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THE EVALUATION OF INNOVATION CRITERIA IN THE PHOTOVOLTAIC INDUSTRY

Imene Azazga¹

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Abstract

This study purposes to discuss the mechanisms of innovation in the solar power industry. It reveals the innovation criteria adopted by the solar power enterprises. To identify the innovation criteria in the PV industry, this paper uses a quantitative method based on a technical evaluation of four PV technologies. Then, it assesses the obtained results qualitatively.

This research work demonstrates that the PV industry is highly influenced by innovation. It also concludes that the innovation of the photovoltaic panels is based on two major criteria: structure and function. The former comprises the interior and exterior components, their measures, weight, raw materials, and layering. The latter involves the PV panel's applicability, efficiency and durability. This paper shows that the standard version of a PV rigid panel witnessed innovative modifications with an average of 14.06% on its structure and 15.62% on its function.

Keywords: *innovation; photovoltaic panels; international market; management; assessment*

JEL Codes: *O14; O31; P18*

1. Introduction

Solar energy became a growing sector in the world. Most countries adapted agendas for the exploitation of sustainable resources with the aim of creating added value to their economies. In the last ten years, the international solar power marketplace witnessed a significant development in terms of the growing number of the established companies offering different products. The latter include solar modules, batteries, inverters, and other parts of the photovoltaic system. In fact, the lack in scientific research that defines the innovation criteria in the photovoltaic industry prompted us to conduct a research project on this subject matter.

The present study addresses the following issue: What are the innovation criteria that the solar power companies adopt in the manufacturing of the photovoltaic panels?

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The present research paper approaches photovoltaic industry on the innovation management level. It discerns the innovation criteria adopted by the PV companies. In essence, it identifies the aspects of the PV panels which are highly impacted by innovative projects worldwide and their innovative criteria as well.

The increasing competition in the solar power industry pushed several enterprises to innovate new production processes, methods, products, and services to impose their brands on the growing PV market. This led to the supply of the PV market with a variety of solar power devices with innovative aspects on the one hand and stirred business competition between the companies on the other. However, there is a lack in the research works which define the innovation criteria in the photovoltaic industry. For this reason, this scientific paper depicts the innovative modifications adopted in this type of industry on the international level as a step to classify and, then, rate them.

This study relies on a variety of scientific studies to define the mechanisms of the industrial innovation such as Coccia, Mario's Classifications of Innovations Survey and Future Directions (2006), Timur Kogabayev and Antanas Maziliauskas's The definition and Classification of Innovation (2017) and Arkady Trachuk and Natalia Linder's Innovations and their Industrial Classifications: Approach to Building a New Typology (2019). The available bibliographical references define the innovation criteria in a global manner comprising all the industrial areas. They emphasize that industrial innovation criteria involve the measurement of the intensity, novelty degree and change levels. Because of the lack in the research works that identify the innovation criteria in the PV industry, the present paper uses technical reports and data statements of different PV samples that provide us with the necessary technical data of our samples. This scientific work uses data sheets to discern and evaluate the structural and the functional innovation criteria such as the Korean LSIS: PVM S320PD (2016), the German ASCA Inlay: OPV (2022), the British BIPVco: Flextron (2017) and the Chinese KSENG (2023).

This study relies on the quantitative approach - technical assessment - to evaluate the average of the innovative modifications brought on the photovoltaic panels. Then, it uses the analytic method to assess the results obtained from the quantitative study. As a step to identify the criteria and the elements of innovation in the photovoltaic industry, this paper starts by defining the industrial innovation, its types and characteristics. Then, it conducts a study on different photovoltaic technologies. Finally, it classifies and assesses the results and the data achieved from the quantitative study.

2. Theoretical Background and Hypotheses Development

Nowadays, it becomes necessary for the industrial organizations to set their proper innovation plans and policies. The need for establishing an innovation managerial portfolio resulted from the endless competitiveness that is continuously

flaring between the enterprises on the national and the international levels. In fact, contemporary experts in strategic management emphasize the importance of innovating in the industrial sector as a survival tool that would guarantee the continuity of the industrial enterprises. Throughout our bibliographical research, we noticed that innovation was classified according to the following criteria:

2.1. Synchronizing Improvement, Novelty, Invention and Innovation

Timur Kogabayev and Maziliauskas Antanas standardized the key elements of innovation in their research work *The Definition and Classification of Innovation* (2017). They noted that innovation is a process that synchronizes the four elements of improvement, novelty, invention and innovation (Kogabayev & Maziliauskas, 2017, p. 61). First, the improvement element requires modification in the system without changing its operation. Second, novelty refers to the realized changes that were brought into the product such as finding solutions to a business problem. Third, the element of innovation brings changes to the system of the product, service or process. Last, the element of invention proposes new processes or technical aspects to the product that is destined for the marketplace (Kogabayev & Maziliauskas, 2017, p. 63).

2.2. Typology through the Intensity of Innovation

During our research implementation, we noticed that innovation has a broad meaning. It can be adopted into a variety of domains, such as medicine, architecture, agriculture, industry, literature, arts and economics. Our investigation ended into the premise that innovation is an abstract concept which implies a set of principles of thinking and the application of logic to find solutions to problems. The proposed solution should be distinguished from the previous ones due to its added value. Theoretically, there is a wide variety of academic research publications which divided innovation into types; most of them identified four types, which are radical, disruptive, incremental and architectural.

Radical innovation means the proposal of a new product, service or process to an existing or new market. The products involved within this type of innovation are characterized with highly technological aspects. This type relies on new technologies to supply the market with products with high prices in comparison to the disruptive innovation (Gay & Béragère, 2022, p. 186). In disruptive innovation, technology constitutes a significant element in the innovation process of the product in an existing market. Moreover, technology is used to improve the existing product and to make its use more comfortable and profitable. The pricing is lower compared to the radical innovation (Trachuk & Linder, 2019, p. 302).

Incremental innovation refers to a product or a service which is improved gradually. It purposes to bring value to an existing market and uses existing technologies too. This type of innovation is characterized with bringing improvements in sequential short periods of time. The pricing differs according to the competition

level in the market (Trachuk & Linder, 2019, p. 301). Besides, in architectural innovation, the modifications of the product or the service are destined for a new market. Explicitly, it brings changes on the design of the product in short or middle terms (Coccia, 2006, p. 11).

According to innovation management experts, radical, disruptive, incremental and architectural innovation types are classified according to a set of criteria. As an illustration, they emphasize the innovation's adaptability for further modifications to meet the market's demands, the innovated product's level of applicability in different settings, the autonomy for using the product despite the existing novelties and the compatibility of the innovated product/service with the market values (Trachuk & Linder, 2019, p. 296). In fact, this typology is based on the technical aspects of innovation and emphasizes both the levels of novelty and modifications.

From the explanation above, we concluded that the context and timing in which innovation -in its broader sense- was defined play an important role in determining the typology and criteria of innovation. Based on the theoretical literature on innovation, there are two types of definitions of innovation: traditional and modern. The former identifies innovation with the individual works and findings carried out by researchers or innovators individually. This definition was widely adopted during the 1950's (Hidalgo & Albers, 2008, p. 114). The latter states that innovation is a process of finding solutions for problems; it involves companies and other parties from different sectors. Likewise, some theorists defined innovation in terms of the process of the development of an idea into a tangible outcome (Boyanov, 2022, p. 44). The modern definition of innovation comprises a collaborative process between innovators, in contrast to the traditional definition.

In general, the technical classification of innovation relies on several criteria such as the depiction of the modifications brought on the product or the service. It also relies on determining the intensity of the modifications and the improvements by considering the period of time and the pricing too. Furthermore, our research focuses on the innovation of the photovoltaic panels that were industrialized and have an important market share. Based on the available bibliographic sources in relation to the working thesis of the present investigation, the hypotheses of this study are as follows:

- The photovoltaic industry is a productive sector in terms of innovation.
- Innovative PV panels are increasingly modified structurally and functionally.
- Innovation of the PV panels is extensively influenced by the technical criteria of efficiency, applicability, and durability.

Our investigation excludes the innovations in the photovoltaic sector that are not destined for the industry or were not industrialized yet. We labeled this type with the laboratorial innovation. The latter refers to the innovative products, services, research or methods that were performed in the laboratories, research centers, universities, and other institutions in both the private and the public sectors.

Laboratorial innovation generates innovative achievements for academic and scientific purposes only. Nevertheless, the industrial innovation refers to the innovated products, services, methods and production processes that are already industrialized and available in the market. In this context, the present study investigates the industrialized innovations in photovoltaic sector, particularly, the panels.

3. Methods

As a step to discern the innovation criteria in the PV industry, this study starts by demonstrating the standard criteria and the components of a simple model of a ground-mounted PV panel. Then, it discusses our selected PV technologies and the four samples that we will assess too. We will measure the innovation intensity of our samples in comparison to the criteria of the standard PV panel model.

Our evaluation starts by discussing the main components of a photovoltaic panel and studies the design of a standard version of a PV panel. We will demonstrate its structural and functional aspects. This step is crucial for our research for it provides us with the necessary data about the main parts that are subject for innovative improvements, particularly on the technical level.

The photovoltaic panel consists of an encapsulated set of solar cells. The interconnected cells constitute a module. Generally, the latter has a lifespan of more than 25 years and has between 60 and 72 electrically connected and stringed cells. The function of the solar cells resides in absorbing sunlight to generate electricity (Clancy, 2022). At the international marketplace, there are three main types of PV panels: the Mono-Crystalline, the Polycrystalline and the Thin-Film modules. Throughout the table below, we compiled the main characteristics of the three PV types. Likewise, we show their convergences and divergences in terms of efficiency, aesthetics, longevity and price.

Table 1. A Comparative Table between the Mono-Crystalline, the Polycrystalline, and the Thin-Film Modules (A General Overview)

	Mono-Crystalline	Polycrystalline	Thin-Film
Efficiency	Higher efficiency (15%-20% range) than polycrystalline panels in ambient temperatures	In the 13% -16% range efficiency. Lower heat tolerance compared to Mono-Crystalline modules	Efficiency between 7% and 18% Less efficient in power production
Aesthetics	Dark color	Bluish color	It contains thin vehicle lines made from the chemical etching process

			involved in the production of the solar cells.
Longevity	Warranty goes up to 35+ years	Warranty goes up between 25 years up to 35 years.	Shortest lifespan (From 10 to 20 years)
Price	Most expensive	Cheapest crystalline silicon	Cheaper than crystalline silicon

Source: The Data Are Compiled by the Author, Based on Different Sources, (Exsolar, 2023; Clancy, 2022; Geotherm, 2023; Ases, 2021).

The basic design structure of a photovoltaic panel (rigid type) is constituted from six parts. We have paired them with brief descriptions in terms of structure and function in the following points:

- **The Frame:** It is made from aluminum and supports the structure of the module. It is resistant to exterior extreme conditions and forces too (Chandra, 2021).

- **The Front Glass:** The heaviest component of the module with a thickness between 2 mm and 4mm. It ensures greater light trapping depending on the glass quality (Ecoprogetti, 2014).

- **The Encapsulant Material:** It is a transparent plastic layer, also called Ethylene Vinyl Acetate; it laminates and joins the solar cells. It is resistant to high temperatures and harsh weather conditions (Chandra, 2021).

- **Photovoltaic Solar Cell:** It is made from silicon crystalline wafers. Both types the Mono-Crystalline and the polycrystalline solar cells absorb sunlight and transform it into electricity. The solar cells are joined together by a ribbon (a thin tape made from copper and alloy) (Ecoprogetti, 2014).

- **Back-sheet:** A back plastic sheet functions as a shield protecting the cells from moisture and weather conditions.

- **Junction Box:** It is made from plastic and placed at the backside of the module. It contains the protection diodes and the cables that are interconnected to the module (Ecoprogetti, 2014).

The above six components demonstrate the basic parts that are involved in the manufacturing of the Mono-Crystalline and the polycrystalline SRPV panels. The following section defines the technical aspects of four innovative PV technologies and compares them to the standard rigid PV panel (SRPVP).

To uncover the innovative modifications brought on the PV panels (Mono-Crystalline, Polycrystalline and Thin-Film), we focused on the manufactured solar panels that are available on the international marketplace. Moreover, we excluded those that are registered but not industrialized. We conducted our research investigation on a variety of PVs that are manufactured in different continents. We selected four innovative technologies for they are most widely industrialized and have an important market share compared to other innovative PV panels. We selected the following photovoltaic technologies:

– **Floatovoltaics (FPV)**: In this technology, PV panels are placed on water; they have higher efficiency than land-based PVs. The floating PV panel technology achieved 1.6 GW in 2021 of global market share and would reach 4.8 GW by 2026 (Saurenergy, 2022).

– **Solar Fabrics (SF)**: the flexible solar textile technology involves the incorporation of a fabric textile on photovoltaic cells; the SF generate electricity through absorbing sunlight. This innovative technology - though less efficient- helps the user to charge his mobile and portable devices outdoor without using batteries. It can be placed on clothes, tents, uniforms ... etc (Schubert & Werner, 2006, p. 43). Its global market share achieved \$1095.7 million in 2022 and will reach \$1493.7 million in 2030 (Marketwatch, 2023).

– **Building Integrated Photovoltaics (BIPV)**: The BIPV refers to the incorporation of photovoltaic properties into the construction materials. This technology reached a global market size of \$14 billion in 2020 and is supposed to achieve \$86.7 billion in 2030 (Anil & Eswara, 2021). The BIPV allows different parts of the building such as window glass, tiles and facades to contribute to the generation of electricity which will be consumed by the building itself (Jelle, 2016, p. 5).

– **Agrivoltaic Panels (APV)**: This technology relies on posing PV panels over installed rails in farms. Recent statistics revealed that the APV global market attained \$3.6 billion in 2021 and will increase into \$9.3 billion in 2031 (Yamini & Yerukola, 2023). This technology protects the plants from inconvenient climate conditions such as harmful temperatures. The posed panels help to control the emitted sunlight into the farm and protect the crops too. In addition, this technology has efficiency of 30% (Insolight, 2023).

We selected the following four samples for our technical assessment: LSIS: PVM S320PD module, ASCA Inlay: OPV module, BIPVco: Flextron peel and stick module and KSENG module. The following table comprises the technical aspects of the four PV panels pertaining to the FPV, SF, BIPV and APV technologies. First, we will discuss their innovative aspects. Then, we will rate their innovative modifications in comparison to the standard version of a PV rigid panel (SRPVP).

Table 2. Mechanical Specifications of the Four Samples of PV Panels

Innovative PV Technology N°01
Floatovoltaics (FPV)
Sample 1: LSIS: PVM S320PD Modules 2016 (Korea)
<ul style="list-style-type: none"> – Encapsulant: Specialized material – BUSBAR Material: Pb Free – IP Class: IP67 – Insulation Class: >50MΩ – Presence of water-polluted material: None (passed by drinkability) – Resistancy for high temperature and humidity: High resistancy

<ul style="list-style-type: none"> - Damp Heat Test Result (5,000hr, 85% humidity, 85°C): 2~3% output decline (Lselectric, 2016).
Innovative PV Technology N°02
Solar Fabrics (SF)
Sample 2: ASCA Inlay: OPV Module (Germany)
<ul style="list-style-type: none"> - OPV inlay thickness: 0.3 +/- 0.1 mm - Operating temperature range: -20 °C to 65 °C - Storage temperature: -40 °C to 85 °C - NOCT: 48 °C - Easy combination with various materials - Customizable design, shape, size and color (ASCA, 2022).
Innovative PV Technology N°03
Building Integrated Photovoltaics (BIPV)
Sample 3: BIPVco: Flextron Peel and Stick Module (GB)
<ul style="list-style-type: none"> - Length: 2609 mm - Width: 358 mm - Module Area: 0.934 m² - Thickness, laminate without adhesive: 2.5 mm - Weight (Module without adhesive): 2.08 kg - Junction Box type: IP67 - Cell Type: Copper Indium Gallium Diselenide (CIGS) - Warranty: 5 year Product, 10/25 year Performance - Cell Efficiency: 15.5% - Watts <i>per</i> Square Meter: 128 w/m² - Cells/Bypass Diodes per module: 56/28 - NOCT: 56.2 °C - Applicability onto roofs and walls and building materials too (Kalzip, 2017).
Innovative PV Technology N°04
Agrivoltaic Panels (APV)
Sample 4: KSENG Agricultural Ground PV Mounting System (China)
<ul style="list-style-type: none"> - Applicable module: framed or frameless - Module orientation: portrait or landscape - Application: agriculture farm - System material: aluminum 6005-T5 & SUS304 stainless steel - Service life: 25 years - System components: PV modules, rails, beam splices, ballasts, pillars and others. - System features: Lightweight, easy transportation and installation. - Wind load: 60M/S - Snow load: 1.4 KN/M² (Xmkseng, 2023).

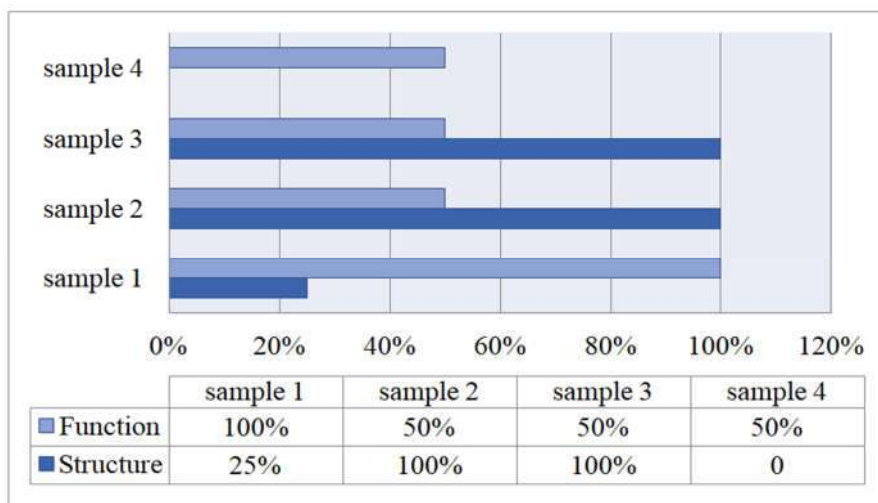
Source: The Data Are Compiled by the Author, Based on Different Sources

4. Results and Discussion

This section demonstrates the results we obtained from our technical assessment; it rates the modifications that were brought on the PV panels in four

significant innovative technologies, namely the FPV, solar fabrics, BIPV and the APV. We rated the innovative changes using the scale of 0 - 10 to define the intensity of the modifications on the parts of the panel. This study assesses the innovative modifications relying on data collection from different PV companies and through our technical evaluation. The rate 0 indicates there were no innovative improvements; the rate 5 indicates slight, partial or important modifications. The rate 10 indicates major and total changes that radically affect the structure or the functioning of the PV. We rated both the exterior and interior parts (structure) and the functional aspects that comprise performance, applicability, uses and longevity.

Figure 1. Assessment of the Innovative Modifications per PV Technology



Source: The Data Are Calculated by the Author

Further, we calculated the percentages of the structural and the functional innovative modifications based on the collected data from our technical evaluation. We converted the results of our evaluation of the intensity of the innovation with reference to our scale (0-10) into the percentages shown in the figure above. Our evaluation of the four PV panels fed into the following results.

Sample 1 is rated with 100% functionally and 25% structurally. The Korean LSIS: PVM S320PD 2016 module has both structural and functional innovative aspects compared to the standard PV rigid panel (SRPV). Its encapsulant is made from specialized material not EVA. Its Bus Bar Material (conductive material) is Pb free unlike our version of SRPV. This indicates that it does not emit toxic and chemical materials (lead) into the waters. In addition, the LSIS: PVM S320PD PV junction has an Ingress Protection of IP67; this rate affords a complete protection from dust and guarantees its proper functioning under water immersion, unlike the SRPV that has

an IP 65. The LSIS: PVM S320PD module has an insulation class of $>50M\Omega$ compared to $>40M\Omega$ of the SRPV. Also, the LSIS: PVM S320PD module has higher resistance for high temperature and humidity. The damp heat test (85°C with 85% of humidity for an uninterrupted 5000 hours) results show 2~3% output decline for the LSIS: PVM S320PD module compared to 90% for the SRPV (Lselectric, 2016). As a result, though both modules are Mono-Crystalline cell type with approximately the same dimensions and structure, they are different in terms of function (efficiency and resistance).

Sample 2 is rated with 50% functionally and 100% structurally. The German ASCA Inlay: organic PV module has innovative features structurally and functionally. First, it has a thickness of 0.3 +/- 0.1 mm compared to SRPV's that ranges between 4 cm and 5cm. It can be combined with different materials and can also be integrated with fabrics. Due to its structural features, it can be manufactured in different sizes, shapes and colors according to the clients' demands. Moreover, it operates at a temperature range between -20 °C and 65 °C lower than the SRPV's allowable temperature rate of -40°C to 85°C. The Nominal Operating Cell Temperature (NOCT) of ASCA Inlay OPV module has a rate of 48 °C compared to SRPV's average 40-45°C (ASCA, 2022). Our evaluation ends into the following points. Structurally, the ASCA OPV has innovative modifications in terms of raw materials, size, shape, thickness, weight and colors that allow it to be integrated into fabrics and other materials. However, it does not show significant features on the functional level, mainly efficiency and longevity.

Sample 3 is rated with 50% functionally and 100% structurally. The British Flextron peel and stick module -manufactured by BIPVco- aims at offering sustainable solutions for the construction sector through its flexible and portable PV panels. Structurally, this product has an area of 0.934 m² and a thickness, laminate of 2.5 mm and weighs 2.08 kg (without adhesive) which make it lighter than the standard ground-mounted PV panels. On the functional level, Flextron module has a Junction Box Ingress Protection type IP67 higher than the SRPV. Unlike the ground-mounted SRPV (mono-crystalline), its cell type is Copper Indium Gallium Diselenide (CIGS) with cell efficiency of 15.5% lesser than the mono-crystalline rigid panel. In addition, its Nominal Operating Cell Temperature (NOCT) rates 56.2°C higher than SRPV's 45 ± 2 °C (Kalzip, 2017). Our assessment reveals that the CIGS cells are easily applicable onto different surfaces such as walls, roofs, metals and construction materials and can be applied onto balconies, windows, facades ... etc. This makes it innovative in terms of flexibility, structure and usage. Functionally, the CIGS modules are less performing than the standard rigid mono-crystalline panels. Despite this inconvenience, the Building Integrated Photovoltaics (BIPV) technology is developing the performance of the CIGS modules.

Sample 4 is rated with 50% functionally and 00% structurally. The Chinese KSENG Agricultural Ground PV Mounting System is an innovative product

pertaining to the Agrivoltaic panels (APV) technology. On the structural level, it is applicable with or without a frame. It can also be installed on portrait or landscape orientations. All types of solar power modules can be used for the installation of this system, whether a SRPV or other elaborated types such as transparent panels. On the functional level, the present KSENG Agricultural Ground PV Mounting System can use a variety of PV panels. It does not require any specific innovative type because it relies predominantly on the installed system of stainless rails and other pillars. This technology focuses on the development of an easy installation system that is lightweight and portable (Xmkseng, 2023). Our evaluation illustrates the fact that there are no innovative modifications brought on our sample of the SRPV structurally and functionally. Meanwhile, the application of the PV panels to agricultural projects and farms is innovative in terms of usage for it contributes to the generation of clean energy. This reduces the electricity bills for the farms and protects the plants from inconvenient climate conditions such as high temperatures and winds.

Table 3. The Averages of the Innovative Modifications in APV, BIPV, SF and EPV Photovoltaic Technologies

FIMR	15.62%
SIMR	14.06%
OIMR / SRPVP Model	29.68%
SM	70.32%

Source: The Data Are Calculated by the Author

The present study assessed the innovative modifications brought onto a standard rigid PV panel (mono-crystalline). Our technical assessment of the four samples (LSIS: PVM S320PD module, ASCA Inlay: OPV module, BIPVco: Flextron peel and stick module and KSENG panel) pertaining to different PV technologies demonstrated that the innovative modifications affected the SRPV model with the following averages. The functional innovative modifications (FIMR): 15.62%, the structural innovative modifications (SIMR): 14.06%, the overall innovation rate (OIMR): 29.68% and the standard model (SM): 70.32%. This research reveals that the standard version of a mono-crystalline PV rigid panel was innovated with a rate of 29.68% (15.62% functionally and 14.06% structurally). This demonstrates that innovation plays a significant role in the PV industry as it provides the international market with innovative PV panels with different types, sizes and weights that are applicable to agriculture, water surfaces, construction materials, infrastructures and other uses and sectors. Our study shows the importance of innovative scientific and technological research in boosting the entrepreneurial arena with advanced photovoltaic products. The findings also support the assumption that emphasizes the importance of innovation in scientific institutions in providing the market with sophisticated technological equipment in different domains (Almeida, 2012, p. 17).

5. Conclusion and Recommendations

This research account approached the Photovoltaic industry from the innovation perspective. It exposed the criteria that were adopted in this sector quantitatively and qualitatively. As a step to identify the innovation criteria adopted by the solar power companies, this paper defined the main components of a standard ground-mounted rigid PV panel (SRPVP); then, it selected four different PV technologies that have a large global market share, i.e.: Floatovoltaics (FPV), Solar Fabrics (SF), Building Integrated Photovoltaics (BIPV) and the Agrivoltaic panels (APV). We conducted our study on four samples that are the Korean LSIS: PVM S320PD module, the German ASCA Inlay: OPV module, the British BIPVco: Flextron peel and stick module and the Chinese KSENG module. We identified the innovative aspects of the four samples. By using the 0-10 scale, we assessed them in comparison to the SRPVP model.

This research paper concluded that the standard rigid PV panel model was innovated with an average of 29.68% while it remained with its original design with 70.32%. The innovative improvements included 14.06% on the structural level and 15.62% on the functional level. The former involved both the interior and the exterior parts such as the raw materials, the measures and the layering. The former comprised efficiency, applicability and durability. Remarkably, this research work revealed that the innovative modifications of the PV panels were based on two major criteria which are structure and function.

This research study demonstrates a new way to evaluate innovation in the industrial sector, the solar power field in particular. It proposes a quantitative approach that measures the innovative modifications brought on a PV panel structurally and functionally.

We intended through our approach to help the solar companies and the researchers as well to systematize their innovations in the photovoltaic field instead of applying innovation models from other fields. In addition, this study emphasizes the assumption which asserts that the role of innovation spans from academic contributions and economic benefits to the establishment of social welfare (Bogdanova, 2022, p. 24). Explicitly, the theoretical and practical contributions of this paper yield to develop methods to assess innovation in the photovoltaic industry that can be used by companies and academics and to afford knowledge to elaborate further innovative PV panels. Consequently, this will endorse sustainable development within societies economically, scientifically, and culturally. Besides, our approach opens the door for future research that will develop tools for measuring innovation in the solar power industry. It contributes to the enhancement of the link between scientific research in universities and entrepreneurship. This reflects the significant role of universities in providing the companies with innovative technical and technological innovations (Belgoum & Benessalah, 2023, p. 24).

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EUROPEAN INNOVATION POLICY IN THE BULGARIAN INDUSTRIAL SECTOR

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Abstract

The industrial sector in Bulgaria has undergone a significant transformation in recent decades. Since the country's accession to the European Union in 2007, Bulgaria has made significant efforts to modernise its industrial base and bring it in line with EU standards. While initially dominated by traditional industries such as metallurgy and textiles, Bulgaria is actively seeking to diversify and specialise in high value-added sectors, including advanced manufacturing, information and communication technologies and biotechnology. The aim of this paper is to examine the development of the industrial sector in Bulgaria in the context of European innovation policy. The main tasks to be accomplished are related to the study of the objectives, strategies and instruments implemented by Bulgaria to promote innovation and improve competitiveness in its industrial sector. The expected outcomes are: by analysing policy impact, successes and areas for improvement, to provide clarity on how Bulgaria's industrial sector can harness the potential of emerging innovations to remain competitive in an increasingly dynamic global market.

Keywords: *innovation policy; innovation system; instruments for innovation policy; industrial sector*

JEL Codes: *O31, O33, O36*

1. Introduction

The rapidly evolving global landscape of the 21st century requires constant reinvention and modernisation of industries to maintain competitiveness. Some of the main characteristics of the external environment of enterprises are its strong volatility and high dynamism, the continuous intensification of competition in industry and/or regional markets, the extremely rapid development of information technology, leading to major changes in the conditions of competitive struggle (Dimitrova, 2014, p. 5). In the conditions of such a multifaceted and complex competitive environment, characterized by a high degree of dynamism and instability, at the present stage enterprises are faced with a number of topical problems affecting all areas of their business activities (Dimitrova, 2023; Filipova, 2004; Logodashki, 2019; Yuleva, 2019c). In this pursuit, innovation plays a key role in stimulating economic growth,

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promoting sustainable development and ensuring a prosperous future. Moreover, it is innovation that helps not only to build competitive advantage and increase competitiveness, but also to advance scientific and technical progress (Kyurova, Koyundzhiyska-Davidkova, 2020, p. 200; Filipova, 2005, p. 55; Kalaydzhieva, 2014, p. 110; Prokopenko, 2011, p. 168). It is necessary to take into account that creativity contributes to stimulating innovative behavior and to using more fully the innovative potential of managers and employees in the enterprise (Kyurova, 2020, p. 363). Recognizing the importance of innovation, the European Union (EU) has formulated comprehensive policies to stimulate progress in Member States. Among these nations, Bulgaria, with its thriving industrial sector, is embarking on a path towards using European innovation policy to propel its enterprises forward.

As a member of the EU since 2007, Bulgaria is gradually aligning itself with the main objectives of the European innovation policy. This overarching framework aims to promote R&D, improve access to finance, strengthen public-private partnerships and boost the entrepreneurial spirit in Member States. With a specific focus on the industrial sector, the EU seeks to facilitate the transformation of traditional business by encouraging the adoption of advanced technologies, fostering collaboration between business and research institutions and nurturing a culture of innovation in the industrial sector in Bulgaria.

From manufacturing to engineering, Bulgaria's industrial sector plays a central role in the country's economy, contributing significantly to exports, employment and overall economic activity. However, as technological advances continue to change the state of the industrial sector, businesses must adapt to the changing demands and expectations of consumers and investors. In this context, the European innovation policy represents a comprehensive toolbox that enables Bulgarian industrial enterprises to embrace change and research and development-oriented practices, and to foster cooperation with other stakeholders to unlock their full potential.

Important in this process are government policies to promote innovation, increased R&D investment for industrial enterprises, the impact of public-private partnerships, the challenges faced by small and medium-sized enterprises (SMEs) and the role of entrepreneurial culture in stimulating innovation. On this basis, the aim of this paper is to offer a comprehensive overview of the implementation of European innovation policy and its effects on the Bulgarian industrial sector.

2. Innovation policy objectives, strategies and instruments in Bulgaria

Our country, as a member of the European Union, pursues its innovation policy in compliance with the European Directives on Innovation. It is important that we strive to follow the developed European countries in terms of the results obtained from an innovation policy in order to be competitive on the European market. Economic growth and the development of the country are priority objectives of innovation policy. Filipova and Yuleva point out that innovations are the basis for the high

competitiveness of Bulgarian enterprises, the transition to a digital economy, as well as a key factor for the realization of a green economy (Filipova & Yuleva-Chuchulayna, 2020, p. 471). They add that the green economy is a model of economic development that implies a responsible attitude of man to the Earth's resources. Innovation in practice is used to gain strategic advantage, create new market niches, reduce production costs, provide higher employment and profits. Innovation grants competitiveness and a stable and sustainable over time successful presence in the market (Kalaidjieva, 2016).

If we consider the activity of an innovative enterprise, innovation policy takes the place of a link between research policy and industrial policy. Kyurova has a more specific view of the innovation policy of the enterprise. Starting from the marketing activity of the enterprise, she considers the creation of new products or new markets for the enterprise as part of its innovation policy (Kyurova, 2013, p. 20).

The Ministry of Innovation and Growth has as its main objective the development of traditions in education and science as well as the development of modern technologies. It is the institution that supervises, organises and coordinates the implementation of state policy in the field of innovation, as well as technological and economic development (Ministry of Innovation and Growth, 2022).

The ultimate goal of our country's innovation policy is to achieve a knowledge-based economy and smart growth. This goal can be achieved through measures in the areas of education, science, innovation, technology and the interconnection between them (Ministry of Innovation and Growth, 2022). Yuleva describes that the problem of the renewal of the national economy of small countries (such as Bulgaria in the EU), which are not among the leaders in the world economy, is a major problem that has not been solved in both theoretical and practical aspects. It is important to note that through innovation and proper innovation policy companies can achieve better competitiveness among others in the industry (Yuleva-Chuchulayna, 2019a, p. 283)

The final goal of our country's innovation policy thus formulated is close to the priorities set in the evolutionary generation of open innovation, namely the sixth generation of the evolutionary model. There, the creation and development of knowledge-based innovations is a guiding principle.

Like any strategic objective, the goal of our innovation policy should be achieved through the implementation of set tasks. The website of the Ministry of Innovation and Growth of the Republic of Bulgaria (the Ministry of Innovation and Growth) structures the tasks to be carried out in relation to the realisation of the innovation policy objectives.

These tasks cover innovation in the following sectoral policies:

- ✓ Green Economy;
- ✓ Digital Economy;
- ✓ Space Policy;
- ✓ Defence;

✓ European cooperation.

The Green Economy aims to tackle the adverse effects of climate change, to implement the Green Transition, thereby increasing competitiveness and also the growth of the economy.

The digital economy is also key to innovation and economic growth. As our country is part of the European Union, we actively share European policies. Bulgaria is part of the European policy on the exploration and use of space for peaceful purposes.

In addition to the European Union, our country is also a member of the North Atlantic Treaty Organization (NATO), which makes us participants in the NATO Innovation Fund, founded in 2021 and to which our country was admitted on 8th June, 2022. The NATO Fund will support new businesses and other high-tech companies that are aligned with NATO's strategic objectives.

European cooperation as a task focuses on active participation and cooperation with international partners in the framework of European programmes and initiatives. The specific instruments for the implementation of the set tasks are:

- ✓ National Development Programme BULGARIA 2030;
- ✓ Innovation Strategy for Smart Specialisation 2021 - 2027;
- ✓ Legislative framework;
- ✓ National Innovation Fund;
- ✓ Financing enterprises under the National Recovery and Sustainability Plan;
- ✓ Enterprise Finance under the Enterprise Competitiveness and Innovation Programme 2021-2027.

For the purpose of the study and for the sake of clarity, in Table 1 we will present the strategic documents that serve as instruments for achieving the innovation goals of our country and explain their nature.

Table 1. Innovation policy instruments

Innovation policy tool	Essence
National Development Programme BULGARIA 2030	The strategic framework document determines the vision and overall objectives of development policies in all sectors of government. The document's three strategic objectives and national priorities include: <ul style="list-style-type: none"> - accelerated economic growth; - demographic boom; - reducing inequalities (Ministry of Finance, 2020).
Smart Specialisation Innovation Strategy 2021-2027	It is expressed in the relationship between regions and the EU. The aim is for regional policies to help create competitive advantage,

	generate sustainable economic growth and jobs (Ministry of Innovation and Growth, 2022).
Legislative framework	The focus is on the preparation of a Law on the Promotion of Research and Innovation, as well as the definition of principles and rules to regulate the financing of technology transfer (Ministry of Innovation and Growth).
National Innovation Fund	The Fund aims to promote research and development to increase the competitiveness of enterprises (Ministry of Economy).
Financing enterprises under the National Recovery and Sustainability Plan	Enterprise finance options include: <ul style="list-style-type: none"> - technological modernisation; - ICT solutions and cyber security for SMEs; - Investments to combine renewable sources for electricity with local storage facilities; - funding for innovative enterprises that have been awarded the European Innovation Council quality label (Council of Ministers of the Republic of Bulgaria, 2022).
Enterprise Finance under the Enterprise Competitiveness and Innovation Programme 2021-2027	Funding opportunities under this strategy paper include: <ul style="list-style-type: none"> - developing innovation in enterprises; - supporting research and development in research and knowledge dissemination enterprise (Ministry of Innovation and Growth).

Source: compiled by the author from material on the website of the Ministry of Innovation and Growth, *Innovation*, <https://www.mig.government.bg/politiki-i-strategii/inovaczii/>

It is important to point out that the strategic objectives set out in the National Development Programme include all the most important socio-economic problems that may hinder the innovative development of the country. Innovation policy in the industrial sector, in our opinion, can have the most effective impact on the first strategic objective - accelerating economic development.

In all the strategic documents reviewed, alongside resources, financial position and the creation of competitive advantages, attention is paid to the role of human resources, which take a leading role in the innovation process. Knowledge is the most valuable resource in modern technological development.

3. National innovation system and industrial sector

In this paper the focus is on the industrial enterprise. In the implementation of innovation policy, one of the stages, as already mentioned, is the control of the implementation of innovation development measures. On the basis of the results of

the monitoring of the implementation, the extent and existence of positive innovation development can be reported.

In his study examining the global experience in building innovation systems in agro-industrial complexes in countries applying an alternative model of innovation policy, Tireuov (2013), subdividing innovation development into sectoral, outlines the following important trends in the development of sectoral innovation systems:

- Orientation towards a multidisciplinary approach - this includes the development of scientific fields to allow the coverage of all sectoral activities for a given industrial complex. Activities such as innovation in the sector, non-traditional production systems, intensification of production, the use of modern information technology and other key processes require the systematisation of the knowledge accumulated in different scientific fields, which in turn leads to the emergence of new scientific schools for the development of regional competence in new areas of the sector ; the problems of each productive sector must be studied in relation to the impact of sectoral problems on other areas of activity. This can contribute to the consideration of the problem, from a scientific point of view, by more specialists from each of the fields involved in solving the scientific problem. This effectively means more in-depth research and higher value scientific outputs for a given sector (Tireuov, 2013).

- Integrating basic and applied research into a unified system - initially only specialisation is applied, except in highly developed countries where basic science operates autonomously outside applied science. These highly developed countries include the USA, Germany, France, etc. In the developed sectoral innovation systems of industry and agro-industry, as a rule, there is a deepening of specialization in the field of basic research by the public sector, and applied research is carried out independently or in partnership with private organizations, in subordination to their social relevance or other factors that negatively affect the attractiveness of research for the private sector (Tireuov, 2013).

- Enhancing international cooperation - The global problem of resource scarcity is giving rise to increased international cooperation processes in the field of manufacturing sector research. A significant part of research should be conducted in partnership with foreign organisations. In this way, the development and absorption of new methods and the saving of resources through joint funding are achieved (Tireuov, 2013).

It should be noted that even if all the above trends are observed and applied, there is not enough similarity of the different national innovation systems in terms of production activity. It is important to maintain the aspiration to combine the best foreign experience with the characteristics of the traditional innovation system. To identify priority areas of research, a structure is formulated which includes issues such as the competitiveness of the product as well as its impact on environmental factors.

In countries with a developed innovation system R&D funding should be jointly provided by the state and private organisations. Publicly funded research is generally of a fundamental nature.

In countries with developing innovative systems the focus is on funding applied research that aims to increase labour productivity.

Based on the above innovation trends and taking into account the distinction made by Mamatova (2017) regarding the types of national innovation systems, we can draw the following conclusions:

Firstly. Although countries belonging to the alternative model of national innovation policy cannot, in view of the experience of observation, move towards a Euro-Atlantic or Eastern model entirely, they can still develop their innovation activities jointly with countries applying the other two models. This points to the possibility of implementing partial innovation technologies that could contribute to the integration of countries applying the alternative model into common activities with countries applying the other models;

Secondly. Countries where all stages of the innovation process are missing and the innovation cycle is reduced to the most resource-intensive activities - material and human - can still achieve commensurate results through appropriate collaboration.

Georgieva (2008) analyzes the state and potential for development of the national innovation system of Bulgaria in her paper, in which she reveals the elements of the national innovation system of the country after our accession to the European Union. The importance of the national innovation system of the country for innovation policy and innovation development is expressed in the direct link between the activities of planning and implementation of innovation strategies, set in the innovation policy and following the national innovation model and its principles. According to Yuleva, "today innovation is one of the key characteristics of entrepreneurial behavior, which is significantly related to the competitiveness of enterprises and determining the innovation policy of all in the industry" (Yuleva-Chuchulayna, 2019b, p. 350)

According to Freeman (Georgieva, 2008, p. 90), national innovation systems should be seen as "... a network of public and private sector institutions whose activities and interactions initiate, introduce, change and diffuse new technologies". Georgieva (2008) argues that Bulgaria's innovation system is still at a nascent stage. In the process of increasing the effectiveness of the state's functions in innovation policy, namely: planning, regulation, coordination and control, our innovation system has the opportunity to get closer to developed European countries and to expand its innovation activities by improving the stages in innovation processes.

Our membership in the European Union and the requirements we have to fulfill on the measures set to improve our innovation policy according to the European directives gives us the opportunity to put our country on a higher level in the field of innovation.

In our recent past, before the beginning of the transition to a market economy, agro-industrial complexes, created by merging the pre-existing Workers' Cooperative Agricultural Farms and State Agricultural Farms, were the main way to achieve results from productive activity on the basis of enterprise concentration. This part of the history of the development of the agricultural sector in our country has left a lasting imprint on our national psychology and, apart from joining the countries belonging to the alternative model of national innovation policy, this innovation policy of our country in the productive aspect has made it difficult for us to subsequently move towards a Euro-Atlantic model of national innovation policy, or at least to expand our innovation process, with elements belonging to developed countries that actively apply fundamental and applied innovations.

In short, if we are able to change the essence of the national consciousness and traditions remaining from the period before 1989, we could achieve more quickly satisfactory results in innovation activity and more effective development of innovation processes. Investment in research and, more generally, our membership of the European Union can help to accelerate our transition towards modernising innovation activity in our country. Knowledge-based innovation, even in combination with open innovation, is the way to modernise and improve the quality of the innovation process for our country.

4. Conclusion

The article focuses on Bulgaria's efforts to stimulate innovation and improve the industrial sector by aligning it with European innovation policies. The development of the industrial sector is characterised by diversification, the introduction of advanced technologies and the establishment of international collaborations. The objectives, strategies and instruments implemented by Bulgaria demonstrate a commitment to enhancing competitiveness, promoting research and development and facilitating technology transfer.

On the basis of the foregoing, we can draw the following conclusions:

Firstly. Bulgaria's innovation policy in the industrial sector reflects its commitment to align with EU directives and promote competitiveness through technological progress. The country has made significant progress in diversifying its industrial base, attracting foreign investment and promoting research and development. Through the implementation of a range of strategies and instruments, Bulgaria seeks to enhance the competitiveness of its industrial sector while promoting cooperation and knowledge exchange. Continued investment in innovation and skills development will be critical to ensuring sustainable growth and long-term success in Bulgaria's industrial sector.

Secondly. By applying the principles of European innovation policy, Bulgaria's industrial sector can reap the significant benefits of technological progress, increase productivity, create competitive advantage and contribute to sustainable economic

growth in the wider European context. Through initiatives such as national innovation funds, innovation clusters and education and skills development programmes, Bulgaria is creating an ecosystem conducive to innovation and entrepreneurship. By attracting foreign direct investment and fostering collaboration between industry and academia, the country aims to harness knowledge and expertise to drive technological progress

For Bulgaria, however, it is crucial to continue investing in innovation and skills development to sustain the progress made so far. The industrial sector must adapt to rapidly changing technological conditions and remain globally competitive. Strengthening partnerships with other European countries and active participation in EU research and innovation programmes will facilitate knowledge sharing and strengthen Bulgaria's position in the European innovation ecosystem. The country's national innovation policy can continue to follow the examples of developing and developed innovation systems in other EU countries, thus showing results that raise the level of national innovation development.

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BRANDS IN THE METAVERSE

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Abstract

Recently, terms such as cryptocurrencies, web 3.0, AR/VR, NFTs, blockchain, avatars, holograms, metaverses have been heard, which are still not clear to the general public. The terms are targeting the young tech-savvy generation Z, which is the next big group of spenders! What intrigues the general public are the large investments of powerful, wealthy corporations in the digital world. More than 500 companies of various profiles (retail, fashion, food and beverages, banks, telecommunications, entertainment, real estate, education, etc.) are present in the metaverse. The purpose of this paper is to explore why companies are increasingly interested in metaverse and what are the comparative advantages of the virtual world. What are the advantages and disadvantages of the 3D space? What is the metaverse' future? The main research method that is used in the paper is investigating secondary data from journals, company's websites, blogs, and other literature in the field presented with descriptive statistics.

Keywords: metaverse; marketing; brands; 3D space; avatars

JEL Codes: M31, M37, M38

1. Introduction

Because the metaverse is a new complex term and is still evolving and developing, it is difficult to define it (Helal & Costa, 2022). Different people define the metaverse differently. According to Eyada (2023), "metaverse is a distinctive and immerse virtual world, a network of 3D virtual environments resided by avatars of actual people that focuses on social connections". The simplest definition is that the metaverse is the Internet in 3D. If today we look at the Internet, in future we are going to live inside the Internet (Zuckerberg, 2021). The metaverse is a virtual simulation

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of the real world. According to research by Statista (2022), some define the metaverse as a virtual world, others as a new name for Facebook or Google, others as web 3.0, and some as cryptocurrency. McKinsey & Company believes that the metaverse is a world of twins, where people, companies, brands have their second digital representatives. Metaverse is a 3D environment where an unlimited number of avatars engage in social, political, economic and cultural activities. Main attributes of metaverse are the virtual objects, the use of avatars, a shared environment, synchronization, being 3D (virtual) and the user experience that has to be interactive and social (Kim, 2021). The metaverse is a digital reality that combines aspects of social media, online gaming, augmented reality (AR), virtual reality (VR), and cryptocurrencies to allow users to interact virtually (Folger, Brown & Velasquez, 2022). Quite the contrary, there are people who believe that the metaverse is a vague concept, just a fantasy of a colorful future created by giant tech companies without any utility for users (Kim, 2021). For the purpose of this paper, a metaverse can be defined as a 3D virtual world where people participate with personalized avatars that work, socialize, play, travel, explore, and that can invest in, buy and own land, buildings, exclusive digital products and services, artworks, etc.

The metaverse most literally means “beyond the universe”! Its origin is associated with the American writer Neal Stephenson who coined the term metaverse in 1992 in his science fictions novel “Snow Crash”. The metaverse as a term that was mostly used in 2021 when the Facebook owner, Mark Zuckerberg announced the rebranding of the company to Meta and more intensive work on the metaverse. The history of the metaverse is presented in the Figure 1.

The above Figure shows that over time the conditions have been created for the emergence of the metaverse. The advancement of information technology, blockchain, cryptocurrencies, NFT. The Metaverse will especially target the young population, Generation Z, that is a large next spender ‘group (Dimitrieska & Efremova, 2022).

A question that arises is why would people prefer the virtual world to the real one? What are the advantages of the virtual world, which is sometimes more expensive than the real one? Why would people escape from the real world to “live” in a virtual world? The answers to these questions are provided by Internet users themselves in a survey conducted by Statista in 2021. According to this research, users prefer the virtual world mostly because they can overcome obstacles that prevent them from doing something in real life. Other arguments are as follows:

- Enhancing creativity and imagination
- Travelling the world without moving
- Increasing technological literacy and skills
- Connecting with new people without feeling awkward
- Creating completely new job opportunities
- More possibilities in education

- Giving opportunities for self-expression, etc.

Figure 1. The history of the Metaverse

METAVERSE TIMELINE	
1983	The birth of Internet
1992	American writer Neal Stephenson coined the term metaverse in his sci-novel "Snow crash"
1998	B-Money, the first system where all transactions are publicly (but anonymously) broadcast
2002	Birth of digital twins, a virtual model designed to reflect a physical object
2003	Second life is the first platform that allows users to "live" in a virtual world
2006	Roblox -gaming platform that uses avatars
2009	Bitcoin was launched as the first cryptocurrency by anonymous founder
	Blockchain is introduced as public transaction ledger for Bitcoin
2011	Ready Player One, a film imagining a full-fledged virtual world called "The Oasis" based on the book from 2011
2012	NFTs "Colored coins", the concept of crypto-collectibles was established by the NFTs (non-fungible tokens)
2014	Oculus headset, Facebook acquired Oculus VR
2015	Ethereum, a blockchain designed to make cryptocurrency and allow people to build decentralized applications
	Decentraland, an open -source virtual platform powered by blockchain technology
2016	Pokemon GO, a game merging digital and physical worlds that took augmented reality (AR) from niche to mainstream
2017	Fortnite - a multiplayer game and social hub that offers virtual tours and concerts
2018	Axie Infinity - blockchain-based war game which includes complex player-owned economies and rewards
2020	Covid-19 pandemic foster the virtual interactions
2021	Microsoft Mesh platform designed for virtual collaboration across multiple devices
	Facebook becomes Meta
	Birth of Metaverse
2022	Large companies and businesses start investing in the metaverse

Source: Glen (2022). History of the Metaverse in one picture, Data Science Central – A Community for Big Data Practitioners, Tech Target

The metaverse has certain drawbacks, but they cannot overshadow its advantages. The most cited drawbacks are addiction to a simulative reality, privacy issues, mental health issues, ethical issues, combo of different technologies that are still developing, etc. (Statista, 2021). The answers that users gave to the question of what things they would do in a virtual world that they would never dare to do in the real world are worrying. Although technology should bring benefits and make people's lives easier, these responses are alarming, such as (Statista, 2022):

- Extreme sports (bungee jumping, paragliding, skydiving)
- Pretend to be someone else (different age, nationality, sex)
- Spending a lot of money on collectible clothes or accessories
- Playing adult games that involve extreme violence or sex
- Watching virtual gladiator fights to death
- Viewing virtual executions
- Ownership of a virtual harem, etc.

The metaverse is a story yet to unfold. According to Mark Zuckerberg (2021), in 10 years from now the metaverse will become a reality.

2. Literature Review

Pioneers in the use of the metaverse are gaming platforms, such as Fortnite, Roblox, The Sandbox, Minecraft, Decentraland, where users use their avatars to play and interact with others in real time. Today, they offer their experience as a partnership to large corporations. The signal for the involvement of large corporations in the metaverse was given in October 2021, when the owner of Facebook, Mark Zuckerberg, rebranded the company as Meta and announced large investments in the virtual world of the metaverse (Barrera, 2023). At first, technical giants such as Microsoft, Apple, Google responded to his "call", and then in 2021/2022 large corporations from various fields (fashion industry, food and drinks, real estate, education, banking, automotive industry, etc.) joined the virtual world with their huge investments. The new technology involves a process of creating opportunities and challenges for economic entities (Bogdanova, 2022). Today, over 500 powerful and large companies participate in the metaverse space (Murgai, 2022). One of the reasons for their inclusion in the metaverse is the expectation that the global market metaverse value will rise to 936.6 billion US dollars by 2030 (Statista, 2022). Also, the new digital marketing and advertising is the most direct way to reach customers (Zlateva, 2020).

Brands can ensure their presence in the metaverse in two ways:

- a) by investing in specific digital technologies and tools, such as AR, VR, NFTs, gamification to create their own brand experience;
- b) by partnering with established, experienced gaming platforms through which a brand experience will be provided for consumers. (Chrimes & Boardman, 2023).

Most often, companies use the second method, i.e. gaming platforms have become the venue for launching brands into the metaverse. So in 2021, the following companies joined the metaverse this way: Nike with its virtual “Nikeland” used the gaming platform Roblox, Hyundai launched the “Hyundai Mobility Adventure” through Roblox, Gucci with “Gucci Garden” through The Sandbox, Balenciaga through Fortnite, Ferrari through Fortnite, Dolce and Gabbana with “DG families” through Decentraland, etc.

How can brands participate in the metaverse? The ways in which brands can be active in the metaverse are the following (Ramic, 2022):

- Digital products and services: users can buy various digital products for their avatars, such as land, buildings, houses, clothes, yachts, luxury items, food and drinks, insurance, etc. Moreover, during the virtual game, users have the opportunity to acquire digital collectibles (NFTs). Examples of some companies that sell these digital assets are Nike, Coca Cola, Gucci, Balenciaga, Burberry, Dolce and Gabbana, Starbucks, etc. Sometimes, the value of their assets is several times higher than the real twin-version of the products due to the high demand (Jasani, 2022). According to Forbes (2021), the land price of metaverse platforms has increased by 700%! Gucci handbag that in the real world costs 3400 USA \$, was sold for 4600 USA \$ on gaming platform Roblox. An example of in-game sponsorship is the luxury company Louis Vuitton, which in partnership with the game “League of Legends” sponsors players with its accessories.

- Metaverse events: In the digital space, concerts can be organized in real time with a large attendance. The biggest concert ever organized in the metaverse is Travis Scott's musical performance in April 2020, which was attended by 28 million people! Similar concerts were organized by the platforms Fortnite, Epic Games, Roblox for Ariana Grande, Justin Bieber, DJ David Guetta and others. Other metaverse events that users can attend are museum tours, conventions, casinos, dancing at nightclubs, fashion weeks, metaverse treasure hunts, etc.

- Metaverse travels and tourism: A very interesting and ambitious metaverse project is the launch of “Metaverse Seoul”, by the Seoul Metropolitan Government, which should be realized by 2026. Users can walk through the metaverse replica of the real city, interact, explore the city and learn about its history and culture. India created a virtual world called “India Tour World” to promote tourism, China sells traditional dishes served in different Chinese towns and also Chinese medicines, Taiwan promotes its tourism and food by using interactive Taiwanese avatars, etc. (Bushell, 2022).

- Exclusive experience: the high-profile metaverse can offer consumers an exclusive experience, such as airport lounges, luxury cars, watches, jewelry. Nissan created his virtual world “Nissan world” where avatars can test drive its cars and learn about their features (Bushell, 2022).

- Metaverse influencers are either real people or AI bots that should spread positive news about the brand. Bushell (2022) numbers some of the influencers, such as Paris Hilton (who launches her fashion line), Justin Bieber (who gives a chance people to look at his life), Kim Kardashian (who creates her avatar for phone games), Rihanna (who launches her beauty line and offers makeup for avatars), etc.

The marketing literature notes advantages and disadvantages for brands' participation in the metaverse. According to Bushell (2022), positive sides refer to:

- Reaching a large audience, people all around the globe.
- Participating in a shared interactive environment with consumers that can provoke more engagement and contact with them.
- Collecting data about the target audience and find out easily their needs and wants as a base for the tailor-made products.
- Obtaining a competitive advantage over the competitors.
- Fostering innovations and creation of new products.

Some disadvantages that can be noted are:

- Metaverse is a new technology, constantly evolving, and it lacks stability, standards, ethics, regulation.

- Metaverse is a highly competitive environment that can cause a negative publicity to companies, avatars theft, negative user-generated content.

- Metaverse is a place where people from many cultures, regions, religions, habits meet and companies need to have that in mind as well.

Brands need to be present where consumers are. The metaverse is changing the way they will interact with consumers. They need to understand well and fully utilize the potential of the metaverse. Despite the weaknesses, the metaverse is happening now and will be with us for a long time (Nadella S, Microsoft).

3. Methodology

For the purpose of this paper, secondary data published in International journals, blogs, e-books, opinions of marketing experts and company websites were used. This data is presented with descriptive statistics.

4. Analysis and discussion

In this part of the paper, responses from companies around the world are analyzed for their opinion on participating in the metaverse. The data was published by Statista in 2022. The paper presents seven important questions and answers given in the following figures:

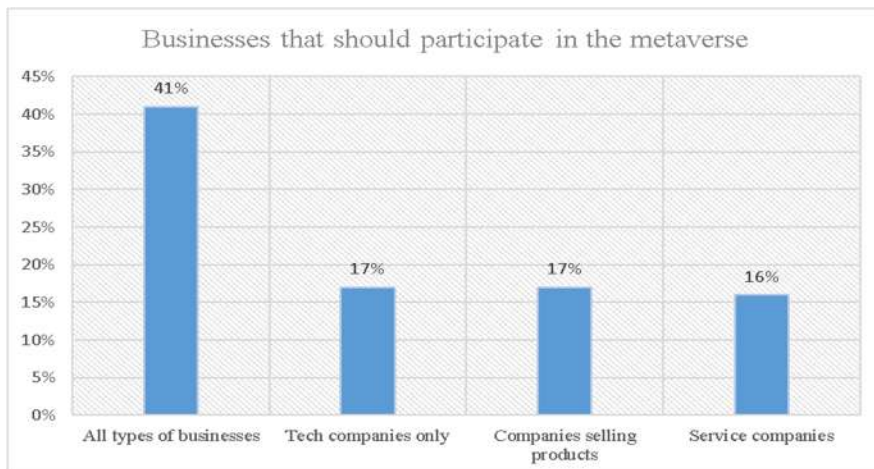
Figure 2. Leading business sectors worldwide that have already invested in the Metaverse as of March, 2022

LEADING BUSINESSES IN METAVERSE
Computer and information technology
Education
Finance
Marketing and Advertising
Technology and Innovation
Construction
Transport
Customer Service
Manufacture
Others

Source: Statista, Metaverse – Statistics and Facts, March 2022

The research conducted by Statista in the period February-March 2022 included 200 business companies from all over the world. According to this research, companies from the Computer and IT sector have the largest participation in the metaverse. Behind this sector, bigger investments have been made from sectors, Education and Finance. The Transport, Construction and Manufacturing sectors see the least business opportunities in the metaverse and their investment is very small.

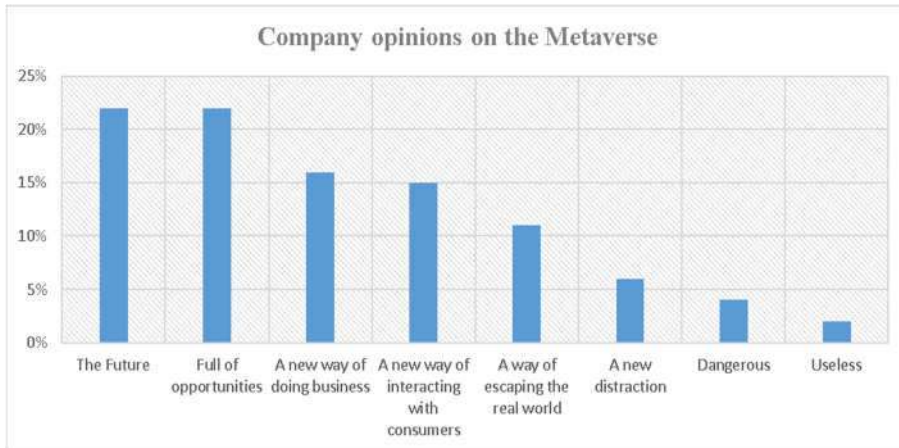
Figure 3. Types of companies that should be present in the Metaverse



Source: Statista, Metaverse – Statistics and Facts, March 2022

When asked which companies should be included in the metaverse, the answer of 41% of the respondents who said that all types of companies should find their place in the metaverse is surprising. Only 17% of respondents believe that only tech companies should be involved in the metaverse.

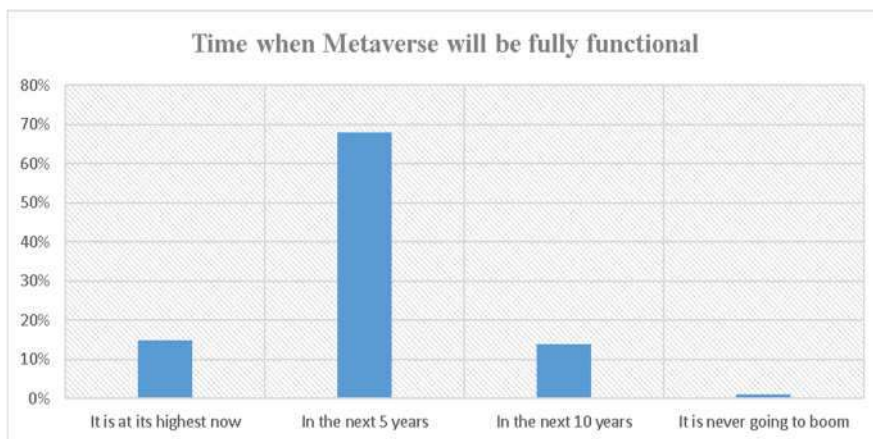
Figure 4. Business point of view regarding the Metaverse according to companies worldwide that have already invested in the Metaverse as of March, 2022



Source: Statista, Metaverse – Statistics and Facts, March 2022

How much the metaverse can be a new reality is shown by the answers to the question of what companies think about the metaverse. Over 20% of business companies believe that the metaverse is the future and a world of many opportunities. A very small percentage of respondents believe that the metaverse is useless.

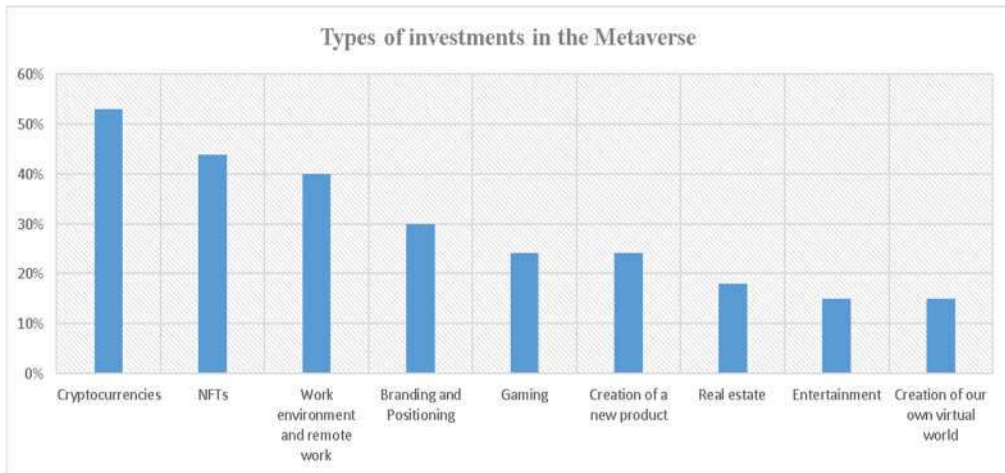
Figure 5. When do companies think that the Metaverse will start booming?



Source: Statista, Metaverse – Statistics and Facts, March 2022

When asked when the metaverse can be expected to be fully operational and functional, a greater number of respondents indicate the period from 5 to 10 years. A very small percentage of respondents are pessimistic and believe that this virtual world will never flourish.

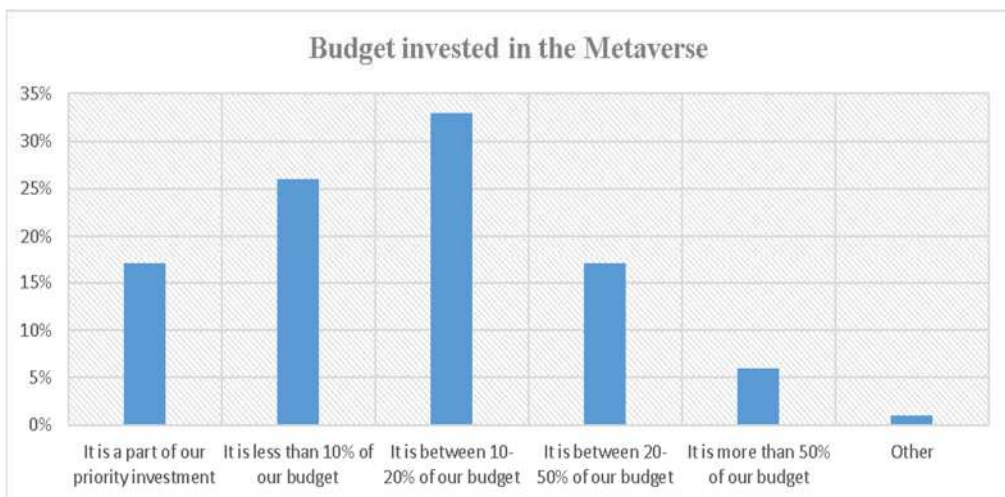
Figure 6. Type of projects that companies invest in the Metaverse



Source: Statista, Metaverse – Statistics and Facts, March 2022

Businesses consider that in the metaverse it is best to invest in cryptocurrencies, in NFTs, in replica of working conditions and remote work. They are least interested in offering entertainment, which is also a somewhat surprising answer.

Figure 7. Budget that companies invest in the Metaverse

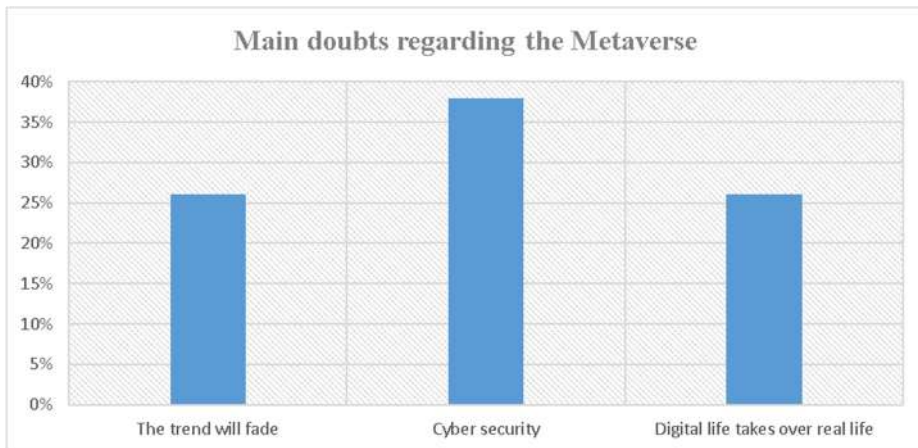


Source: Statista, Metaverse – Statistics and Facts, March 2022

The results of the question: “how much businesses are ready to invest in metaverse” show that they are willing to allocate a maximum of 10-20% of their total budget. These results show the willingness of companies to continue investing in this virtual world.

For business companies, cyber security represents the biggest threat to the metaverse (Figure 8).

Figure 8. Main doubts regarding the Metaverse



Source: Statista, Metaverse – Statistics and Facts, March 2022

The Statista research shows an increasing interest among companies worldwide of various profiles to participate and invest in the Metaverse. For most of them, the metaverse represents a future and a trend full of possibilities. Also, many companies think that the metaverse offers them new ways of doing business and new ways of communicating with consumers. However, they also agree that the metaverse is in the early stages of development and believe it will be fully operational within 5-10 years. This is shared by the World Economic Forum participants (Edmond, 2022) who believe that metaverse is going to change our daily lives over the next decade. Companies are already participating in the digital world with cryptocurrencies, NFTs, branding and positioning, creating new products, etc. In terms of budget, companies are willing to set aside 10-20% of their budget for the metaverse. The biggest doubts about the metaverse are about cyber security.

5. Conclusion

Brands should always follow their consumers. Nowadays, consumers are interested in the new technological challenge - a Metaverse - that is a mixture of the real and virtual worlds. The metaverse is a parallel 3D space that provides great opportunities for brands. Its advantages are that brands can reach a wider audience,

have a comparative advantage over competitors and can earn greater revenues. Through the metaverse, brands can promote their products and services, create brand experiences, build consumer loyalty and better develop their products.

Over 500 major companies are already participating and investing in the metaverse. The companies are from various fields, such as computers and IT, education, real estate, fashion industry, food and beverages, automotive industry, tourism, etc.

However, the metaverse is an area that is still developing and is expected to be fully functional within a period of 5-10 years. The metaverse represents a field for research in the next period by various marketers, experts, and academics. Metaverse is already native to generation Z and brings with it greater efficiency and customer experience, and businesses are already creating large volumes of revenues, but it also brings many drawbacks as well, that should be carefully considered.

The recommendations for further research in this area should be focused particularly on the impact that metaverse could have on economy sectors and at what cost. In other words, should the metaverse be used as a simulation world where different companies, brands or strategies and policies could be tested, or it should be our new reality.

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DIGITAL TECHNOLOGIES AS AN OPPORTUNITY FOR BUSINESS DEVELOPMENT

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Abstract

In the modern economy and society, the role and importance of digital technologies is constantly growing. Their application by businesses contributes to achieving sustainable growth and high competitiveness. This is the reason why the article discusses the issue of digital technologies as an opportunity for business development. The aim is to clarify the specifics of digital technologies and their role and importance for business. Atlas.ti specialized software was used to achieve the goal. The theoretical aspects of digital technologies have been considered. A classification of digital technologies has been made. The characteristic features of some basic digital technologies have been systematized.

Keywords: digital technologies; business; specifics; application

JEL Codes: L20; O10

1. Role and importance of digital technologies for the business

As a result of significant changes in the business environment, as a consequence of a deep and prolonged crisis, as well as the intensified process of globalization, it is necessary for the business to react and respond adequately to them. This requires the search and implementation of new ways to deal with this situation, as well as for long-term sustainable development. Digital technologies play a decisive role in this process. In support of this, some researchers point out that the use of digital technologies by businesses plays an important role in dealing with crises (Guo, Yang, Huang & Guo, 2020, p. 2). At the same time, digital technologies also change the ways, which turn out to be newer compared to those applied so far, through which

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new opportunities are exploited (Nambisan, Wright & Feldman, 2019). It turns out that digital technologies lead, on the one hand, to fundamental changes to business processes, products and services, and on the other to the relationships between business representatives (Nambisan, Wright & Feldman, 2019). In addition, they also contribute to defining the increasingly changing wants and needs of consumers. Moreover, the application of digital technologies specifically focused on the needs of consumers and the dynamics of competitors (Jiao, 2020) provides an opportunity for businesses to achieve accurate determination of diverse consumer needs (Li, 2022). In addition, digital technologies significantly influence the way representatives of a given business interact with its customers and partners, transforming internal processes and creating opportunities to define and use new methods of product placement (Averina, Barkalov, Fedorova & Poryadina, 2021).

The implementation of digital technologies is changing the global economic and business landscape (Kyurova, 2022). It is not by chance that they are rapidly entering the economy and society in today's dynamically changing conditions. In these conditions, the digital economy has a strong impetus in its development, manifested precisely through the active introduction and real application of digital technologies specifically for collecting, storing, processing, transforming and transmitting data in every sphere of human activity (Wetherbe, McLean, Leidner & Turban, 2006). On the other hand, digital technologies push businesses to transform and modernize and at the same time lead to the quality and efficiency of the economy (Chen et al., 2020). At the same time, the digital economy is based on digitization (Mottaeva, Stepanova, Meshkova & Semenova, 2021, p. 706), at the centre of which are digital technologies (Guo, Yang, Huang & Guo, 2020, p. 15). These technologies affect various aspects of society, resulting both in everyday entertainment and communications, but also in such important areas as infrastructure, transportation, healthcare (Given-Wilson, Baranov & Legay, 2020, p. 1199), and, in our opinion, in education too.

In our opinion, it is necessary to pay attention to the fact that digital technologies directly affect both the internal and external business environment. They are directly related to communication. It is no coincidence that the implementation of digital technologies in business activity leads to a significant change in communication methods, both within the organization and with other organizations, customers and various institutions (Soltanifar & Smailhodžić, 2021; Richter et al., 2017; Samara & Terzian, 2021). In addition, these technologies expand the possibilities of communication, as they introduce a new type of communication tools, namely social networks (Atanasova, 2022).

The businesses that are oriented towards the application of digital technologies in their activity are of key importance for the economy and are defined as an important factor in global competition. Moreover, nowadays the businesses applying these technologies are an integral part of the global market (Shkalkenko & Fadeeva, 2020, p.

1194). The application of these technologies by the businesses creates opportunities to increase their competitiveness and to achieve competitive advantages.

Considering the importance and essential role of digital technologies for the development and competitiveness of modern business in a highly dynamic and unpredictable environment, it is necessary for this business to pay attention and know their specifics. This will allow them to make the right choice in terms of timely use and the specific type of technology.

2. Specifics of digital technologies

2.1. Defining the concept of digital technologies

One of the most important issues regarding the operation of modern business is the one related to the knowledge and application of digital technologies. In this context, there is a need to clarify the specifics of digital technologies from the point of view of innovation. In this regard, Wang et al. (2022) emphasized that they are a tool applied in business management in order to effectively solve various problems related to innovation. Moreover, according to some authors, digital technologies even lead to a change in the nature of innovation (Yan et al., 2021). Other authors add that they also increase the potential for innovation (Li et al., 2020; Martínez-Caro et al., 2020). Some authors have a more particular view on the matter, pointing out that digital technologies are a prerequisite for innovation and entrepreneurship mainly by changing the mechanisms of value creation (Bresciani et al., 2018; Brock & Von Wangenheim, 2019; Usai et al., 2021). In addition, some authors argue that these technologies lead to a change in the way value is created (Averina et al., 2021). It is obvious that digital technologies are an important management tool that a business can successfully use in solving innovation problems, to increase innovation potential, as well as to create innovations, which in turn leads to the increase of its competitiveness and the achievement of a higher financial result.

In clarifying the nature of digital technologies, some authors' views are focused on the technologies. According to Stegmann (2020), they should be seen as computer-based technologies that present basic and domain-specific content while allowing interaction with or of the content. Sturgeon (2019) has a more particular understanding of digital technologies. He considers them to be a combination of computerized information and communication technologies (Sturgeon, 2019). In addition, some authors associate digital technologies with products or services that are embedded in either information and communication technologies or integrating information technologies (Fitzgerald et al., 2014). At the same time, Yoo (2010) argues that digital technologies are programmable, addressable, felt, transmittable, memorable, traceable and associable.

The analysis of the scientific literature shows that some researchers, when clarifying the specifics of digital technologies, emphasize the application of data. For example, digital technologies are defined as technologies containing data or executing

algorithms in digital form (Schwab, 2017; Hanelt, Piccinini, Gregory, Hildebrandt & Kolbe, 2015). Moreover, they should be seen as knowledge, skills and know-how to create, process, transmit and use digital data (Lipsmeier, Bansmann, Röltgen & Kürpick, 2018). At the same time, digital technologies are also a key foundation for data acquisition, use and management (Liu et al., 2022). It stands to reason that these technologies are strongly related to data-driven information. This means that providing timely and accurate information is a prerequisite for more efficient business management, for quick resolution of problems, and for successful and correct communication in the organization.

As a result of studies, it has been found that digital technologies are the main means, both for reducing business costs and duplication of effort, and for improving productivity. Businesses can use them as an important resource allocation tool (Liu et al., 2022).

It is obvious that digital technologies play an important role in the optimal running of business processes. To achieve this goal, it is important to know the types of digital technologies. The analysis of the literary sources shows that there is no unified opinion on the issue related to the types of digital technologies. For example, Schwertner (2017) considers that these technologies include cloud computing, the Internet of things (IoT), mobile technology and data analytics and big data. In the same direction are the thoughts of a group of authors who classify digital technologies into the following seven types: social, mobile, big data, cloud computing, IoT, platform development and AI related technologies (Sebastian et al., 2017; Vial, 2019).

2.2. Characteristics of digital technologies

Such representatives of theoretical thought as Yang, Plotnick, Kranz, Maple, Almeida, Gorelik, Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, Byers, Obeidat, Zolnowski, Hadi, Proaño Maya, Schwertner, Armbrust and others have contributed to clarifying the problem. They were able to bring out the inherent characteristics of some digital technologies. Knowing them is a prerequisite for a more complete and accurate understanding of the specifics of these technologies.

Regarding IoT, some authors point out that the main goal is to share information effectively in real time (Yang, Yang & Plotnick, 2013). At the same time, IoT is a network of physical objects that includes technology and software. This creates the possibility of communication and intelligent interaction inside or outside the Internet (Kranz, 2016). Characteristic of IoT is the potential to disrupt business reality and lead to significant ongoing improvements, thereby offering new services to consumers and high-quality products (Maple, 2017). Moreover, IoT provides the complete transformation of the vision and perception of the activity, thereby achieving more competitive advantages, as well as a deeper and real knowledge of the business (Almeida et al., 2020).

Regarding Big data as an important digital technology applicable in business operations, Gorelik (2019) points out that Big data should be used as a term to denote an extremely broad set of data. The same author points out the need to use special tools for storing, retrieving, organizing and transforming data into information. Also, of interest is the opinion of Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh and Byers (2011), according to whom "Big data refers to a set of data whose size exceeds the capabilities of typical database software tools to capture, store, manage and analyse". Characteristic of Big data is that they provide the possibility to analyse and predict future results and events (Obeidat et al., 2015). In addition, Big data allows managers to acquire more knowledge to use for decision-making, to optimize customer relations and to apply new business models (Zolnowski et al., 2016). It is necessary to keep in mind that some authors direct their searches to the determination of the characteristic features of Big data. In this regard, Hadi et. al. (2015) reveal that they are volume, variety, velocity, veracity and value.

It is of interest to clarify the features of Cloud computing. Some authors' understandings regarding Cloud computing are related to defining it as a system. They come to the conclusion that Cloud computing "is based on the outsourcing of computing resources and can offer various applications and provision of services through the Internet, eliminating physical devices" (Proaño Maya, 2011). A feature of Cloud computing is that it provides convenient network access to businesses, a direct connection to a shared location with adaptive computing resources, which in turn are accessible with little effort in terms of management and communication with suppliers (Schwertner, 2017). Cloud computing plays a key role in the provision of services in the Internet space. Moreover, it is characteristic of Cloud computing that it refers to applications delivered as Internet services, as well as to the hardware and systems software in the data centers (Armbrust et al., 2010).

The clarification of the characteristic features of AI also deserves special attention. Borissova's (2021) conception of AI is that it represents a system. According to the same author, it is inherent to AI "to apply predefined models which the system looks for in the data and automatically take certain actions if they are found, in case of the processing of too much data in a short time" (Borissova, 2021). An important feature of AI is that it allows to analyse the surrounding environment and take actions that would in turn increase the chances of achieving certain goals (Russel & Norvig 2003). At the same time, AI is characterized by the opportunities it provides for analysing large volumes of data to serve as a basis for business decision-making (Artificial Intelligence Innovation Report, 2018).

3. Application of digital technologies and forecasts for the development of the Industry 4.0 market

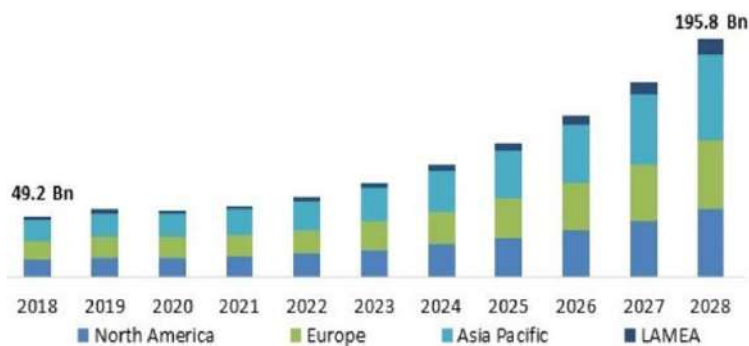
Digital technologies have a serious impact on modern business, which supports various aspects in the operationalization of processes and the construction of

successful company strategies. Digital and artificial intelligence are fundamentally changing the way we live and work. Businesses are aware of these trends, but are increasingly struggling with how to successfully integrate these capabilities to ensure their smooth operation within businesses (McKinsey, 2023). The emergence of cloud technologies, the Internet of Things and the possibility of analyzing huge data sets were the basis of Industry 4.0. It is no coincidence that with the advent of digital technologies, we began to talk about an era of wisdom, because knowledge and creativity are the basis of the investments that the modern organization makes to achieve its goals more effectively. According to Garther's senior director, the analyst Sarah James "increasingly, data and analytics has become a primary driver of business success, and the potential for data-driven business strategies is greater than ever, with further acceleration of digital transformation and data-driven business" (Garther, 2023).

Artificial intelligence is having a major impact on 6 major industries as it improves operations, streamlines work processes and improves customer experience (Sajid, 2023a). According to the author of the article, the most affected industries are marketing, legal services, sales, technology, healthcare and finance.

A study by Knowledge Based Value shows that the Global Industry 4.0 market is expected to reach 195.8 billion by 2028 (see Fig. 1), which shows a sustainable growth trend in the use of digital technologies (KDB Research, 2022).

Figure 1. Industry 4.0 Market Size by Regions 2018-2028



Source: KDB Research, 2022

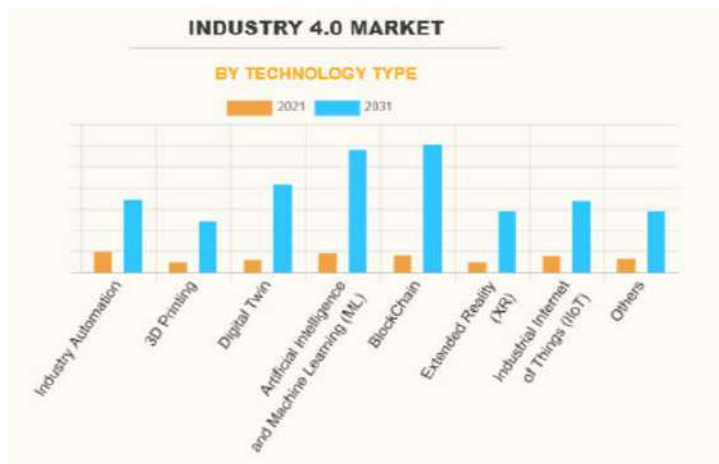
The data illustrates the ever-increasing role of digital technologies and the need for businesses to adapt to the new reality. This is a consequence of the advantages provided by the intelligent technological environment through connectivity, machine

learning, automation in the processing of huge data, forming an integrated ecosystem for companies.

The impetus for the digitization of life was the COVID-19 pandemic. It appeared as a catalyst for changes in the global economic situation, in the context of Industry 4.0. The new circumstances required a rapid transformation of the business and adaptation to the new market environment, the basis of which were the opportunities to implement innovative solutions at all business levels.

However, a study by Allied Market Research (2023) shows that "the high cost of implementing industrial robots and the complications of their integration and interoperability are a barrier to market growth." of Industry 4.0 (Fig. 2). This is to a certain extent compensated by the increasing application of 5 G automation of cloud technologies. In the same study, the Industry 4.0 market is considered on the basis of segmentation by technology type, end user and region, covering a forecast period of 2021-2031.

Figure 2. Forecast for the development of the "type of technology" segment 2021-2031



Source: Allied Market Research, 2023

The data indicates that the industrial automation segment will continue to dominate in the coming years, but the most serious growth is expected in blockchain technologies, the explanation being that this is due to the improved security, privacy and openness of data.

GlobeNewswire forecasts, citing [Market.U.S. research](#), show similar trends, drawing key takeaways for Industry 4.0 and specifically: by technology, the industrial

IoT segment will dominate the market by 2022, with North America having the highest share of digital technology revenue in the industrial sector for the same year. Impressive is the projected growth for Europe, with expectations that it will reach 25% for the period 2022-2032, and for the same period the most significant growth rate will be the Asia-Pacific region (GlobeNewswire, 2023). The report identifies the most important factors that will influence the growth of the global Industry 4.0 market and as such examines: technological advancements, the growing need for data transparency, the focus on sustainability in manufacturing processes, the demand for customized products and the need from operational efficiency.

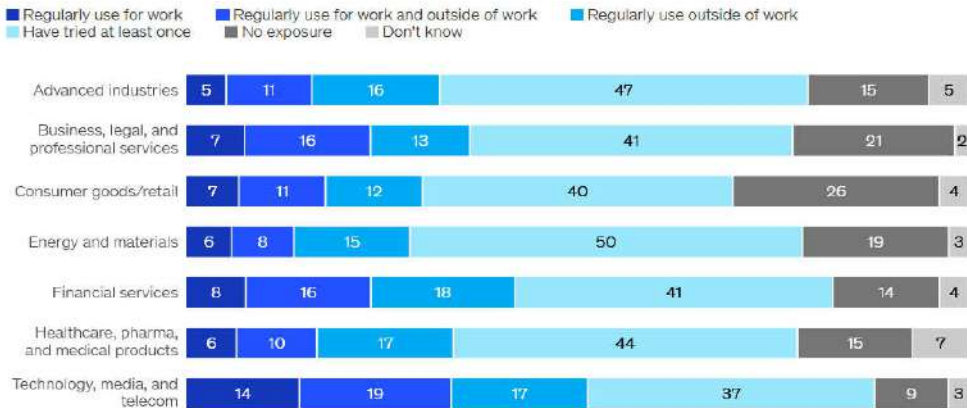
Due to the continuous improvement of artificial intelligence (AI) and machine learning, the Internet of Things (IoT) continues to evolve and expand its scope at a rapid pace. The presence of high-quality suppliers, IoT devices, wearable technologies, 5G networks and other innovative technologies play a key role in the development of smart cities, processing of huge information arrays, smart homes, automation and wider connectivity on a global level (CompTIA, 2022).

A McKinsey report on the state of AI in 2023 says that this is the breakthrough year for Generative AI (McKinsey, 2023b). Less than a year after its appearance, there is a significant increase in companies that regularly use next-generation AI. Over 40% of surveyed organizations intend to increase their investment in gen AI. However, the adoption of this technology also carries certain risks because it will lead to significant changes in the workforce, including layoffs in certain areas and retraining efforts to meet competency requirements. The interest in Gen AI is not abating, on the contrary. Businesses across regions, industries, and the companies with different ranks are using the new technology for work or beyond. The survey was conducted from April 11 to 21, 2023 among 1,684 participants and included representatives of various regions, industries, company sizes, functional specialties and ownership. The data shows increased interest in adopting the new technology. The respondents share that they expect its implementation in their business activities to lead to the transformation of their industries and it is the most preferred among those working in the technology sector (Fig. 3).

The research shows that the widest application of this tool is where it brings the most value: marketing and sales, development of new products and services, including customer service, back-office support, etc. The needs of today's consumers are constantly evolving, expecting businesses to understand, anticipate and even exceed their wants and needs. Therefore, a more precise approach that is tailored to individual preferences is needed (Sajid, 2023b). The new tool, together with software engineering, provides about 75% of the total annual value of the companies that implement it. AI will have a strong impact in professions in which there is a creative process (Profit.bg, 2023). Gen AI can significantly streamline the ideation process in product and service development, for applications in optimizing the product development cycle or improving existing ones, especially those in the AI field.

However, using the superpowers of artificial intelligence is also a great responsibility, as the focus is on the human factor and respect for personal privacy (Digitalk.bg).

Figure 3. Application of gen AI by industry type



Source: McKinsey, 2023b

Artificial intelligence has ushered in a new era of innovation and entrepreneurship across industries. Especially during the COVID-19 pandemic, they played an important role in adapting businesses to new market conditions. It turns out that few companies are fully prepared to use next-generation AI because they are not prepared for the risks these tools can bring (McKinsey, 2023b) (Fig. 4).

Figure 4. Risks companies see from using Gen AI



Source: McKinsey, 2023b

Despite the risk concerns that companies have, more are implementing them, having implemented at least four or more business functions, thereby leveraging the capabilities of artificial intelligence. According to a global survey by MIT Sloan Management Review and Boston Consulting Group of 1.741 managers representing more than 100 countries and 20 industries, organizations are much more likely to derive value from AI when their employees do, too. Rather, AI is seen as a "coworker" at work, not a threat, "when the use of the technology enhances their self-improvement, which includes their competence, autonomy and connectivity" (Boston Consulting Group, 2022).

Artificial intelligence is becoming a natural part of our daily lives. It should not be taken for granted, but ways of combining it with training programs aimed at developing the "soft" skills of employees should be sought (Economy.bg, 2020). Artificial Intelligence (AI) is in the main of the digital transformation of businesses and plays a key role in achieving competitive advantage and innovation progress. Its ability to analyze, interpret and extract valuable information from large volumes of data not only optimizes operations but also helps to take more informed and strategic decisions.

With the help of AI, businesses can automate tasks that previously required a huge number of human resources and time. This automation process reduces human error, increases the efficiency and reliability of operations, and lowers operating costs.

Additionally, AI supports the personalization of products and services by analyzing user behavior and providing tailored solutions and experiences. This increases customer satisfaction and creates closer relationships with them.

Most importantly, AI enables the anticipation of future trends and challenges, allowing businesses to be more agile and adaptable to changes in the rapidly evolving digital environment.

In the world of digital transformation, AI is not just a tool, but a key partner for successful innovation and business development. The integration of artificial intelligence is becoming an increasingly urgent necessity to succeed and survive in the future.

4. Conclusion

The study of digital technologies is currently an extremely important issue of scientific and practical importance, since their in-depth knowledge is an important prerequisite for achieving competitive advantages and long-term sustainable development of business, including the innovation of its activity.

The theory proves that digital technologies are important for business development. They are an important condition for making significant changes to business processes and providing opportunities for more efficient communication with counterparties and users. Knowing the nature and characteristics of digital technologies contributes to business modernization. That is why it is necessary for the

business to direct its efforts and attention to the knowledge and application of digital technologies in its activity.

In the contemporary landscape of the global economy, the inexorable rise of digital technologies has redefined the very essence of business operations, propelling enterprises toward sustainable growth and unmatched competitiveness. This article embarked on an insightful journey into the heart of this digital revolution, meticulously unravelling the multifaceted dimensions of digital technologies and their profound impact on business development.

The fundamental premise of this study was rooted in the recognition of digital technologies as catalysts for transformative change. By delving into the intricate tapestry of these technologies, this research aimed to demystify their nuances and illuminate the path for businesses to harness their unparalleled potential. Employing the sophisticated tools of Atlas.ti specialized software, this study delved deep, unearthing not just the surface-level applications but the intricate threads that weave the fabric of digital innovation.

The theoretical underpinnings explored in this research provided a robust foundation, elucidating the theoretical frameworks that underlie digital technologies. This theoretical grounding served as a springboard, enabling a nuanced classification of digital technologies. Through this classification, a systematic understanding emerged, delineating the diverse landscape of digital tools available to businesses.

In the pursuit of clarity, this study meticulously characterized some of the fundamental digital technologies. By systematically dissecting their features, this research illuminated the unique strengths and applications of these technologies, providing businesses with valuable insights into their potential utility.

The implications of this exploration are profound. In a world where adaptability and innovation are the cornerstones of success, businesses armed with a profound understanding of digital technologies are poised for unparalleled growth. The insights gleaned from this study serve as a guiding light, illuminating the path toward strategic digital integration. By embracing the specificities of digital technologies elucidated herein, businesses can not only streamline their operations but also unlock new avenues for creativity, customer engagement, and revenue generation.

As we draw the curtain on this endeavour, it is evident that the discussion surrounding digital technologies as engines of business development is not merely an academic exercise but a clarion call for action. The businesses of today stand at a critical juncture, where their ability to adapt and innovate in the digital sphere directly correlates with their survival and success. Through the lens of this research, the transformative power of digital technologies comes into sharp focus, urging businesses to not just embrace but actively leverage these tools to sculpt a future that is not just sustainable but thriving.

In essence, this study is not just a culmination of theoretical explorations and empirical analyses; it is a testament to the limitless possibilities that unfold when

businesses recognize digital technologies not as mere tools but as strategic allies. The digital age is here, and as businesses navigate this uncharted territory, the knowledge distilled from this research stands as a beacon, guiding them toward a future where innovation knows no bounds and sustainable growth becomes not just a goal, but a tangible reality.

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INFLUENCE OF CORPORATE CULTURE ON SOCIAL ENTERPRISE

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Abstract

The potential of the social entrepreneurship and the social economy to find solutions to social problems, create sustainable jobs, facilitate social and social labour integration, the fight against poverty and social exclusion leads to continuous development of social entrepreneurship in Bulgaria in recent years. The focus of this article is on the nature of social enterprises, the main characteristics of social entrepreneurs and the impact of organizational culture on the activities of social enterprises. The main objective of this paper is to provide a comprehensive understanding of the importance and impact of organizational culture in the context of social entrepreneurship. The main tasks are related to: research the essence of social enterprise; identification of the main characteristics of the social entrepreneur; identifying the link between the social enterprise and the organisational culture; assessing the impact of the organisational culture on the social enterprise by studying the impact of the organisational culture on the achievement of the social enterprise objectives and the social impact; and analysing the relationship between the organisational culture and motivation, commitment and satisfaction of employees in the social enterprise. The expected results are: to establish a thorough understanding of the relationship between organisational culture and social enterprises, to demonstrate that a strong and strategically aligned organisational culture positively influences the overall performance and impact of social enterprises.

Keywords: social enterprises; organizational culture; mission; social impact; social entrepreneur

JEL Codes: L26, M14, L30

1. Introduction

In recent years, as organisations with the aim of dealing with social and environmental challenges in a financially sustainable manner, social enterprises have attracted considerable attention. These unique entities combine entrepreneurial practices with a strong commitment to driving positive social change, often operating in complex and dynamic environments. In this context, corporate culture becomes a critical factor in the formation of values, norms and practices in social enterprises.

Corporate culture is the major socio-cultural factor for the improvement of the activities of an enterprise. Corporate culture is an intangible asset, which

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indirectly influences the improvement of the activities of any organization in any sphere of business and of any form of ownership (Filipova, 2021).

Although the importance of corporate culture in social enterprises is widely recognised, there is a lack of systematic understanding of its specific dimensions and characteristics. Understanding corporate culture in social enterprises is a challenge due to fragmented literature in this area. This article aims to fill this gap by conducting a systematic survey of academic research on the corporate culture of social enterprises. The concepts of entrepreneurship, the relationship between business activity by Social Entrepreneurs and corporate culture need to be clarified in order to carry out this research.

2. Development Definitive components of the social enterprise

There is a large amount of existing social enterprise definitions reflecting various regional variations (Kerlin, 2010). The debate on social enterprises in the United States has been dominated by market based approaches to revenue generation and social change (Austin, Stevenson & Wei-Skillern, 2006; Dees, 1998; Defourny & Nyssens, 2010). Social enterprises are already found in Europe within the cooperative spirit of collective social action (Borzaga & Defourny, 2001; Defourny & Nyssens, 2010; Nyssens, 2006). The United Kingdom's definition for a social enterprise was derived from tradition and the government of this country states that it is "a business with primarily social objectives whose surpluses are basically reinvested for this purpose in the business or in the community, rather than being driven by the need to maximize profits for shareholders and owners" (DTI, 2002, p. 13). The concept of social enterprises is increasingly noticed by policymakers and researchers from all over the world (Wilson & Post, 2013), with an accompanying increase in scientific interest reflected in a growing number of academic and press articles about them as separate categories of organisations (Cukier, Trenholm, Carl & Gekas, 2011; Lepoutre, Justo, Terjesen & Bosma, 2013; Lumpkin, Moss, Gras, Kato & Amezcua, 2013). Earlier research on social enterprises was dominated by developments devoted to defining their distinguishing characteristics and explanations for their emergence (Chell, 2007), and studies that looked at the management of social enterprises were successful. Much of the early research on social enterprises is untheoretical and seeks the positive (Parkinson & Howorth, 2008). In response, more recent research has developed new theories to explain their emergence (Tracey, Phillips & Jarvis, 2011), their governance (Battilana & Dorado, 2010; Pache & Santos, 2010), and also criticality, ethics, power, and emancipatory aspects of social enterprises (Teasdale, 2012). Social enterprises can be regarded as "hybrid" because they constitute an intermediate form of a traditional profit generating business and nonprofit organizations which seek the creation of societal value (Gupta, Dey & Singh, 2017). To generate positive social and environmental externalities, a social enterprise is an

organisation that trades, not for private profit, but for the purpose of generating positive social and environmental externalities (Santos, 2012).

Organizational tensions arise from the dual nature and hybrid character of social enterprise, which is why it is crucial that social enterprises deal with this tension (Ashforth & Reingen, 2014; Smith, Gonin & Besharov, 2013). It is important to point out that social entrepreneurs, as well as traditional entrepreneurs, also conduct business. The personality characteristics of the two types of entrepreneurs overlap to a large extent. In the academic literature on the subject of the personal characteristics of entrepreneurs, there is a distinction from businessmen on the basis that entrepreneurs "create needs," and businessmen "satisfy needs". Entrepreneurs are presented as individuals who see the world differently and have the ability to anticipate changes in the environment (Seleznova, Boiko & Bondar, 2020).

They also take advantage of opportunities that others ignore, and recognize and accept the risks they face in carrying out their activities. V. Poznyakov defines the following main characteristics of the entrepreneur as a subject of economic and innovative activity:

- Initiative;
- Organizational skills;
- Strategic thinking;
- Creative approach to business;
- Focus on success and profit;
- Willingness to take risks;
- Focus on innovation;
- Commitment to the cause and the idea;
- Creation of economic benefit;
- Ability and willingness to take advantage of new opportunities;
- Insight;
- Leadership skills;
- Persistence (Poznyakov, 2013).

It is important to point out that a large number of researchers do not perceive social entrepreneurship as part of entrepreneurial activity in the general sense of this term.

Although the use of the term "social entrepreneur" is beginning to be used more and more, the scope of activity of social entrepreneurs is not yet strictly limited and is in the process of development (Kyurova, Koyundzhiyska-Davidkova & Durmishi, 2022). Analyzing the scientific literature on the problem, we can establish that there are common personality characteristics of traditional entrepreneurs and social entrepreneurs. This suggests that social entrepreneurs prioritize achieving a certain social mission through the use of a business approach. But the priority of social entrepreneurs is not the maximization of profits, but the fulfillment of a certain social mission (Samer, 2012).

A. Zhuravlev notes that the corporate culture is a background on which the company's activities are carried out (Emelyanova, 2009). It acts as a powerful lever for regulating the interactions and relationships of the external and internal environment of the social enterprise in the conditions of modern management. (Makarchenko & Antonov, 2013). For this reason, for the purposes of the study, it is necessary to focus attention on the influence of corporate culture on social entrepreneurship and its management.

3. Impact of corporate culture on social enterprise

Conducted systematic analyzes of academic research on the given topic, on a given topic, it should be noted that company culture studies have been actively conducted in the area of business administration since the 1980s (Schein, 2010). Empirical studies on commercial enterprises are seeking ways to enhance corporate performance, and many confirm that corporate culture is a factor that influences performance (Cameron & Quinn, 2006; Gordon & DiTomaso, 1992; Koster & Heskett, 1992). Firms' performance in professional services, such as law firms (Hogan & Coote, 2004), is influenced by a strong cultural trade organization (Deal & Kennedy, 1982) and a corporate culture that promotes innovative norms. The relationship between corporate culture and organisational context, or the relationship between the type of corporate culture and organisational performance, has been the focus of earlier research on corporate culture. Corporate culture is also a key factor in the success of applying new practices to welfare agencies (Aarons & Sawitzky, 2006). The assumption that culture, as a competitive factor, has a significant influence on the presentation of an organisation is based upon previous studies in corporate culture. The assumption that culture, as a competitive factor, has a significant influence on the presentation of an organisation is based upon previous studies in corporate culture. There is a lack of relevant research in spite of its importance to discuss the corporate culture of social enterprises.

If social enterprises aim to be competitive in the market, it is essential to manage their human resources and their organisational culture and differentiation (Logodashki, 2019). As a summary of the systematic review, we can see that corporate cultures have an impact on organization values and behaviour regardless of type of organisation through their role as social control mechanisms (O'Reilly, 1989).

This type of business has certain contextual conditions such as a lack of stable revenue generation by management, and excessive emphasis on social objectives, despite the important role played by social enterprises in providing social services and job creation. A management strategy, that will allow social enterprises to be more likely to survive and also be effective, is therefore needed (Yusr, 2016; Kim & Jung, 2015).

In combination with business and charity characteristics, social enterprises pursue the dual objective of achieving both financial sustainability as well and social

purposes (Doherty, Haugh & Lyon, 2014) by adopting a unique organisational structure (Julie & Mathew, 2014).

Gregory Dees defines the factors that identify social entrepreneurship: "adopting a mission to create and maintain social value; opening up and seizing new opportunities for the implementation of the selected mission; implementation of innovation, adaptation and training; decisive action, unconstrained by disposable resources and high responsibility of the entrepreneur for the results of its activities, both to customers and to society" (Dees, Emerson & Economy, 2001).

In relation to the thus formulated factors determining social entrepreneurship, three components of the conceptual model of organizational culture proposed by Schein (1985) can be drawn up, namely:

- Artifacts – stories, symbols, language;
- Values – strategies, goals, philosophies;
- Assumptions – unconscious, taken for granted.

On the basis of the comparison of the factors determining social entrepreneurship and the components of the conceptual model of organizational culture, we can establish that *corporate culture and social entrepreneurship influence the human resources of the organization in the same direction, namely - in order to generate and sustain social value for employees of organisations, clients and also society as a whole, by pursuing the Social Enterprise mission.*

As to the management, missions and resources of social enterprises, it is assumed that they will have a different organisational culture than those of businesses. Moreover, since social enterprises have "dynamic" characteristics which distinguish them from businesses, nongovernmental organisations and public organizations, a well organised company culture of social enterprises would make an overall difference in the organisation performance of companies.

There are a number of reasons why it is important to understand the corporate culture of social enterprises.

First, corporate culture influences the identity and orientation of the social enterprise's mission, providing a framework for decision-making and behavior.

Second, it plays a crucial role in talent recruitment and retention, as people are often attracted to enterprises whose culture is in line with their personal values and beliefs.

Third, a strong corporate culture is associated with improved productivity, innovation and the ability to achieve social impact.

The role of corporate culture in social entrepreneurship can be particularly important, as this area of economic activity implies greater participation in the process of organization or in a specific project. This can be explained by the fact that when working in a social enterprise, the social entrepreneur and the employee cannot initially pursue the goal unilaterally and win of the project. In this case, profit turns out to be a secondary goal, and the social mission that the project contains must be

put first. Thus, in order to perform his duties and functions, the employee must feel himself belonging to the group and existence involved in the labor process. Corporate culture plays a big role in this (Makarchenko & Antonov, 2013).

In relation to the need to have an effective corporate culture, we can conclude that there is a type or types of corporate culture that are best suited to social Entrepreneurship. The need to identify the requirements for the corporate culture of the social enterprise is formed (Cameron Kim & Quinn Robert, 2011).

These requirements for corporate culture take into account the specifics of the field of social entrepreneurship and are reduced to the following:

- Commitment to the idea;
- Stable relationships in the team;
- Flexibility;
- Ability to delegate powers;
- Democratic type of leadership;
- Opportunity for personal and professional growth;
- Realization of needs in conditions of insufficient material benefits;
- Encouraging the initiative;
- Innovation;
- Opportunity for creativity at work (Makarchenko & Antonov, 2014).

Corporate culture should ensure the effective functioning of the organization so that its employees can compare their desire to realize each social idea with the mission and purpose of this organization. If these conditions are met, employees will feel closely connected to the work of the organization, bringing their life aspirations into professional activities, such as this, the fulfillment of the goals and mission of the organization are associated with the realization of the employees' own needs. This, in turn, can act as a factor due to which the personal needs of employees and their realization are possible in the conditions of insufficient financial gain (Dimitrova, 2023). In this case, the relationship between the team members should be close and a sufficiently long period of time should be formed. This, in turn, can be a problem for new employees, as not every newly hired employee can immediately realize the essence of the work of an organization that is engaged with social entrepreneurship (Makarchenko & Antonov, 2014).

Innovation is also a necessary criterion for social entrepreneurship (Kalaydzhieva, 2014). One of its key characteristics is to look for opportunities and see market failures (Kalaydzhieva, 2016). Taking into account the essential potential for social innovation, the Economic and Social Council urges that social enterprises be further encouraged in their efforts to find innovative solutions to social problems (Economic and Social Council, 2013). Effectiveness is manifested by adopting new solutions that have a long-term positive impact on society as a whole (Makarchenko & Antonov, 2014).

The human resource potential of a social enterprise requires more detailed

consideration and analysis (Prokopenko, Osadchenko, Braslavskaya, Malyshevskaya, Pichkur & Tyshchenko, 2020). When applying a democratic type of leadership and the possibility of delegating powers, it is assumed that the social entrepreneur or manager of the social enterprise interacts with departments based on overall employee involvement in all aspects of organizational activity (Usheva, 2010). The democratic type of leadership implies freedom in choosing and making one decision or another (Yuleva, 2019), as well as the possibility of applying a creative approach to work (Prokopenko, 2011). This type of leadership can be defined as the most suitable for modern social entrepreneurship (Makarchenko & Antonov, 2014).

The influence of the corporate culture on the activity of the social enterprise is expressed in:

- implementation of the social mission, which includes the project of the social enterprise from the point of view of providing social services and creating jobs;
- identifying the employees' own goals with the organizational goals and with the social enterprise as a whole by accepting its norms and values;
- implementation of the norms prescribing striving to achieve the goals;
- formation of a strategy for the development of the social enterprise;
- unity of the strategy implementation process and evolution of company culture, under the influence of the requirements of the external environment (Adapted from Filipova, 2015).

Based on the formulated spheres of influence of the corporate culture on the activity of the social enterprise, we can establish that the influence exerted is significant and can lead to both positive and negative effects. For greater clarity, the following table 1. defines the positive and negative, in our opinion, effects of the influence of corporate culture on social enterprises.

Table 1. Impact of corporate culture on social enterprise

Positive effects	Negative effects
Aligning the commitment and social responsibility of human resources with the social mission.	Existing risk of prioritizing profit over social mission.
Employee engagement and retention through inclusion and fostering a sense of responsibility.	Promoting hierarchical structures that inhibit inclusion and participation.
Strengthening social enterprise connections with various stakeholders, leading to increased support, partnerships and funding.	Insufficient responsiveness to customers and users, emphasizing profit over satisfying customer needs.
Increasing the innovativeness and adaptability of employees and, accordingly, of the social enterprise.	Risk of conflicts between the goals of the social enterprise and the corporate strategy.
Achieving financial sustainability of the social enterprise through a corporate culture that promotes sound financial practices.	Risk of conflicts and disunity in the organization if the organizational

	culture does not sufficiently create a sense of solidarity and cooperation.
A strong corporate culture leads to higher organizational resilience.	

Source: systematization of the author

As can be seen from the above table, it is of particular importance for social enterprises to carefully develop their corporate culture, which is in line with their values and goals in order to maintain a high level of positive impact on society. Corporate culture acts as a factor that forms psychological qualities or maintains existing ones, as well as develops them. The basis of motivating the employees of any organization is the satisfaction of their personal needs at one level or another. Within the framework of social entrepreneurship, there is an opportunity for the greatest satisfaction of such needs as the recognition of the individual by society, which is one of the highest levels of human needs.

4. Conclusion and Recommendations

In conclusion, we can point out that the corporate culture influences the adoption of new practices, it is the ability to adapt to the changing social environment and shapes the perception of the social enterprise. A culture that values experimentation, learning and continuous improvement enables social enterprises to remain flexible and adaptable to emerging social challenges. A supportive and inclusive corporate culture fosters social enterprise collaboration and partnerships with stakeholders, including government bodies, non-profit organizations and other social enterprises.

Based on the research, we can draw the following main conclusions:

First. Social enterprises are unique organizations known for their social mission-driven nature that operate within the context of business and social impact. The dynamics of the corporate culture play a decisive role in achieving success.

Second. As they focus to address societal issues and meet the needs of society while at the same time providing a sustained source of income social enterprises are differentiated by their nature. They combine trading strategies with a strong sense of purpose, resulting in a hybrid model that goes beyond traditional profit maximization. Social enterprises aim for long-term, sustainable solutions, not quick fixes.

Third. The main characteristics of social entrepreneurship are crucial to its success. They demonstrate dedication to their cause, a strong sense of social responsibility and creative thinking. Social entrepreneurs have a unique ability to identify opportunities, mobilize resources and navigate complex social systems, driving positive change in their organizations and communities.

Fourth. In the field of social enterprises, corporate culture becomes important. A strong culture fosters creativity, a sense of shared purpose, values and identity, uniting employees and stakeholders behind the organization's mission. It creates an

environment where innovation, collaboration and social impact can thrive. The corporate culture of a social enterprise influences decision-making processes, relationships and overall organizational behavior.

Fifth. The impact of corporate culture on social enterprises spans multiple dimensions. It has a profound impact on attracting and retaining mission-driven employees, which is essential to achieving the organization's social goals. A strong and positive culture helps create a sense of belonging, motivation and engagement among employees.

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THE CONTRIBUTION OF PSYCHOLOGICAL EMPOWERMENT IN ENHANCING ACHIEVEMENT MOTIVATION AMONG PHD STUDENTS

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Abstract

The present study aims to identify the level of psychological empowerment with its four dimensions: competence, self-determination, impact and meaning and its relationship to achievement motivation among PhD students from the business faculties in Algerian universities. For this purpose, two measures scales were relied upon for each of psychological empowerment and achievement motivation. They were examined on a sample of (307) PhD students. The statistical analysis performed using the Smart PLS4 software revealed a statistically significant correlation between psychological empowerment and achievement motivation. Based on these findings, the study concluded with recommendations, the most important of which is to rely on psychological empowerment as an effective strategic instrument for increasing PhD students' achievement motivation.

Keywords: *psychological empowerment; achievement motivation; PhD students*

JEL Codes: *M12*

1. Introduction

In recent years, as Interest in the human resource has increased recently. It has become the focus of researchers. The psychological aspect is also the focus of modern attention to motivate and develop it to achieve adequate performance. Empowerment is considered a topic that has received attention as a strategic tool to detonate latent energies. In this regard, psychological empowerment is a modern method that gives individuals confidence, independence, and motivation. It generates a higher achievement motivation towards creativity and the completion of work efficiently and

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effectively. In a related context, achievement motivation expresses the internal or external force that directs the individual towards achieving specific goals, moving his behavior, his determination to do his best, and perseverance and diligence towards achieving success. At the PhD level, PhD researchers, especially at the beginning of their research career, usually encounter several pressures, especially psychological ones. This results from vagueness, ambiguity, anxiety about the future, and lack of information and research capabilities. These problems affect their practical and scientific lives in particular. It is reflected in their motivation towards scientific research and its continuation, especially in preparing scientific papers.

On the other hand, psychological empowerment is an effective tool for detonating the latent capabilities of individuals and their skills and awakening their motivation towards achievement and reaching goals. This study gained importance as it dealt with the link between psychological empowerment and achievement motivation. The researchers noted that previous studies would not have addressed the relationship between psychological empowerment and achievement motivation. In addition, previous studies focused on psychological empowerment as a modern strategy to awaken the latent energies of individuals. PhD students' achievement motivation must be at its highest level with psychological empowerment.

2. Literature review

Thomas and Velthouse (1990) have claimed that psychological empowerment is a procedure that makes the employee self-sufficient. Spreitzer (1995) divided the psychological empowerment process into four axes: "competence, impact, self-determination, and meaning". According to him, competence is the ability to do particular duties with personal efficiency. Meaning is concerned with the value of this duty, where self-determination refers to the liberty degree during the duty execution. Finally, the impact is involved with the work surrounding and the importance of the personal manner. Thus, as a psychological reaction in empowered business environments, psychological empowerment with their cognitions motivates the employee and raises his efficiency. Psychological empowerment is related to the working environment and the employee's psychological response to their working environment (Meng, Jin & Guo, 2016). Psychological empowerment is not linked only with the organization's motivation but is an active, inspirational guide. Those are pillar components of psychological empowerment to obtain proactive behavior (Seibert, Wang & Courtright, 2011). Psychological empowerment aims to eliminate disabilities among organization employees by instilling a sense of self-efficacy (Conger et al., 1988). Psychological empowerment manifests through four cognitive entrances that help direct work within the organization "meaningfulness, competence, choice and impact" (Albar, García-Ramírez, Jiménez & Garrido, 2012). Psychology research in business organizations has figured prominently in the emergence of psychological empowerment to encourage organizational employees' innovation and

competitiveness (Bowen & Lawler, 1992). To conclude, psychological empowerment expresses an individual's internal psychological state. It is an internal stimulus that causes the individual to believe he is effective and capable of completing his tasks and achieving his objectives. This motif can be found in the following dimensions:

Meaning: It means the individual's sense of the value of his work and what he performs, which is vital to him personally. Doing it to work is not just because it is routine work that employees are accustomed to and is ultimately linked to a wage that he receives, but because he is self-interested and feels satisfied and self-appreciative of their performance. For example, a worker who does not master his work because it does not mean a lot to him but also because it is linked to the material return, that is, he has a materialistic view and not a self-moral view towards this work, such as a nurse who practices her profession with a sense of humanity what she is doing. He feels what he is doing, which is the essence of achievement, like a lecturer that makes every effort to deliver his scientific message to his students. All of this expresses a feeling of the moral dimension of the work, for the psychologically empowered individuals do not represent work for them just a material return only, but rather a moral far beyond the materialistic view.

Competence: It means the feeling of ability to perform, but not only performance but beyond that, that is, the ability to achieve the highest levels of performance. Self - Competence is based on belief in abilities (the ability to self-learn, continuous improvement, and acquire skills) to perform tasks efficiently, effectively, and with high quality.

Self-determination means self-exclusivity in the way of performance, i.e., the employee has a particular way of accomplishing his work in the way he deems appropriate and is independent of himself if he has his unique style in performing his tasks or creating his style.

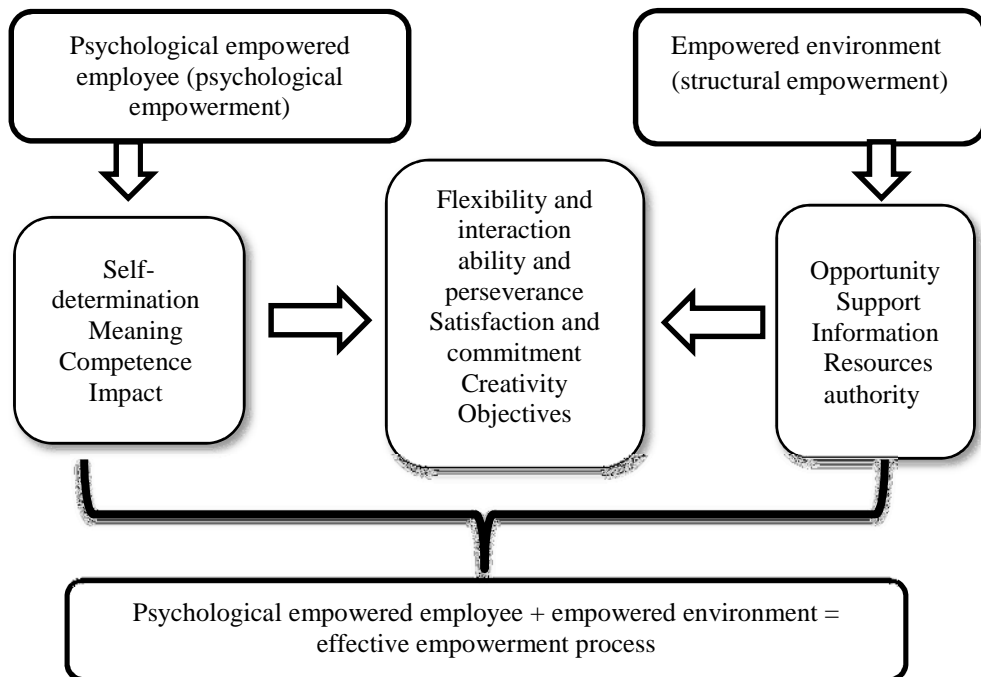
Impact is the influence on the results of his work and the individual's feeling of his ability to change, improve or modify the result of his work, or contribute to decisions in his work environment, and that he has an imprint and an audible voice among his peers at work, and that he can express his opinion and contribute to the change of results and decision-making.

For instance, organizations that fulfil the conditions of structural empowerment in a business environment will achieve staff satisfaction. Also, structural empowerment will push employees to increase their profitability. At the same time, the absence of psychological empowerment elements for employees will make the empowerment process challenging and not achieve the intended purpose. Business organizations with an empowered business environment (structural empowerment) and employees who do not feel the conditions of psychological empowerment cannot achieve the following outputs: satisfaction, commitment, creativity, and achieving goals. The success of the empowerment process is the availability of both sides of psychological and structural empowerment. Empowerment must be based on

something other than the administration's efforts toward providing an enabling environment for workers. It is only possible to focus on the psychological aspect of the worker and his feeling that he is self-effective with some incentives in his work environment. Therefore, it can be said that:

Psychologically empowered employee + empowered environment = effective empowerment process. The relationship is complimentary, and the success of the empowerment process, both psychological and structural, is a means to achieving organizational goals. The following figure illustrates this:

Figure 1. Structural empowerment and psychological empowerment relationship



Source: elaborated by researchers

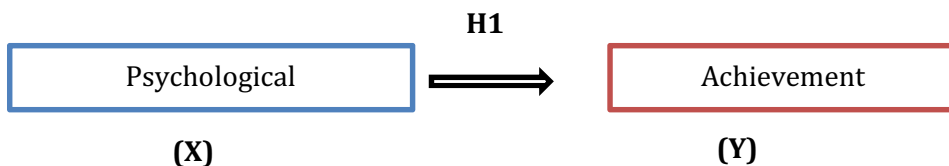
Nevertheless, achievement motivation is a personal and internal psychological motivation that enables individuals to pursue valuable work and motivates them to achieve their objectives (Singh, 2011). It is an individual's success or determination to achieve an objective. Achievement motivation also refers to excellence-seeking (Werdhiastutie et al., 2020; Zuber, 2023). Additionally, it is the motivation to overcome obstacles, build strength, and work as rapidly as possible on complex tasks to achieve internal or external objectives (Michel et al., 2022; Ran, 2022). Achievement motivation is the achievement-oriented behavior of a person that depends on three parts: The first part is the individual's willingness. Second is the

probability of success, and third is the individual's perception of the value of the task (Atkinson & Feather, 1966). It all involves persevering with tasks vital in carrying and performing them (Wigfield & Eccles, 2000). Bakar et al. (2010) claimed that achievement motivation is an individual's internal desire to succeed. It empowers individuals to pursue work they see as valuable and motivates them to reach their goals. Additionally, the motivation for achievement is the tendency to approach success and the desire to avoid failure.

As a human phenomenon, achievement motivation is characterized by characteristics. It is a psychological phenomenon vital to success and achievements (Awan et al., 2011). Achievement motivation refers to using time and energy to achieve goals. Achievement motivation involves directing behavior to achieve specific goals in certain situations (Aydın & Coskun, 2011). Thus, achievement motivation is characterized by an invisible, future, unrestrained internal state that causes people to act in a certain way (Affum-osei et al., 2014). For PhD researchers, psychological empowerment is to enhance the self-efficiency of research students by expanding their powers, enriching their information and motivating them. Nonetheless, motivation for student achievement refers to the internal and external encouragement provided to students learning to modify their behavior. The desire to succeed; support and need in learning; future targets and ambitions; gratitude in learning; engaging tasks in learning; and a conducive learning environment are indicators of student achievement motivation (Dwijuliani et al., 2021).

This research paper seeks to achieve several objectives. It defines the theoretical concept of psychological empowerment and achievement motivation and literature reviews. Determining the level of psychological empowerment PhD students feel its relationship to their achievement motivation. Also, to verify the relationship of psychological empowerment with achievement motivation among PhD students and reach results and recommendations to benefit from them scientifically and in educational practice. Hence, the subsequent hypothesis is suggested:

H1: Psychological empowerment has a positive impact on achievement motivation among PhD students.



Source: elaborated by researchers

3. Research Method

The study population is composed of business PhD students in Algerian universities. The sample was random, consisting of 307 PhD students. The data was collected using an electronic questionnaire. A questionnaire consisting of three axes was developed. The first axis was related to demographic information, gender, age, academic specialization, and academic level. The second axis dealt with psychological empowerment with four dimensions: competence, self-determination, meaning, and impact. The third axis dealt with items of achievement motivation.

Table 1. Instrument Sources and Number of Items

Constructs	Total of items	Sources
Achievement motivation	05	Albeltagi (2016)
Psychological Empowerment	15	Dust et al.(2018) Spreitzer (1995)
Impact (PEI)	03	
Meaning (PEM)	04	
Self-determination (PES)	04	
Competence (PEC)	04	

Source: The authors' process data using Smart PLS 4

Table 2. Characteristics of the study sample

	Category	Frequency	Percentage (%)
Gender	Male	162	52.8 %
	Female	145	47.2 %
Age	Less than 25 years old	21	6.8 %
	Between 25 and 35 years old	177	57.7 %
	Between 36 and 45 years old	95	30.9 %
	Between 46 and 55 years old	14	4.6 %
Scientific specialization	Management sciences	132	43.0 %
	Economic sciences	72	23.5 %
	Commercial Sciences	54	17.6 %
	Accounting and financial sciences	49	16.0 %
Educational level	First -year PhD	130	42.3 %
	Second -year PhD	36	11.7 %
	Third -year PhD	70	22.8 %
	Fourth -year PhD	68	22.1 %
	Fifth -year or more	3	1.0 %
	Total	307	100 %

Source: The authors' process data using Smart PLS 4

Table 3. Descriptive statistics of scale items

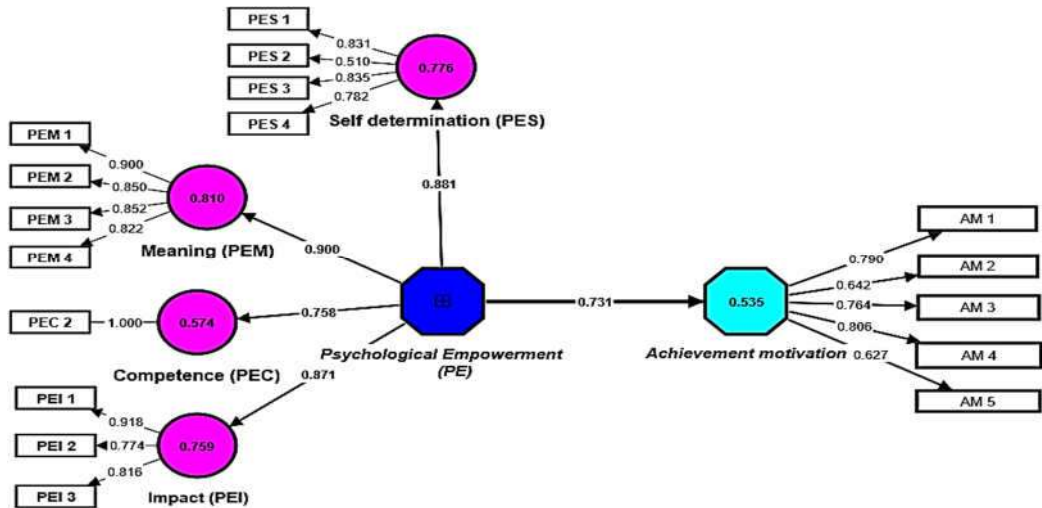
Code	Item	Min	Max	Mean	SD
PEM 1	Graduate studies are meaningful to me personally.	1	5	4.302	1.002
PEM 2	The supervisor's advice and guidance have meaning.	1	5	4.038	1.181
PEM 3	The research I do makes me feel valued.	1	5	4.151	1.071
PEM 4	I seek self-fulfillment through my research.	1	5	3.868	1.332
PEC 1	I am distressed by my lack of research competence.	1	5	Deleted	
PEC 2	I trust my abilities when I do research.	1	5	4.038	1.081
PEC 3	I master the skills needed to do research.	1	5	Deleted	
PEC 4	I follow training courses to acquire new research skills.	1	5	Deleted	
PES 1	The supervisor gives me complete autonomy to carry out my research.	1	5	4.094	1.103
PES 2	On my own, I can decide how to do my research.	1	5	3.208	1.558
PES 3	I have the space to tell my supervisor about the difficulties of my research	1	5	3.962	1.197
PES 4	I can consult the supervisor without hesitation.	1	5	3.792	1.419
PEI 1	I have a good relationship with my supervisor.	1	5	4.170	1.023
PEI 2	I can influence decisions about my research with my supervisor.	1	5	3.623	1.363
PEI 3	The supervisor's experience influences me, and I try to benefit from it.	1	5	3.849	1.365
AM 1	I focus more on the high quality of my research content than quantity.	1	5	3.981	1.107
AM 2	I do not wait for meaningful opportunities; I create them.	1	5	3.585	1.420
AM 3	I ensure that my tasks are completed promptly.	1	5	3.528	1.382
AM 4	I work more effectively when there is leadership.	1	5	3.887	1.341
AM 5	I strive, through research, to address existing societal problems.	1	5	3.774	1.238

Source: The authors' process data using Smart PLS 4

4. Evaluating the Measurement Model

The present research paper used PLS-SEM analysis and a reflective-formative model to acquire the study results.

Figure 2. Measurement Model



Source: The authors' process data using Smart PLS 4

Table 4. Results of Measurement Model

First Order Construct	Second Order Construct	Scale type	Items/Dimensions	Loadings	AVE	CR
Achievement motivation		Reflective	AM 1 AM 2 AM 3 AM 4 AM 5	0.790 0.642 0.764 0.806 0.627	0.533	0.849
Impact (PEI)		Reflective	PEI 1 PEI 2 PEI 3	0.918 0.774 0.816	0.703	0.876
Meaning (PEM)		Reflective	PEM 1 PEM 2 PEM 3 PEM 4	0.900 0.850 0.852 0.822	0.733	0.917

Self-determination (PES)		Reflective	PES 1 PES 2 PES 3 PES 4	0.900 0.850 0.852 0.822	0.565	0.834
Competence (PEC)		Reflective	PEC 1 PEC 2 PEC 3 PEC 4	Delete 1 Delete Delete	1	1
	Psychological Empowerment	Reflective	Impact PEI Meaning PEM Self-determination PES Competence (PEC)	0.871 0.900 0.881 0.785	0.519	0.932

Source: The authors' process data using Smart PLS 4

Construct reliability, convergent validity, and discriminant validity have been assessed to evaluate the measurement model, as shown in Figure 2 and Table 4, respectively. Therefore, the reliability indicator was evaluated by determining the factor loading of the items. As shown in Table 1, all items received a score greater than 0.5, except for PEC 1, PEC 3, and PEC 4, which were eliminated due to their low loadings. In addition, composite reliability (CR) was assessed to validate the construct reliability. The outcome indicated that every value was greater than 0.7 (Hair et al., 2016). However, average variance extracted (AVE) has been utilized to evaluate the convergent validity. The results of this model showed that the AVE values were more than 0.5 (Hair et al., 2010).

5. Discriminant validity Results

In The Fornell-Lurker metric, which represents the comparison between the square root of AVE and the correlations of each variable with its corresponding variables, determines discriminant validity. Accordingly, the square root of AVE for all variables is greater than the correlations with the other variables in the model (Fornell & Larcker, 2014); Table 5 shows this. Thus, the discriminant validity is well established between the variables. In addition, it indicates no overlap between the independent study variables that belong to the dimension they represent (Rabhi et al., 2023).

Table 5. Fornell-Lurker Criterion Analysis for Discriminant Validity

	Achievement motivation	Competence (PEC)	Impact (PEI)	Meaning (PEM)	Self-determination (PES)
Achievement motivation	0.730				
Competence (PEC)	0.626	1.000			
Impact (PEI)	0.564	0.510	0.838		
Meaning (PEM)	0.691	0.649	0.694	0.856	
Self-determination (PES)	0.591	0.676	0.761	0.641	0.751

Source: The authors' process data using Smart PLS 4

Table 6 depicts the results of the HTMT test (Heterotrait-monotrait ratio). For instance, it refers to the mean value of the indicator correlations among constructs relative to the geometric mean value of the overage correlations that measure the constructs. Henseler et al. (2015) propose a threshold value 0.90 for structural models with conceptually very similar constructs. Based on the results, the HTMT also confirmed that the discriminant between the variables was established except for the HTMT value between the impact PEI and self-determination, which was 0.960.

Table 6. Heterotrait-monotrait ratio (HTMT) Matrix

	Achievement motivation	Competence (PEC)	Impact (PEI)	Meaning (PEM)
Competence (PEC)	0.707			
Impact (PEI)	0.681	0.556		
Meaning (PEM)	0.829	0.692	0.811	
Self-determination (PES)	0.750	0.760	0.960	0.772

Source: The authors' process data using Smart PLS 4

6. The Results of the Structural Model

The obtained outputs of Table 7, 8, 9 informed that the r-square value indicates that.

Table 7. R-square

	R-square	R-square adjusted
Achievement motivation	0.535	0.525

Source: The authors' process data using Smart PLS 4

Table 8. *f-square*

	f-square
Psychological Empowerment -> Achievement motivation	1.149

Source The authors' process data using Smart PLS 4

Table 9. *Path Coefficient Test & Significance of effect*

Hypothesis	Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	Decision
H1	PE->AM	0.731	0.723	0.114	6.418	0.000	Supported

Source: The authors' process data using Smart PLS 4

Psychological empowerment can explain 53.5% of the variance in the Achievement motivation construct, while the remaining 46.5% is explained by other constructs not examined in this study. For the effect, if the effect size < 0.02 , it is assumed to have no effect (Loan et al., 2023). Similarly, f^2 values of 0.02, 0.15, and 0.35 correspond to weak, moderate, and substantial effects, respectively (Cohen, 1988; Rabhi et al., 2023). The *f-square* of this model is 1.149. Furthermore, psychological empowerment significantly affects achievement motivation, with $P\text{-Values} = 0.000 < 0.05$ (Hypothesis Accepted); it means a significant and direct positive effect is obtained.

7. Conclusion and Recommendations

Psychological empowerment is considered one of the relatively recent topics, and it expresses a sense of the individual's self-efficiency in performing his tasks and a sense of the value and meaning of work. In contrast, achievement motivation expresses the individual's desire to be successful, and motivation is stimulated through internal and external factors. The present study attempted to link psychological empowerment and its relationship to achievement motivation among PhD students from different colleges through an electronic questionnaire. The PhD study period is an important and difficult stage for the student because of the challenges. In this regard, Burgos et al. (2020) confirmed that students face various pressures, such as responding to greater academic demands, changes in the social support network, more independence and heroism, professional failure or academically, living on their own if they come from the province, as far as university

education has its necessities and challenges. The study reached several results after analyzing the standard and structural model. Composite reliability, that is, all values were greater than 0.70; that is, the level of internal consistency between the study factors is considered high. Psychological empowerment explained achievement motivation by 53%, and the remaining 47% represents factors not studied in the model. There is an influence relationship between psychological empowerment and achievement motivation 1.149, which is a high effect. Psychological empowerment significantly affects achievement motivation, with P-Values = 0.000 < 0.05.

The study also recommends enhancing achievement motivation among PhD students through moral support, guidance, scientific guidance, material support, and motivation to continue scientific research and organizing scientific events. Also, it is necessary to increase psychological empowerment among doctoral researchers. Studying the present topic on different populations and environments is required for the future.

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