concept. Agile methodologies enhance project management capabilities, particularly in IT-intensive initiatives. To improve project outcomes, organizations should focus on key operational areas, such as fostering flexibility in teamwork and strengthening collaborative efforts within IT projects. This approach promotes adaptability, efficiency, and the successful execution of projects in the dynamic environment of Industry 4.0.

In the context of Industry 4.0, creativity plays a pivotal role in design work. It is crucial to understand the principles of creative thinking, develop innovative solutions to technical problems, and apply these solutions in practice. The importance of creativity extends to education, where understanding the Agile concept and its practical applications is integral to producing innovative solutions in technical disciplines such as IT 4.0 or Engineer 4.0.

Gajdzik and Wolniak (2022b), in their analysis of metallurgical study programs in Poland, emphasized the importance of fostering creativity across all areas of knowledge. Their findings highlight that students not only attend lectures but also engage in practical, laboratory, and design exercises. Moreover, subjects related to project management are integral to engineering sciences, as they inherently teach creativity. This focus on creativity is particularly relevant as more companies operating within Industry 4.0 adopt a new innovation paradigm centered on flexibility and customer collaboration.

6. Conclusion

Agile is a contemporary management concept characterized by specific features that support the creation of new products, emphasizing development and continuous improvement. This includes prototyping, with a particular focus on product personalization ("constantly meeting customer expectations"). As a result, flexibility and adaptability become crucial characteristics for organizations aiming to thrive in today's highly competitive market environment. According to Agile philosophy, decentralization is the key to achieving these qualities.

A transition is required from a monolithic system to a more distributed one, where each unit is treated as an autonomous entity. However, it is important to note that these units remain part of a system, forming a network of communication and mutual interdependence.

This gives rise to an analogy between the structure and functioning of two organizational types: the "machine" and the "brain." An organization with a highly hierarchical and bureaucratic structure resembles a machine, where every part has a specific user manual and operational procedures. In contrast, an organization requiring continuous cooperation, quick decision-making, rapid responses to external stimuli, innovation, and a network of interdependent units resembles the neural network of a brain.

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