Technology Intelligence as a One of the Key Factors for Successful Strategic Management in the Smart World

Anna Adamik

Institute of Management, Faculty of Organization and Management,
Lodz University of Technology, Poland
https://orcid.org/0000-0002-6007-5675

Abstract

Purpose: Due to the poor recognition in the literature of the phenomenon of Technology Intelligence in contemporary organizations, the aim of the paper is to attempt to recognize the essence and significance of Technology Intelligence of organizations operating in a Smart World.

Design/methodology/approach: The paper is conceptual-empirical in nature. The operationalization proposal is based on the identification and assessment of the Technology Intelligence of organizations as one of the key pillars of effective management in the Smart World.

Findings: An organization's Technology Intelligence significantly accelerates and improves the quality of many organizational processes, including smart strategic management. Unfortunately, it does not drive itself, but is one component of a larger system of activities. In order for it to realize its full potential, it must be supported by intelligently matched resource capabilities developed in the individual pillars of the Smart World (Intelligent People, Intelligent Technology, Intelligent Collaboration, Organization Intelligence). Technology Intelligence cannot function effectively without their support.

Research limitations/implications: The results of the research indicate that the interviewed companies already have some potential for Technology Intelligence, primarily in understanding the technology landscape. Unfortunately, they often still lack the resources and competences to apply the insights in practice (deficiencies in relation to the other pillars of the Smart World). The main constraints seem to be financial and human resources. Organizations should simultaneously develop their potential in all pillars of the Smart World.

Originality/value: The original contribution of the study is to systematize knowledge about the essence and importance of Technology Intelligence in the Smart World and to propose a methodology for examining its maturity in enterprises.

Correspondence address: Lodz University of Technology, Wólczańska 221, 93-005 Łódź, Poland; e-mail: anna.adamik@p.lodz.pl.

Inteligencja technologiczna jako jeden z kluczowych czynników skutecznego zarządzania strategicznego w Smart World

Streszczenie

Cel: w związku ze słabym rozpoznaniem w literaturze przedmiotu zjawiska inteligencji technologicznej we współczesnych organizacjach za cel pracy przyjęto próbę rozpoznania istoty i znaczenia inteligencji technologicznej organizacji funkcjonujących w Smart World.

Projekt/metodologia/podejście: artykuł ma charakter koncepcyjno-empiryczny. Propozycja operacjonalizacji opiera się na identyfikacji i ocenie inteligencji technologicznej organizacji jako jednego z kluczowych filarów skutecznego zarządzania w Smart World.

Wyniki: inteligencja technologiczna organizacji znacząco przyspiesza i poprawia jakość wielu procesów organizacyjnych, w tym inteligentnego zarządzania strategicznego. Niestety nie napędza się ona sama, lecz jest jednym z elementów większego systemu działań. Aby mogła wykorzystywać swój pełny potencjał, musi być wspierana inteligentnie dobranym potencjałem zasobów rozwijanym w poszczególnych filarach Smart World (Inteligentny Człowiek, Inteligentne Technologie, Inteligentna Współpraca, Inteligencja Organizacji). Inteligencja technologiczna nie może efektywnie funkcjonować bez ich wsparcia.

Ograniczenia/implikacje badawcze: wyniki badań wskazują, że ankietowane przedsiębiorstwa posiadają już pewien potencjał inteligencji technologicznej, przede wszystkim w rozumieniu krajobrazu technologicznego. Niestety, często jeszcze brakuje im zasobów i kompetencji, aby zastosować te spostrzeżenia w praktyce (braki w odniesieniu do innych filarów Smart World). Głównymi ograniczeniami wydają się być zasoby finansowe i ludzkie. Organizacje powinny jednocześnie rozwijać swój potencjał we wszystkich filarch Smart World.

Oryginalność/wartość: oryginalny wkład niniejszego opracowania polega na usystematyzowaniu wiedzy na temat istoty i znaczenia inteligencji technologicznej organizacji funkcjonujących w Smart World oraz zaproponowaniu sposobu badania jej dojrzałości w przedsiębiorstwach.

Słowa kluczowe: Smart World, zarządzanie strategiczne, przewaga konkurencyjna, inteligencja organizacyjna, inteligencja technologiczna, technologia i konkurencyjność, odpowiednia technologia, rozwój firmy.

1. Introduction

We are all becoming more and more aware of the fact that we are living in a unique environment – the so-called Smart World. A world that realizes the ideas of increasingly widespread use of broad intelligence and intelligent solutions. (Huawei, 2021) A world that should become better and better for the benefit of all, through both increasing technological sophistication and greater social and environmental responsibility. This world should be more convenient, more efficient, more responsive to social needs, and more humane (Adamik, Nowicki & Puksas, 2022). In connection with the tasks, it is undergoing breakthroughs, both technological, social and cultural. Technological breakthroughs play a special role. This is because the breakthroughs are

dynamically accompanied by disruptive changes (Christensen et al., 2018) which, as they occur (e.g. as another new technology becomes public and is incorporated), cause profound transformations not only of products, routines, competencies, but also of the functioning of entire organizations (including their business models), industries, and even economies and societies. They thus generate a chain of breakthroughs. Under such conditions, the so-called "Technology Intelligence" of organizations becomes important (Awamleh & Ertugan, 2021). It enables modern companies to see that they need "the right technologies for the Smart World", not just "technologies", and their customers need the "right products", not just "products", chosen intelligently and with specific parameters. In the Smart World, not everything that is new and spectacular will gain recognition and guarantee market success. It must also represent concrete value and quality. Technology Intelligence enables the organizations that use it to discover, select, evaluate, more efficiently develop, deploy, or exploit more valuable technologies, products, and other cutting-edge technical solutions than others (Talaoui & Kohtamäki, 2020). This way enables their faster technological transformation (Albukhitan, 2020; Aybek, 2017), a smoother path to technological maturity (Nogalski & Niewiadomski, 2019), and competitive advantage (Daňa, Caputo & Ráček, 2020; Feng, Sun, Chen & Gao, 2020) in the Smart World. Given the lack of recognition in the literature of the phenomenon of Technology Intelligence in contemporary organizations with respect to strategic management in the Smart World, a research gap was identified in this field. As a result, as the purpose of the study was assumed an attempt was made to recognize the essence of Technology Intelligence of organizations and answer two questions: 1) Can Technology Intelligence be seen as a key factor (Game-Changer) of smart strategic management in the Smart World? 2) Are organizations able to efficiently use Technology Intelligence in their business praxis?

In order to achieve this goal, desk research was conducted on the characteristics of the pillars of the Smart World. The research was deepened with regard to one of the pillars – Organizational Intelligence – and its specific element – Technology Intelligence – as was identified as a fundamental source of success for organizations operating in the Smart World. The analysis of the literature combined the issues of Strategic Management, Technology Intelligence of the organization and the requirements of the Smart World, was supported by analyses of the results of own empirical research. Both a desk study of the issue and a survey research of companies operating in the Smart World have been carried out. The qualitative research was based on the analysis of "Trend Maps". They focused on identifying key contemporary technological trends. Quantitative research based on survey research concerned identification of the ability of organizations to assess the significance and to assess the level of implementation of the new technological trends. The level of implementation of top technological trends (and their new technologies) was considered to be a kind of manifestation

of the Technology Intelligence of the surveyed organizations. The research results were summarized with conclusions and recommendations for further research in the area.

2. Literature Review

2.1. Pillars of Smart World

An exhaustive and focused literature review was carried out in order to identify key and central issues for the areas of "Smart World" and "Technology Intelligence of the Organization". It was based on widely available literature sources and selected key citations. This type of literature review was chosen due to the very limited resources in the Scopus and Web of Science databases for articles with the keywords "Smart World", "Organizational Intelligence" and "Technology Intelligence" in the fields of "Business Management", "Management" and "Business". It was decided to fill the gaps with targeted searches in other widely available source databases and platforms, e.g. Scholar Google, Research Gate, Ebsco, etc. Sources were selected whose authors deal with the issues of managing organizations in the Smart World, taking into account the issues of Organizational Intelligence in its various forms, especially with the use of Technology Intelligence (and new technologies). In this way, they efficiently combine the topics that are important for the study. Unfortunately, most of the articles dealt with the above-mentioned issues separately or did not concern management sciences and therefore could not be includ.

The results of the research carried out showed that Smart World is a unique environment that rests on several essential pillars. Each of them seems indispensable, as it brings a specific quality to the way the entities operating in it operate and enables, or facilitates, the development of the other pillars (Adamik, Nowicki & Puksas, 2022). The foundation of its concept is a well-developed and well-chosen, **intelligent human factor (smart human)**. The state of their intelligence depends on the state of their knowledge, understanding of the environment, culture and value system, so being smart means being proactive, focused, aspirational and goal-oriented in applying innovative ideas to achieve the desired future (Smart Future Initiative, 2016). Skills in abstract thinking, learning, perceiving dependencies and relationships between different facts, and drawing conclusions based on ir are particularly important. The ability to adapt to new conditions and perform new tasks using the means of thinking is also important. It has been scientifically confirmed that the knowledge, competencies, attitudes and skills of individuals, groups and even generations are derived from the technology they use, and therefore the rate of technological development taking place in the locations and times in which they operate. This translates into requirements for desirable employee competencies and attitudes.

Desirable competencies are: 1) hard competencies (specialized and technical knowledge) and soft competencies (ability to work in teams, ability to manage oneself in time); 2) open attitude to novelty and change, adaptability, proactivity, creative skills; 3) understanding of digitization, processes and solutions based on new technologies, 4) ability to use modern machines and equipment, information systems, work with data, analyze, process and synthesize data and information, 5) understanding the principles of safe use of technology and work with data, 6) understanding what type of technology can be used to improve business indicators in the immediate environment; 7) interdisciplinarity, 8) analytical and design thinking, 9) ability to learn from failures, 10) no resistance to taking responsibility; 11) ability to respond to customer needs and behavior; 12) willingness and ability to cooperate, share knowledge within interdisciplinary teams, in a multicultural environment, 13) ability to diagnose and constructively communicate problems, needs and solutions, especially in the areas of new technologies; 14) communication skills, ability to communicate using virtual tools. The pace of development, the way of construction, operation and quality of operation of the entire smart enterprise depends on the above human factor capabilities.

Since we live in a world of Economy 4.0, (Saniuk, Cagáňová & Saniuk, 2021) another pillar of the Smart World is the "right" **technological potential**. A Smart World requires building on the achievements of the digital revolution linked to increasing computing power, ever-increasing data speeds, **smart technologies** and Internet-based applications. This is based on the ability to use four key technologies: integrated cyber physical systems, production process optimization and predictive maintenance systems, Industrial Internet of Things (IIoT) and solutions that guarantee cyber security. They should be efficiently encapsulated with tailored to the needs of the organization, "right" technologies, the so-called companion technologies (e.g. Vertical/Horizontal Software Integration, Machine-to-Machine Communication, Internet of Services, Big Data and Analytics, Clouds, Additive Manufacturing, Augmented Reality, Virtual Reality, Digital Twin, Artificial Intelligence, Neural Networks and Mass Customization). In a Smart World, objects (machines, cars, computers, cell phones, etc.) are supposed to intelligently serve people in a way based on close and broad collaboration, together constituting a kind of universe of many interconnected devices (Bani Yasin et al., 2019).

The above pillars of Smart World are complemented by the requirement for **social responsibility (CSR) and environmental responsibility linked to sustainable business development**, which is more than just technological development (see Directory of Key Intelligence in the Industry 4.0 Era) (Adamik, 2021). Activities of organizations in the Smart World should be oriented toward the creation and implementation of proactive and innovative technological solutions that will shape increasingly qualitatively better, and at the same time more humane and environmentally sustainable,

conditions for social and economic functioning (De Sousa Jabbour et al., 2018). This involves a greater emphasis on, among other things, the ethics and social responsibility of business operations, a deepening commitment to the ecology of production and circular operations, including maximizing the use of renewable energy sources, incorporating the development of a circular economy, and changing the transportation network (cars, buses, trains) to electric and hydrogen-powered vehicles.
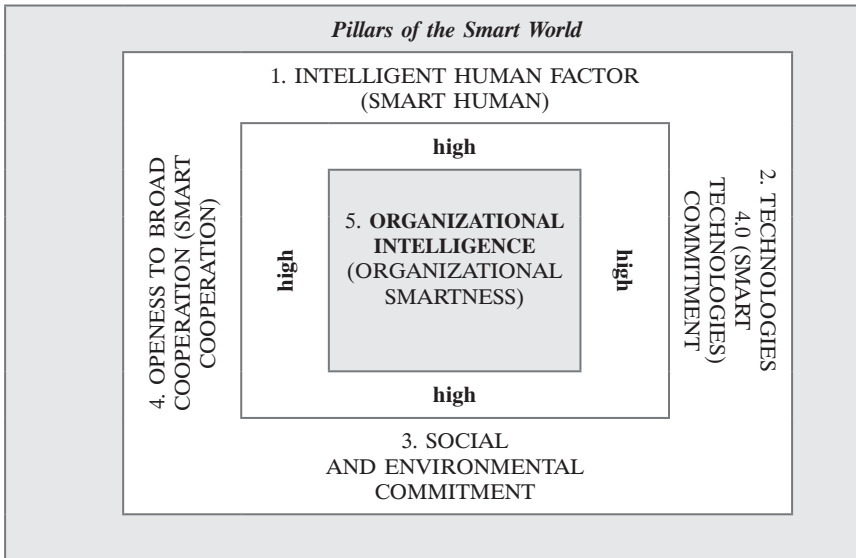
The fourth pillar of Smart World, is the requirement for organizations to be open to **broad cooperation**, inter-organizational partnerships and co-creation, etc. (**smart cooperation**) (Adamik & Sikora-Fernandez, 2021; Kiel, Muller, Arnold & Voigt, 2017; Al-Kasasbeh, Al-Kasasbeh & AL-Faouri, 2016; Saunila, Nasiri, Ukko & Rentala, 2018; Zawawi & Wahab, 2019). In this way, Smart World is betting not only on the genius of the individual, but also on the strength of relationships that will strengthen the dynamics of development in the long term, as well as the sustainability of the partners' competitive advantages. They should be built on both real and virtual levels.

The set of pillars is crowned by the fifth, it supports all of the above. Therefore, it most extensively supports the operational and strategic management processes of organizations of the Smart World era. It relates to the need for organizations to develop the so-called strategic foresight, i.e. the ability to create space for entrepreneurship and creativity, to expand the possibility of solving future problems by taking into account new challenges, and therefore new ways of operating that will be effective in the future. They are related to the organization's possession of broad knowledge and **multidimensional intelligence (organizational smartness)** (García-Piqueres, Serrano-Bedia & Pérez-Pérez, 2019; Závadská & Závadský, 2018; Mao, Liu, Zhang & Deng, 2016) in terms of how it is gathered and how it is used. The subject's **intelligence** is considered to be its ability to find itself in any situation, especially a new one. Thanks to accumulated knowledge and the ability to perceive interdependencies between facts, successive behavioral modifications more and more efficiently directing it toward desired goals. Intelligence gives subject's ability to adapt to environmental conditions or to adjust the environment to its needs, or to choose the context most suitable for satisfactory action (Awamleh & Ertugan, 2021; Sternberg & Sternberg, 2015).

In its full form, the Smart World will emerge when (see Figure 1) human beings intelligently create and use the knowledge they possess. It will also be important for people and organizations to engage so strongly and widely with the technologies of the Fourth Industrial Revolution (IR 4.0) that the two realities of physical reality (PR) and virtual reality (VR, cyberspace) seamlessly intermingle in their lives. Under such conditions, computer processing, Internet solutions and other Industry 4. 0 technologies will not only be ubiquitous, but also the most effective. In addition, a widespread commitment to social and environmental issues must be recognized, and innovative technological solutions must be accompanied by a highly

developed social and environmental responsibility for the smart solutions put into practice. At the same time, humanity must be ready to pursue various forms of open, partnership-based cooperation aimed not only at profit, but also at the well-being of present and future generations.

Figure 1
Pillars of the Smart World

Pillars of the Smart World

1. INTELLIGENT HUMAN FACTOR (SMART HUMAN)

4. OPENESS TO BROAD COOPERATION (SMART COOPERATION)

2. TECHNOLOGIES 4.0 (SMART TECHNOLOGIES) COMMITMENT

high

high

high

high

5. **ORGANIZATIONAL INTELLIGENCE** (ORGANIZATIONAL SMARTNESS)

3. SOCIAL AND ENVIRONMENTAL COMMITMENT

2.2. Importance of Technology Intelligence of Organization in the Smart World

With the requirements of the Smart World in mind, **Organizational Intelligence** becomes a central pillar for successful development in the environment. It includes a set of individual characteristics of a given organization demonstrating its ability to perceive and create in an authoritative way the knowledge resources necessary for the realization of its goals (Gogoi & Barooah, 2021; Talaoui & Kohtamäki, 2020; Bratianu & Vasilache, 2006; Albrecht, 2002). It also involves the ability to perceive, understand, interpret complex situations, events and market signals, as well as effectively act and respond to them. It involves not only an organization's ability to gather knowledge related to its business purpose, but also to interpret it, develop it, use it, share it, as well as to reflect on it, learn from it and act effectively. In order for it to perform so many functions, it must be perceived, built and exploited in a multifaceted way (*multidimensional Organizational Intelligence*). The overall construct of an Organization's Intelligence is therefore **made up of quite a number of components**. Their types depend on how they

are classified (Adamik, 2021). The most common are social, relational, organizational, business, marketing, information, financial, environmental, technological intelligence. Each of them has specific tasks to perform.

In the Smart World, **Technology Intelligence acquires special importance in the set**. It is the organizational ability to notice the importance, recognize the specificity, evaluate the usefulness, choose the right selection and implementation mechanisms of technological solutions adequate to current organizational needs (Noh, Mortara & Lee, 2023). Because of its specificity, it gives guidance on technological requirements (the so-called "right technologies") and technical support (supporting technologies and tools) in terms of task feasibility to the other types of intelligence. This is because this type of intelligence ensures the proper integration of the technological variable into the production and business system, enabling not only proper negotiation, but also laying the groundwork for improved decision-making, especially related to the development of innovation processes. Based on it, a systematic model is created by a given entity for collecting, analyzing and disseminating information about the technological environment designed to ensure that the organization in question is constantly, and effectively, searching for new opportunities (Moradi, Salehi & Mozan, 2022; Savioz, Luggen & Tschirky, 2003; Savioz & Scacchi, 2001). Through it:

- Social Intelligence (Riggio, 1986; Kihlstrom & Cantor, 2011) – understood as the self-awareness and level of development of a given subject/ individual, their social attitudes, abilities and appetite for managing social change, developed on the basis of experiences of cooperation with people, learning from successes and failures, etc. -receives additional information supply in terms of social world knowledge resources in the Smart World environment (e.g., through social media, Metaverse, web resources, *various types of browsers*);
- Relational Intelligence (Pless & Maak, 2005) – understood as the ability of an entity to engage in collaborative relationships, the ability to communicate and interact with stakeholders from different backgrounds through accurate identification of their emotions, values, interests and requirements, and critical reflection on them. It gains in the Smart World the support of such tools as, for example, instant messaging, applications, platforms (e.g. crowdfunding), recruitment, sales, or promotional services or systems, (including Linkedin);
- Organizational Intelligence (Silber & Kearny, 2009) – understood as the ability of an organization to gather and use knowledge corresponding to its goals, especially concerning employees, organization of their work, cooperation with different locations, branches and partners, including external ones. It gains, in Smart World, the support of databases, software, applications dedicated to companies (e.g. ASANA, Trello, Jira, crowdsourcing solutions, etc.) and tools supporting organizational work, e.g. in the form of readers, sensors, locators, intranets;

- Information Intelligence (https://www.igi-global.com/dictionary/complex-new-world-information-security/14419) – understood as the ability to transform large amounts of complex data into relevant and useful information for better risk management and increased profitability of the organization. It is supported in the Smart World by a number of analytical, forecasting and simulation programs that enable efficient data management (e.g., EDI-class systems-automated data exchange, Tableau-type solutions).
- Business Intelligence (Fink, Yogev & Even, 2017; Shollo & Galliers, 2016) – understood as the ability to provide an overview of various activities of the company through access to current and historical information to improve and optimize decisions and performance of various areas. It gains support in Smart World through applications, infrastructure and tools dedicated to it, e.g. CRM systems, SAP, power BI servers, data repositories, competence centers.
- Data Intelligence – (https://www.techopedia.com/definition/28799/data-intelligence) – understood as the ability to accurately analyze data in the Smart World. It has gained support from artificial intelligence and machine learning tools (including advanced analytics; neural networks, computer speech recognition, learning algorithms to support, for example, autonomous vehicles, automated translations from audio to audio, the so-called speech-to-speech, automated intelligent advisors, and the Internet of Things) to analyze and transform huge data sets into intelligent information that can be used to improve products, services, investments or business processes.
- Technological Intelligence (https://www.infoentrepreneurs.org/en/technological-and-strategic-intelligence/; Tugrul, Daim, Dundar, Kocaoglu & Anderson, 2011) – understood as an entity's ability to accumulate and use scientific and technical assets (patents, publications, know-how), as well as to carry out its ongoing research activities, design and develop products and services, efficiently carry out production processes, obtain and use various raw materials and supplies, as well as other tools necessary for day-to-day operations. It gains, in the Smart World, the support of databases, information systems and platforms (accumulating information on what, who, where, with what, and based on what standards does what), as well as simulators, operational and specialized programs that allow efficient management of the company's technical resources (e.g. ERP systems).
- Technical Intelligence (Zhang et al., 2016) is understood as the ability to collect, process, analyze and use data and information on foreign equipment and materials to prevent technological surprise, assess foreign scientific and technical capabilities, and develop countermeasures designed to neutralize a competitor's strategic actions. In the Smart World it is supported by the creation of its own repositories and databases

and access to Open Data, Open Innovations, Open Resources, or various types of industry and world reports available on the Internet and on the websites of various types of reporting organizations, etc.

- Environmental Intelligence (Kraselsky & Gravatt, 1989) – understood as the ability to collect (measurements/observations), compile, use, analyze data to characterize the state of the environment in a given place or region and time (past, present, future) is gaining, in the Smart World, among other things, the support of applications, platforms and media providing weather and environmental information 24 hours a day, based on data from satellite systems, as well as collected by drones, or various types of sensors available to organizations monitoring the areas.
- Ecological Intelligence (Goleman, 2010, 2009) is understood as the ability of individuals to gather knowledge about their impact on the environment and use the information to make changes in their behavior toward more sustainable living. In the Smart World, it is supported by environmental analyses e.g. LCA, CBA, CEA, supported by sensor readings that monitor in various ways the side effects of production activities e.g. carbon footprint.
- Market Intelligence (Najm & Alfaqih, 2021; Prescott et al., 2001) is understood as the ability to gather information from an organization's environment that is relevant to the development of the market in which it operates, and thus refers to efficient monitoring of trends, competitors, suppliers and customers (current, lost and targeted). In Smart World, it gains the support of data available from online sources, news services, company websites, secondary data sources, social media, RSS feeds, etc. It thus gives decision-makers a more complete picture of a company's current performance under specific market conditions which facilitates decision-making when determining strategy and better market penetration and development.
- Competitive Intelligence (Oubrich, 2011; Oubrich, Hakmaoui, Bierwolf & Haddani, 2018) is understood as the ability to effectively gather and use relevant information about competitors, current or potential, including analyzing their strategies and competitive advantages, products or processes. In the Smart World, it gains support from, among other things, open-source corporate or competitive intelligence services (Hastedt & Guerrier, 2010).
- Strategic Intelligence (Levine, Bernard & Nagel, 2017) is understood as the ability to collect, process, analyze and disseminate data necessary to shape policy and strategic, long-term plans at the national and international levels. In the Smart World, it gains support not only from dedicated software or platforms, but also from open source intelligence services, publicly available industry analysis, or reports on economic, technological, environmental or social trends monitored by world-class consulting firms or government organizations. It is also supported by

the results of active use of the aforementioned types of intelligence in the organization.

Taken together, the above construct provides a platform of intelligent support for the processes of knowledge accumulation, decision-making and, consequently, intelligent, the so-called smart strategic management of enterprises in the Smart World. Graphically, the phenomenon is visualized in Figure 2.

Figure 2

Using Technology Intelligence to support strategic management in the Smart World

MULTIDIMENSIONAL ORGANIZATION INTELLIGENCE IN THE SMART WORLD		Pillar of the Smart World	Area of Influence	Strategic Intelligence — Policy formulation, strategic planning, organizational strategy building, organizational development management	SMART STRATEGIC MANAGEMENT	STRATEGIC MANAGEMENT IN THE SMART WORLD
Technology intelligence	Social Intelligence	1,3,4,5	knowledge resources of the individual			
	Relational Intelligence	1,4	relational capital, cooperation			
	Organizational Intelligence	4,5	human resource management			
	Information Intelligence	5	organization management			
	Business Intelligence	5	data management			
	Data Intelligence	5	optimization of business decisions			
	Technological Intelligence	2,5	business process management			
	Technical Intelligence	2,5	technical resource management, investment, development			
	Environmental Intelligence	3,5	R&D, prevention of technical surprise			
	Ecological Intelligence	3,4,5	environmental risk management, relations with the environment			
	Market Intelligence	5,4	environmental impact management, relations with the environment, CSR			
	Competitive Intelligence	5,4	knowledge of market development			

The organization's Technology Intelligence strengthens the accuracy of its response to all the requirements of the Smart World (5 Pillars of Smart World). It supports the development of the knowledge of individual employees (Pillar 1), their teams, the entire organization and its network of cooperating partners (Pillar 4). Besides, it allows the organization to build its technological capabilities (Pillar 2) in a conscious, prudent (Pillar 5), socially and environmentally responsible (Pillar 3) manner.

2.3. Importance of Technology Intelligence for Strategic Management in the Smart World

Since a Game Changer, by definition, is a newly introduced element or factor that significantly changes an existing situation or activity it seems that the answer should not be in doubt. In a Smart World environment, technologies change so frequently and strongly, so surprisingly changing the conditions and rules of operation, that greater awareness in this regard is the key to success. Nowadays, the apt and timely selection and smooth implementation of the right technology into organizational operations can do a lot. Research indicates that it affects:

- The technological maturity of the organization (Noh, Mortara & Lee, 2023), i.e. the experience acquired in the technological field, the patterns, values and attitudes outlined and adopted, and consequently the way in which the organization uses its financial, relational, technological and knowledge-based resources. It results from the smooth integration into one system and coordinated development of all the above interdependent resources. It is accompanied by continuous change, rapid response, quality improvement, responsibility for employees and the environment, and comprehensive customer orientation. At the same time, it is based on three main, properly selected underlying factors: 1) the right organizational and management structures, 2) the right employees empowered and equipped with the right knowledge, and 3) the right, flexible production technologies (Nogalski & Niewiadomski, 2019).

- The pace and extent of an organization's technological transformation, i.e., the degree to which the organization adapts to the new so-called digital landscape, which is a condition for survival in the Smart World (Albukhitan, 2020). This transformation is related not only to the focus on technology and machinery, but also to the ability to transform the materials, activities and processes used into digital versions so that they can form the basis for the transformation of the entire business model. "Proper" technological transformation, in fact, is the application of technology to digital transformation in order to radically increase efficiency in every area of the organization (Aybeka, 2017). Applied aptly, ICT technologies then increase the efficiency of operations and provide new sources of value through the synergies created as a result

of integrating digital technologies with individual business processes, which means more than just supporting business processes.

- Organizational culture of enterprises and values held in the organizations – the results of the research indicate that the choice of technology determines the development of other features of organizational culture and values dominant in companies. The biggest influence on the features of the organizational culture of companies is "IT systems integration". Thanks to it, one can see positive changes in the approach to task completion and deadlines. One can also see an increased focus on company performance, as well as an attitude toward cooperation and internal and external dialogue. Further down an increase in the openness of employees to innovative solutions and an increase in attitudes toward creativity was an effect of implementing the technology. The technology is least conducive to fault tolerance and risk-taking propensity. Other technologies of the Industry 4.0 era that significantly shape the parameters of organizational culture are IT networks, business process automation, mobile technologies, machine-to-machine communication, and cyber security (Pol, 2022).

- Competitive advantage – aptly chosen technology is one of the primary sources of competitive advantage for companies (Torrkeli & Tuominen, 2002), as it determines the structure and quality of the processes that a given enterprise uses to transform inputs into higher-value objects (Madureira, Popovic & Castelli, 2021; Christensen & Raynor, 2003). Its importance is growing due to the Smart World's deepening globalization, rapid technological progress and the increasing importance of intellectual capital. Under such conditions, the ability to combine different types of resources and skills, both internal and external (including technological), and create unique and competitive combinations from them is growing. This is increasingly achieved through the conscious use of (global business and technological structures that go beyond the boundaries of a single company and tap into the potential of companies around the world. It increases the chances of building a competitive advantage and long-term market success (Najm & Alfaqih, 2021; Ferrier & Wiltbank, 2010). Research indicates that the accumulated resources of established knowledge and a high level of activity in the area of new technology development have the strongest impact on the ability to increase the pace of building competitive advantage and increase its effectiveness, to a slightly lesser extent on the scale (scope) of impact, and least on cost intensity. This is because they help to make decisions through more efficient, acquisition, analysis, dissemination and flow of information, and consequently change business processes.

The above analysis raises two research questions: RQ1). Can Technology Intelligence be seen as a key-factor (Game-Changer) in smart strategic management? RQ2). Are organisations able to efficiently use Technology Intelligence in their business praxis?

3. Research Methods and Results

In order to empirically verify the suggestions noticed in the literature of the issue, an original research process was designed. It was decided to answer the questions based on qualitative desk research of the subject and empirical quantitative research. Qualitative research was an introduction to quantitative research. They allowed us to indicate the scope of knowledge and activities that are a manifestation of high Technology Intelligence (element of the central pillar of the Smart World-Organizational Intelligence). They focused on identifying key trends and technologies for the development of organizations in the Smart World and determining which of them already constitute our technological reality (new normal) and which will become such in the near future (reactive zone). The purpose of the quantitative research was to test in practice whether respondents had Technology Intelligence and used it to identify and assess the usefulness of the technology trends around them, whether they were more likely to implement new technologies that accompanied the trends thanks to the support of technology intelligence, and whether they perceived the impact and importance of the technologies for the development of their organization.

3.1. Qualitative Research

Supporting qualitative research were the findings of Infuture Institute, which, through a wide range of applied foresight methods (expert interviews, panel discussions, the Delphi method, etc.) based on long-term cooperation with experts (market leaders, inventors, representatives of key institutions, founders of startups, both from Poland and the World) has been systematically preparing future scenarios of the so-called "Trend Maps" since 2018 (Infuture Institute, 2022). Their maps are a comprehensive analysis of the most relevant megatrends. They are presented in three time perspectives: new normal (currently leading trends), reactive zone (short-term perspective, trend needs up to 5 years to become a leading trend), innovation zone (medium-term perspective, trend needs 5 to 20 years to become a leading trend). The research undertaken consisted of two stages. The spheres of technological megatrends included in two maps were selected for further analysis: 1) "2020 Trend Map" and 2) "2022 Trend Map".

The results diagnosed on the first map were the reference point (see Table 1) for the Technology Intelligence assessments of 107 companies operating in Lithuania and Poland surveyed in 2021/2022 (see quantitative research). As a result, 21 technological trends were identified that organizations with developed Technology Intelligence should be aware of.

Table 1

List and description of technological trends

Trend	Technological trends 2020
IMPLEMENTING AI	Implementation of artificial intelligence to solutions based on big data and neural networks implemented in many areas of life. Currently, they are at the initial stage of development.
5G	The new generation of fifth generation mobile technology (5G) has a chance to change and accelerate the development of many areas, including transport, internet of things, telemedicine and smart cities.
DIGITAL HEALTH	The trend indicating the development of digital solutions in the field of broadly understood health based on, inter alia, technologies such as VR, AR, AI or IoT.
SEAMLESS TECH	Seamless Tech is a trend in which technology becomes almost imperceptible to people, while being part of everyday life.
SMART LIVING	As part of this trend, solutions based mainly on new technologies support everyday human life to make it easier.
DATA IS THE NEW BLACK	A trend that speaks of the growing role of data. Basing on the analysis and interpretation of data, i.e., The "data-driven approach" is currently one of the most important elements of digital transformation.
IMMERSIVE ART	This is a trend that speaks of an increasingly common combination of art and technology, it creates solutions that fully engage the recipient.
MAKE TECH HUMAN	Make Tech Human, a trend indicating the increasing role of technology in the service of people.
HUMAN TECH BOND	In this trend, technology acts as an intermediary between people. Thanks, among others, to the development of haptic technologies, devices will allow us to feel the physical presence of another human being.
BABY TECH	Technologies (including IoT, VR, AI) are already entering virtually every area of our lives. Currently, they support parents in their care for the upbringing and health of their children.
HUMAN+	The Human + trend concerns the development of areas and solutions related to improving the human body with the help of technology, so as to overcome human limitations.
AI FOR HUMANITY	The AI for Humanity trend concerns those solutions where humanity is a priority. Artificial intelligence can be used in any field: from medicine, through sport, education, to culture and art.

Table 1 – cont.

Trend	Technological trends 2020
ETHICAL TECH	The dynamic development of artificial intelligence (including the choices made by AI on a racist basis and chauvinistic) makes more and more talk about the need to create a code according to which artificial intelligence would develop and function.
MIRROR WORLD	The constantly developed technologies in the area of XR (Extended Reality) are heading towards a world where everything has its counterpart and representation in the digital world.
QUANTUM COMPUTING	Quantum computers are at an early stage of development. However, we already know today that this development redefines concepts such as efficiency, speed and data security.
BCI (BRAIN-COMPUTER INTERFACE)	Advanced research is underway to create an interface that would allow communication between the brain and an external device. Such a solution can completely change the way we communicate and our relationship with technology in the future.
PRIVACY	In the world of fake news (including the growing amount of data, traces of our activities and online behavior), the fight for privacy is becoming an important challenge today.
SELF-DRIVING CARS	There is more and more talk about the impact of autonomous cars on many areas of our lives, including the functioning of cities and maintaining security. Certainly, their appearance on the market will revolutionize many industries.
VOICE TECHNOLOGY	The use of voice assistants or chatbots in communication is already implemented in the industry, including in the FMCG industry, but the development of the technology will extend to all areas of our lives.
VIRTUAL ASSISTANTS	The trend indicates the growing role of virtual assistants (including Siri, Alexa, Google Assistant), who are becoming an integral part of human life, facilitating everyday functioning.
DEEPFAKES (MALICIOUS USAGE OF AI)	Today, artificial intelligence allows for image and voice processing that creates a false message, very close to the authentic one. Such activities are increasingly used to manipulate or discredit public figures.

To identify which technological trends will be shaping the modern world and which technologies therefore will play a special role in the development of contemporary companies, the research was continued on the "Trend Map 2022". In the map showing 54 megatrends, the technological sphere was named "Mirror World". It contains 18 megatrends. An effort was made to determine what the trends mean and what technologies they are related to. The findings in this area seem important for strategists planning

to intelligently shape the company's management processes in the right direction and with the support of the most up-to-date technological solutions (They develop and use the organizational Technology Intelligence). In 2022, 6 technological trends that have entered the mainstream and are already generating the so-called "new reality" were spotted, 7 qualified for the short-term perspective and 5 for the long-term. Details are shown in Table 2.

Table 2
Technologies as a response to Smart World megatrends

Mirror World (2022)		
Trend Specificity		
Trend	**New Reality (New Normal)**	**Supporting Technologies**
The concept that the digital world is to be an accurate and complete reproduction of the physical world in all its dimensions – material, economic, human, spatial, etc. According to the concept of the mirror world, all the activities we know from the physical world (entertainment, sports, business, work, home, education, tourism, etc.) and people – their way of functioning in the world (including multisensory sensing) will be transferred to the digital world.		
Digital Inequalities	The trend points to inequalities related to web access and digital exclusion. Globally, still about 40% of the population does not have access to the Internet. The development of the metaverse, which the major bigtechs are currently working on, could become a factor that exacerbates digital inequality. (Support: digital transformation, digitization, virtualization, technological maturity)	5G, 6G, FG, *edge computing*, *portable data centers*, quantum computers AI, NFT (*non-fungible tokens*), IoS (*internet of senses*), BCI (*brain computer interface*), neurotechnologies, natural interfaces (BCI, *voice, touch*), *digital therapeutics*, *blockchain*, *facial recognition*,
Privacy	The trend points to the growing amount of data and traces of our online activities and behaviors, and the growing struggle for privacy. We are threatened not only by the theft of sensitive personal data, but also by the loss of privacy in other forms (e.g., data from homes, cars and even clothing). Cyber security is becoming a challenge.	
Accumulation of technology power	A trend recognizing that big-tech companies are referred to as the fifth power and have an increasing influence on legislation, economics, innovation. With access to user data, they influence not only global processes, but also the behavior of societies and the choices of individuals (Perceived increase in importance of: personalization, machine learning, AR, geolocation)	
Invisible technologies	This is a trend in which technology, while embedded in people's daily lives, becomes almost invisible to them (IoT; 5G; Facial recognition technologies, Bots, voice technologies, virtual assistants, machine learning, AR, AI, geolocation. (Effect: the need to incorporate new technological solutions into more products, services or processes to satisfy growing customer demands).	

Table 2 − cont.

Mirror World (2022)		
Trend Specificity		
Trend	**New Reality (New Normal)**	**Supporting Technologies**
The war of influence	A trend signaling an increasingly complicated relationship between the two powers, the US and China, they influence the rest of the world. Economic tensions, ideological tensions and competition for influence and patents are becoming more serious. (Increasing importance of: technological leadership, technological transformation, dependence on technology from outside companies)	*control technologies*, haptic technologies, AR, VR, MR, *smart textiles*, *soft robotics*, *microfluidics*, *passthrough technologies*, *pancake optics*, *wearables*, *EMG input technologies*, *Avatars*, *digital humans*, *emotion recognition technologies*, IoT, (*internet of things*)
Hactivism	A trend recognizing that moving into the online world is causing hacking activity to increase, involving, among other things, hacking into networks or databases to expose information about, among other things, human rights abuses. (Emphasis on cybersecurity development)	
Short-term perspective (1–5 years) (Reactive zone)		
Remote On	People and their activities are moving to the digital world. It is becoming a standard that all our activities can be and are remote: medicine, work, meetings, shopping, entertainment, etc.	
Psychological wellbeing	A trend whose premise is to achieve the so-called mental wellbeing in society. It includes all activities related to the mental health category conducted both online and offline. It addresses issues such as digital wellbeing and digital detox.	
Robotized life	It's a trend that refers to the use of automation and robots increasingly in various areas of socio-economic life, from industry to elderly care assistance and education, etc.	
Algorithmization of life	The trend recognizes that progressive algorithmization is turning humans into products. The systems used and the tools used build individualized catalogs of knowledge, needs or motivations and behaviors. The choices an Internet user makes are overwhelmingly based on the recommendations of algorithms.	
ReCity	The trend recognizes that urban services, transportation, workplaces or shared spaces are undergoing a transformation. The challenge is to reorganize cities to maintain a high quality of life for residents while ensuring their safety	
Multi-sensory	The trend signals that society has begun to feel a greater need for physical experiences. Along with the need to interact with each other in the digital world, the need to experience the world with all the senses is becoming more apparent (the lockdown and Pandemic effect).	

Table 2 – cont.

Mirror World (2022)		
Trend Specificity		
Trend	**New Reality (New Normal)**	**Supporting Technologies**
A-Commerce	The A-Commerce (Anywhere Commerce) trend refers to the ubiquitous availability and ability to purchase a product or service at any time. Unlimited access to products and services is changing the habits of certain groups of consumers, while forcing companies to change their sales model.	
Medium-term perspective (5–20 years) (Innovative zone)		
Smart living	A trend referring to the use of technology in building independence from larger systems. Efforts to manage resources more intelligently, including water or energy, are evident.	
Gigacity	The trend recognizing the importance of deploying fifth-generation (and, in the future, sixth-generation) mobile technologies, which are characterized by zero latency and much higher network capacity. New generations of mobile technology will become drivers of development in many areas of human life.	
Meta-economics	The trend recognizes that economic development is increasingly linked to the introduction of the concept of meta-economy. Meta-economics refers to both the development of the economy inside the digital world (owning, selling, ownership, costs, unlimited growth, new currencies, blockchain, NFT) and economic changes in the physical world as a result of the introduction and spread of new technologies related to the construction of the metaverse.	
Demateria-lization	The trend signals that the intensive shift to the digital world in all aspects of life is causing the physical world to disappear (e.g., cash, physical stores, people in offices, etc.), as well as changing our approach to product value, ownership, purchase or use.	
Decentralization	The trend that sees the need to return to the early days of the Internet – more openness, freedom for all users, and a move away from the management of the world by a few major technology companies, which is growing with the development of technologies such as blockchain, the Internet of Things, the spread of the metaverse concept and the development of the Internet towards web 3.0, as well as the expectations of younger generations.	

Source: own compilation based on Infuture Institute, Trend Map 2022, https://infuture.institute/mapa-trendow/#opcje, retrieved 29.12.2022 and results of expert research.

Companies with developed Technology Intelligence should be familiar with the above areas and should be making efficient use of the new technologies that accompany current technology trends (especially New Reality technologies). Their plans should also include investment in the implementation of technology solutions related to the emerging megatrends (Short-term perspective) and supporting technologies (Table 2 column 3).

3.2. Quantitative Research

In order to identify the symptoms and assess the ability to use Technology Intelligence of modern organizations, a study of their knowledge regarding trends and technological requirements of the Smart World surrounding them was undertaken. The ability to identify them and assess their impact on the activities of the company and the industry was taken as a symptom of Technology Intelligence. This allowed the adoption of two hypotheses in the research: H1- Technology Intelligence helps organizations understand ideas and assess the importance of technology trends surrounding them. H2- Technological Intelligence accelerates the processes of implementing Smart World requirements in organizations (especially technological, but not only).

The original CAWI type survey form based on list of technological trends 2020 (Table 1) was prepared for the research. The survey form was tested in a pilot study (n = 10 companies). The survey was addressed to representatives of more than N = 600 enterprises operating in Poland and/or Lithuania interested in the research "Do you know technological trends of the Smart World". Respondents were managers of the surveyed companies. The data was collected in the period from December 2021 to February 2022. In the end, a total of n = 107 respondents (n PL = 50 and n L = 57; n production companies = 27 and n service & trade companies = 80) filled the form. A basic 5-point Likert scale was used to assess each surveyed technological trend. Details are presented in the two tables below.

In the first step of survey research attempts were made to determine whether the respondents are able to assess how strongly individual technological trends affect the activities of their enterprises (especially building a competitive advantage) and the industry in which they operate, and whether their answers are consistent with the diagnosis "2020 Trend Map". This approach allowed the authors to determine the level of Technology Intelligence of the respondents in terms of their knowledge and ability to assess the technology trends surrounding them. The convergence of the respondents' answers and the results of the positioning of each trend by the experts who prepared the "2020 Trend Map" was taken as a manifestation of their knowledge and the maturity of their Technology Intelligence. The greater the convergence, the more Technology Intelligence the respondents show in a given area/trend. (chance to positive verification H1).

Table 3

Grading scale in the survey questionnaire

Level of implementation of the trend (and technologies typical for trend) in enterprise (IMPL)	Impact of trend implementation on the possibility of shaping a competitive advantage of company in the era of Industry 4.0 (IMPACT)	Maturity level of the trend in our industry (MAT)
1 very low, we do not implement and do not think about it, we are absolutely not ready	1 no impact, implementation of this trend will not translate into the possibility of shaping a competitive advantage	1 We do not see this trend or the opportunities for its development and the possibility of entering the mainstream
2 low, we are not implementing it yet, but we are thinking about it	2 low impact, implementation will allow us to gain an easy-to-eliminate very short-term market advantage	2 foresight level, long-term perspective, the trend takes over 20 years to enter the mainstream
3 moderate, we think about it and started to prepare to implement the trend	3 mediocre influence, implementation will allow us to gain a short-term advantage	3 innovation level, medium-term perspective, the trend needs 5 to 20 years to enter the mainstream
4 high, we are currently implementing the trend	4 high impact, implementation will allow us to gain a medium-term advantage	4 reactive level, short-term perspective, the trend takes 1 to 5 years to enter the mainstream
5 very high, we implement and believe that we are one of the leaders	5 very high impact, implementation will allow us to gain a long-term advantage	5 new normal level, currently the leading trend in the mainstream

In the second survey research step, an attempt was made to determine whether the diagnosed opinions of the respondents in the area of IMPACT of technological trend on company are reflected in the implementation of technologies typical of the trends in the surveyed enterprises (IMPL). It was assumed that the greater the convergence of the indicated IMPACT level with the IMPL level, the greater the Technology Intelligence maturity of the respondents in implementation the Smart World requirements (possible positive H2 verification).

The results of the first stage of the survey research showed that respondents know, how to assess the importance of the technological trends surrounding them. In the 21 technology trends, according to the surveyed, six trends have the strongest impact on their competitive advantage: Smart living, Data is new

black, Make tech human, Privacy and 5G, Implementing AI. Of them, the Privacy trend is the most mature and widespread (MAT 3,290; IMPACT 3,028). It is the only leading trend in today's reality (mainstream). The remaining four trends will enter the mainstream in the short term (1-5 years). Another 7 trends are likely to enter the mainstream in the medium term, and 5 in the long term. Four trends have no chance of public acceptance. All trends are strongly related to new the Smart World technologies. The Deepfakes trend (IMPACT 1,785) has the least impact on the market advantage of those surveyed, in their opinion. The importance of the surveyed trends is illustrated in detail in Table 4.

Table 4
Level of impact and level of implementation of technological trends in practice surveyed companies vs. "2020Trend Map"

	Trends: N/position in "2020 Trend Map"	Differences in positioning (points)	AVARAGE			Σ (IMPL_IMPACT)	PEARSON's correlation coefficient		
			IMPACT	MAT	IMPL		MAT– IMPL	MAT – IMPACT	IMPL – IMPACT
1	Smart living/5	4	**3.364**	3.075	2.907	6.271	0.599	0.641	0.643
2	Data is the new black/3	1	**3.336**	3.028	2.888	6.224	0.727	0.705	0.679
3	Make tech human/7	5	**3.280**	3.028	2.738	6.018	0.681	0.649	0.650
4	Privacy/1	3	**3.131**	3.290	3.028	6.159	0.675	0.610	0.660
5	5G/13	8	**3.056**	2.907	2.364	5.420	0.679	0.667	0.641
6	Implementing AI/10	4	**3.047**	2.598	2.206	5.253	0.735	0.702	0.585
7	Virtual assistants/2	5	**2.963**	2.710	2.215	5.178	0.683	0.701	0.641
8	Seamless tech/6	2	**2.860**	2.570	2.336	5.196	0.713	0.679	0.562
9	AI for humanity/15	6	**2.757**	2.449	2.093	4.850	0.783	0.740	0.632
10	Voice technology/4	6	**2.589**	2.449	1.935	4.524	0.652	0.665	0.564
11	Digital health/12	1	**2.486**	2.467	2.009	4.495	0.732	0.697	0.710
12	BCI /20	8	**2.477**	1.813	1.551	4.028	0.675	0.563	0.390

Table 4 – cont.

Trends: N/position in "2020 Trend Map"	Differences in positioning (points)	AVARAGE			Σ (IMPL_IMPACT)	PEARSON's correlation coefficient		
		IMPACT	MAT	IMPL		MAT– IMPL	MAT – IMPACT	IMPL – IMPACT
13 Human tech bond/14	1	**2.449**	2.243	1.925	4.374	0.802	0.701	0.652
14 Immersive art./8	4	**2.411**	2.280	2.150	4.561	0.777	0.849	0.817
15 Quantum computing/21	6	**2.393**	2.000	1.589	3.982	0.610	0.702	0.495
16 Human+/16	0	**2.374**	2.234	1.944	4.318	0.766	0.664	0.695
17 Mirror world/11	6	**2.336**	2.234	2.009	4.345	0.821	0.778	0.772
18 Baby tech/7	11	**2.318**	2.159	1.879	4.197	0.737	0.808	0.704
19 Ethical tech/17	2	**2.168**	2.000	1.729	3.897	0.763	0.727	0.707
20 Self-driving cars/20	0	**2.000**	1.953	1.589	3.589	0.662	0.665	0.684
21 Deepfakes/ 18	3	**1.785**	1.804	1.486	3.271	0.617	0.663	0.648

IMPLEMENTATION & IMPACT LEVEL VALUES RANGE:
• value > 3 → high or very high = strong impact on the possibility of shaping a competitive advantage
• value 2 ÷ 3 → mediocre impact on the possibility of shaping a competitive advantage
• value < 2 → low impact on the possibility of shaping a competitive advantage
MATURITY LEVEL VALUES RANGE:
• value > 3.25 = currently the leading trend in the mainstream, NEW NORMAL
• value 3.00 ÷ 3.24 = short-term perspective, the trend takes 1 to 5 years to enter the mainstream, REACTIVE ZONE
• value 2.5 ÷ 2.99 = medium-term perspective (5 to 20 years to enter the mainstream), INNOVATIVE ZONE
• value 2.2 ÷ 2.49 = long-term perspective (over 20 years to enter the mainstream) FORESIGHT ZONE
• value < 2.19 = trend most likely will not be developed in the future (lack of even long--term perspective) NO FUTURE ZONE

The results of the survey thus confirmed that the companies surveyed have some knowledge of the importance of the technological trends surrounding them (level of IMPACT). The respondents had an opinion on the trends indicated for evaluation and were able to roughly assess the strength of their impact on their companies. When comparing the results of the "2020 Trend Map" with those of the respondents, there is a convergence

of assessments. The Top 10 of the "2020Trend Map" included quite all the trends indicated by the respondents as having the strongest impact on their companies. Some of them differed only slightly in their ranking position. Ten trends were slightly over-rated and 11 under-rated (see Table 2 in column 2). Only in the assessment of the 6 technological trends studied did the difference between the positioning of the experts who prepared the "Trend Map 2020" and the results of the respondents exceed 5 points. (see Table 2 in column 3). Summarizing this part of the research results, it seems that the respondents generally have a certain level of Technology Intelligence (it varies individually), which helps organizations understand ideas and assess the importance of the technology trends surrounding them. It allows us to confirm hypothesis H1.

Unfortunately, the ability of respondents to implement technological solutions (IMPL) that are related to current trends is somewhat weaker. Although they have knowledge about the importance of technological trends, for the most part, respondents are only just thinking about and preparing for the implementation of technological solutions related to the trends of the Smart World era (for 12 trends 2<IMPL<3). They do not even think about implementing solutions typical of 9 new technological trends yet (1<IMPL<2). This is true even for trends indicated as a leading trend in the mainstream (especially PRIVACY) and short-term perspective trend. There may be many reasons for the discrepancy between respondents' reported level of knowledge of the technology trends surveyed (IMPACT, Table 4, column 4) and their reported level of practical implementation (IMPL, Table 4, column 6) of the new technology solutions associated with them. For example, the organizations surveyed may not be technologically, financially, organizationally or humanly prepared to implement new technologies. In such a case, organizational Technology Intelligence will signal new technological opportunities, but will not be able to significantly accelerate the implementation of Smart World requirements due to the lack of appropriate organizational resources. It needs to be supported by other organizational resources. If the surveyed organizations had such support at an appropriate level, verification of H2 could be positive. The current situation of the surveyed organizations (enterprises from Poland and Lithuania) does not allow a clearly positive verification of H2.

4. Discussion

A review of the literature on the subject revealed that no similar multi-faceted research has been carried out. More often, the topics of Smart World, Organizational Intelligence, Technology Intelligence and Strategic Management have been explored separately. For the reason, the present review of the definition, interrelations, classification, operationalization and meaning of Technology Intelligence and the research results supporting it can be one

of the first steps towards a deeper understanding of the specificity, conditions, development and conscious use of the opportunities inherent in Technology Intelligence of organizations operating in the Smart World. The analyses carried out have clearly shown that the development of an organization in the Smart World environment depends on the development and correct use of specific factors (the Pillars of the Smart World), and their significant support is Technology Intelligence. It offers great opportunities, significantly accelerates and improves the quality of many organizational processes, including intelligent strategic management. Unfortunately, it does not drive itself, but is one of the central elements of the entire system of activities. In order to achieve its full potential, it must be supported by intelligently selected resource potential developed in the individual pillars of the Smart World (intelligent human factor / Smart Human, commitment to Technologies 4.0 / Smart Technologies, social and environmental commitment, openness to broad cooperation / Smart Cooperation, multidimensional organizational intelligence / Organizational Smartness). Technology Intelligence cannot function effectively without their support. It is confirmed by our research and research by Awamleh and Ertugan (2021), Rumelt (2022), Najm and Alfaqih (2021), Adamik (2021).

One of the forms of Technology Intelligence development is the systematic observation and interpretation of the organization's environment, especially the Smart World technological trends emerging there and the new technologies accompanying them. The knowledge collected this way suggests the development of which technologies to implement in a given organization in the near future. The empirical research showed how such observations can be conducted and what they bring to the decision-making processes of Smart World organizations (e.g. technologies of "New reality" and "Short-term perspective zone"). In order to maintain and build their competitive advantage in the Smart World, intelligent organizations should conduct such analyzes and monitoring their environment systematically (Rumelt, 2022).

Comparing the results of the 2020 and 2022 "Trend Maps" analyses (deepening the answer to RQ1 and supporting the verification of H1), while not easy, due to some changes in the naming and classification of trends by the Infuture Institute, nevertheless provides opportunities for some interesting insights. The finding of the study clearly show:

- Firstly, with each passing year, more and more technology trends are entering the mainstream and becoming a reality for today's organizations (2020-1 trend; 2022-6 trends). Technologies are increasingly determining socio-economic development. This phenomenon is also recognized by Albukhitan (2020) and team: De Sousa, Jabbour, Jabbour, Foropon, Godinho and Filho (2018).
- Secondly, not only is interest in new technologies maintained, but map after map emphasizes their growing impact on humanity and the working and living environment they create (higher and higher positions

in subsequent rankings). This is confirmed by the results of studies e.g. Adamik, Nowicki and Puksas (2022) and Zhang, Robinson, Porter, Zhu, Zhang and Lu (2016). It means a growing awareness of the opportunities but also of the dangers of the growing power of technology in the Smart World. It is also perceived by Agostini and Filippini (2019).

- Thirdly, the trends that have already entered the mainstream provide hints for smart organizations about current technology requirements and indicate areas of most urgent change, e.g. product or process changes (e.g. digital transformation, digitalization, virtualization, technology maturity, personalization of products and services, development of the use of IoT, machine learning, AI, AR, geolocation, cyber security, etc.). Similar observations are also made by, Adamik, Ghinea, Ghinea and Nowicki (2022), Agostini and Filippini (2019). The trends that qualified for further time horizons should become a source of inspiration for strategic decisions related to the "right" orientation of the next years of their development, i.e. smart strategic management. It is confirmed by, e.g. Christensen, McDonald, Altman and Palmer (2018). It is related, among other things, to decisions to choose: 1) the "right" domain of activity, 2) strategic resources on the development and exploitation of which the company intends to bet (including especially technological ones), 3) the plane and spheres within which it intends to build its competitive advantage, and 4) the level and forms of commitment to the principles of social, environmental responsibility and sustainable development of activities.

5. Conclusions

It seems that the research carried out has provided answers to two research questions posed in the research process: RQ1). Can Technology Intelligence be seen as a key-factor (Game-Changer) in smart strategic management? RQ2). Are organizations able to efficiently use Technology Intelligence in their business praxis? In the author's opinion an organization's Technology Intelligence deserves to be called the Game-Changer of smart strategic management processes, due to the fact that technology is increasingly changing the organization's approach to many decisions and market activities. Technological Intelligence related to the skillful selection of technology and its effective practical use in various areas of the organization is the key to effective management in the Smart World (one of the pillar of the Smart World). As far as the practice of companies' activities is concerned, the research results allow us to say that the surveyed companies already have a certain potential of Technology Intelligence (mainly knowledge about the technological environment), but they still lack certain resources and competences to use their Technology Intelligence effectively in practice. They are mainly limited by financial

and human resources. New technological solutions are certainly costly and require a high and specific level of employee competence. Unfortunately, not all organizations have sufficiently developed capabilities in the area. Not only do they lack the resources, but they also have problems with the processes of gathering them and the associated decision-making processes, e.g. selecting the right technologies, assessing the profitability and risks of implementing new technologies, preparing the implementation process and its acceptance by employees or customers (Daňa, Caputo & Ráček, 2020).

Moreover, the conducted empirical research allowed us to positively verify H1-Technology Intelligence and helps organizations understand ideas and assess the importance of technology trends surrounding them. Unfortunately, the research did not allow us to clearly positively verify H2-Technological Intelligence accelerates the processes of implementing Smart World requirements in organizations (especially technological, but not only). Although Technology Intelligence provides support for so many organizational processes, it is itself a variable dependent on the support of many other variables.

Further research is recommended in the area of understanding the needs and capabilities of the organization's Technology Intelligence and ways to support and develop it (e.g. What competencies are needed to master Technological Intelligence in different types of companies? Who and how in the company should be responsible for continuous monitoring of the technological environment?). One of the form of such support is, of course, the continuous supply of information to the organization in the form of thematic trend maps, but it is not enough. Off course, tracking and analyzing the above trends make it easier to understand and respond to the environment in which today's businesses will thrive. The "supporting technologies" e.g. signaled in Table 2 (including 5G, 6G, FG, AI, AR, VR, MR, BCI, facial recognition, haptic technologies and, above all, IoT or Io senses) make it possible to collect and analyze data more accurately and, ultimately, to build strategies more precisely, including human resources, investment, production, logistics, marketing, change and development strategies for companies. Other sources of important information can also be: 1) Dervent Patent Databases, 2) Web of Science with inspiring articles, 3) Technology Reports from consulting companies, 4) Endnote. web with lists of patents, 5) IHS Engineering Workbench, CAS Sci Finder and Thomson Innovation with basis of patents, articles, news and deep-web documents. But smart organizations need more, it is also worth accelerating research into the creation of a clear tool (algorithm, software, application or consulting platform) that will allow strategists to quickly assess suitability of the selected technology for the needs of a given company. The results of the type of analysis would greatly enhance the Technology Intelligence of any organization. Thanks to it, the knowledge and Technology Intelligence of the organization will have a chance to be translated faster and more

accurately into practical implementations of new Smart World technologies and competitive advantage of companies (Feng, Sun, Chen & Gao, 2020; Dalenogare, Benitez, Ayala & Frank, 2018). Despite the fact that the research conducted had its limitations (e.g. a limited research sample, difficulties in defining and understanding by the respondents the names of the technological trends diagnosed by the Infuture Institute, changes in the names of the technological trends in the subsequent maps, "Trend Map 2020" and "Trend Map 2022"), the euthor believes that they make a certain contribution to the knowledge of the Technology Intelligence of modern companies.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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