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PROPOSAL FOR TOOL TO EVALUATE INDUSTRY 4.0 DRIVERS AND BARRIERS

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Purpose: The objective of this paper is to present the process of developing a research tool designed to evaluate the enablers and obstacles to the adoption of Industry 4.0, with a particular emphasis on small and medium-sized enterprises (SMEs) in Poland's automotive sector.
Design/methodology/approach: The study employs an extensive review and analysis of relevant literature, emphasizing Industry 4.0 implementation dimensions, maturity frameworks, and readiness evaluation models. A structured survey tool and a proposed framework for result visualization are developed to analyze drivers and barriers within specific functional domains.
Findings: The developed research instrument will enable prioritization of the identified enablers and obstacles to Industry 4.0 adoption based on their influence across various implementation dimensions. Visualization of the outcomes will reveal both the current state and target goals of organizations, providing actionable insights for development.
Research limitations/implications: The study is constrained by the subjective selection of functional domains and the number of Industry 4.0 dimensions considered. Pilot tests are expected to refine the methodology and provide further clarity and enhancements.
Practical implications: The insights derived from this research will offer tangible benefits to SMEs by identifying actionable strategies to address challenges and maximize opportunities in Industry 4.0 transformation. These findings can support effective decision-making and planning for digitalization initiatives in the automotive sector.
Originality/value: This research introduces a unique perspective by integrating the factors of location, sector, and enterprise size in the analysis of Industry 4.0 adoption. The proposed visualization approach and tailored research instrument provide significant value, especially for SMEs in the automotive field.
Keywords: Industry 4.0, Research tool, Performance, Drivers, Barriers, Solutions.
Category of the paper: Empirical research results.

1. Introduction

Recent research (Veile et al., 2020) shows that the latest technological developments in Industry 4.0 are reshaping future processes and interactions between stakeholders. Changes influence social, environmental, and technological aspects of our activities. Two phenomena which are Industry 4.0 and Sustainable Development can address some of the biggest issues we face as a global community, but at the same time can be a driving force for local actions within a company. Much of the work in this area concerns corporate social responsibility and the use of modern technology, for example to reduce a company's carbon footprint or implement energy transition. These two dimensions have been taken as an example to present the results of the following study.

Implementing modern technology is often a solution to the difficulty of finding employees with the right competencies. It can be a response to a lack of resources or the needs to improve operational efficiency. However, implementing Industry 4.0 solutions requires the right approach, preparation, and resources (Hilkenmeier et al., 2021). What is more, "organizational culture can affect employees' attitude towards change" (Michna, Kmieciak, 2020). Each case of implementing a new Industry 4.0 technology has specific driving forces as well as many barriers and obstacles that need to be addressed and skillfully managed in each of the functional areas of organizations. The subject literature (Horvat et al., 2018; Kiel et al., 2017; Müller et al., 2018) addresses the implementation of Industry 4.0 in specific economic conditions, e.g. developing economies, in specific economic sectors, e.g. production enterprises, as well as in organizations varying in size, e.g. large enterprises or small and medium-sized enterprises. The literature research carried out identified a research gap, the filling of which is the aim of the planned research, namely the combination of all the factors mentioned: location of the enterprises, sector of activity, and size of the enterprise. Therefore, the research subject were small and medium-sized production organizations operating in the automotive sector in Poland. These companies are mainly suppliers of materials and components.

This study aims to present and discuss the developed research tool which will be used to explore this specific interaction between the driving forces & barriers, and Industry 4.0 dimensions in functional areas of small and medium-sized enterprises. The presented results are a continuation of recent studies on maturity models, barriers and drivers in Industry 4.0 implementation and dimensions in functional areas of manufacturing organizations (Michna et al., 2021; Michna, Kruszewska, 2020, 2021, 2022).

2. Driving forces and barriers

Firstly, driving forces and barriers were identified from the literature research (Bajic et al., 2021; Grabowska, 2021; Horváth, Szabó, 2019; Karamitsos et al., 2010; Kiel et al., 2017; Michna et al., 2021; Müller, 2018, 2019; Stentoft et al., 2019; Türkeș et al., 2019; Veile et al., 2019; Vuksanović Herceg et al., 2020). The raw list includes, on the one hand, the factors influencing the decision to implement Industry 4.0 solutions as well as the reasons why organizations decide to change or adopt a new technology, and, on the other hand, a list of obstacles that block or hinder the implementation of changes. In many cases, a given driving force can also act as an inhibiting factor, such as "Lack of qualified work force" or "Finance". The raw list of barriers and drivers follows the PESTEL breakdown into political, social, environmental, technological, economic and legal factors. Table 1 presents the results for driving forces and Table 2 for barriers.

Table 1.
Driving forces for Industry 4.0 implementation

Group	**Drivers from literature sources:** (Müller et al., 2018)	(Stentoft et al., 2019)	(Horváth, Szabó, 2019)	(Vuksanovic Herceg et al., 2020)	(Kiel et al., 2017)
P – Political	• New business models • New product offerings • Increased competitiveness	• A deliberate strategy for Industry 4.0 • Cost reduction • Improved time-to-market • Implementation of Industry 4.0 by competitors • Initiation of work in cooperation with public advisory systems	• Growing competition • Increased innovation capacity • Opportunity for business model innovation • Market competition • Increasing pressure from competitors • Tracking market trends • Demand for greater control (from top management) • Continuous monitoring of company performance	• Competitiveness • Business model innovation	• Novel business models • Competitiveness • Expansion and protection of market shares • Innovative offerings
E – Economical	• Increasing efficiency • Decreasing costs • Higher quality • Increasing speed • Increasing flexibility • Load balancing • Stock reduction		• Increasing productivity • Financial and performance factors • Reducing costs, e.g. human resources, inventory management, and operating costs • Reducing the error rate • Improving lead times (compliance with market conditions) • Improving efficiency • Ensuring reliable operation (e.g. less downtime) • Financial resources and profitability	• Cost reduction • Performance improvement	• Finance • Growing sales volumes • Several cost reduction potentials • Shorter set-up and lead times • Faster machine speed • Facilitate faster and more flexible response to customer demands • Decrease of time-to-market • Reduction of non-value-adding activities and time

Cont. table 1.

S – Social	• Reduction of monotonous work • Age-appropriate workplaces	• Lack of qualified work force	• Support for management activities • Increasing labor shortages • Reducing human work • Allocating workforce to other areas (higher added value)	• Labor market changes	• Resource efficiency • Higher quality of work • Optimized human-machine interaction • Higher safety features • Employee involvement • Security of employment • Novel jobs
L – Law		• Legal requirements • Changed legislation (e.g. CE labeling) • Customer requirements	• Customer requirements • Customers' expectations	• Customer requirements • Customer needs	
	(Kiel et al., 2017)				
T – Technological	• Overall equipment effectiveness • Optimization of product and process quality • Higher productivity • Machine availability • Production process and output robustness • Lower scrap and failure rates • Self-optimization of machinery • Access to data and information • Flexible production • Tailoring the offer of products, services and hybrid solutions to customer needs – customization				
	(Müller et al., 2018)		(Stentoft et al., 2019)		
E – Environmental	• Reduction of environmental impact		• Efforts to save energy and improve sustainability		

Source: own work.

Table 2.
Barriers for Industry 4.0 implementation

Group	Barriers from literature sources:				
	(Müller et al., 2018)	**(Stentoft et al., 2019)**	**(Horváth, Szabó, 2019)**	**(Vuksanovic et al., 2020)**	**(Kiel et al., 2017)**
P – Political	• Existing business models endangered • High level of standardization • Too much Transparency • Loss of flexibility	• Lack of standards • Lack of understanding of strategies and the importance of I4.0 • Greater focus on operations at the expense of business development	• Standardization problems • Difficulty of coordination across organizational units • Lack of conscious planning: defining goals, steps and needed resources • Inadequate organizational structure and process organization • Contradictory interests in different organizational units	• Organizational challenges (planning system, protocols, coordination)	• Threatened future viability • Missing out on technological trends • Following wrong standards • Organizational transformation
E – Economical	• Loss of flexibility • High implementation costs • High effort, e.g. for standardization	• Too few financial resources	• Shortage of financial resources • Risk of fragility • Return and profitability • Shortcomings in tendering systems • Long evaluation period for tenders	• Financial issues	• Financial resources & profitability • High investments into technology development • Skilled workers and data security • Uncertain profitability

Cont. table 2.

S – Social	• Employee fear and concerns • Lack of expertise	• Too few human resources • Lack of qualified workforce • Lack of knowledge about I4.0 • Needs for continued education of employees • Lack of employee readiness • Lack of understanding the interaction between technology and human	• Human resources • Working conditions • Lack of planning skills and activities performance • Organizational resistance • Lack of appropriate competences and skilled workforce • Longer learning time (training of staff) • Lack of a leader with appropriate skills, competencies, and experience • Resistance by employees and middle management • Lack of willingness to cooperate (at the supply chain level) • Lack of proper, common thinking	• Managers' and employees' competences • Resistance	• Qualification of employees for process planning and coordination responsibilities • Needs of adequate training and development approaches • Long-term employee loyalty against the background of skilled worker shortage
T – Technological		• Lack of data protection (cybersecurity)	• Concerns about cybersecurity and data ownership issues • Technological integration • Lack of a unified communication protocol • Lack of back-end systems for integration • Lack of standards incl. technology and processes • Unsafe data storage systems • The need for large amounts of storage capacity		• Regionally limited bandwidth and Internet transfer speed
	(Kiel et al., 2017)				
L – Law	• Legal regulations of data ownership • Legal regulations of security aspects • Understanding of specific customer requirements				

Source: own work.

In the next step, all items were grouped by theme and area of interest. The final list of drivers and barriers is presented in Table 3. The political factors include internal and external considerations, government policy, but also internal company policy, including the organization's strategy. The economic factors are financial issues, efficiency, effectiveness, productivity, costs, profits, savings, etc. The social factors are related to work conditions and human resources while technological ones are broad technical requirements, constraints, and guidelines. The environmental factors are connected with improving sustainability and reducing the environmental impact. The legal factors concern customer requirements, law, and regulations.

Table 3.
Drivers and barriers for Industry 4.0 implementation

Group	Drivers	Barriers
P – Political	• New business models • Business model innovation • Opportunity for business model innovation • New product offerings • Innovative offerings • Increased innovation capacity • Increased competitiveness • Tracking market trends • Expansion and protection of market shares • Market competition • Competitiveness • Increased competitiveness • Increasing pressure from competitors • Implementation of Industry 4.0 by competitors • Improved time-to-market • Cost reduction • A deliberate strategy for Industry 4.0 • Demand for greater control (from top management) • Continuous monitoring of company performance • Initiation of work in cooperation with public advisory systems	• Existing business models endangered • High level of standardization • Lack of standards • Standardization problems • Following wrong standards • Lack of understanding of strategies and the importance of I4.0 • Lack of conscious planning: defining goals, steps, and needed resources • Inadequate organizational structure and process organization • Contradictory interests in different organizational units • Difficulty of coordination across organizational units • Organizational challenges (planning system, protocols, coordination) • Greater focus on operations at the expense of business development • Missing out on technological trends • Too much transparency • Threatened future viability
E – Economical	• Improving efficiency • Increasing productivity • Performance improvement • Load balancing • Shorter set-up • Shorter lead times • Faster machine speed • Reduction of non-value-adding activities and time • Increasing speed • Increasing flexibility • Facilitate faster and more flexible response to customer demands • Decrease of time-to-market • Growing sales volumes • Reducing the error rate • Ensuring reliable operation (e.g. less downtime) • Higher quality • Stock reduction • Costs reduction, e.g. human resources, inventory management, and operating costs • Finance • Performance factors	• High implementation costs • Too few financial resources • Lack of financial resources • High investments into technology development • High investments into skilled workers • High investments into data security • High effort, e.g. for standardization • Risk of fragility • Return and profitability • Loss of flexibility • Shortcomings in tendering systems • Long evaluation period for tenders

Cont. table 3.

S – Social	• Reduction of monotonous work • Age-appropriate workplaces • Novel jobs • Lack of qualified work force • Increasing labor shortages • Labor market changes • Security of employment • Reducing human work • Allocating workforce to other areas (higher added value) • Resource efficiency • Support for management activities • Higher quality of work • Optimized human-machine interaction • Higher safety features • Employee involvement	• Employee fear and concerns • Organizational resistance • Resistance by employees • Resistance by middle management • Lack of employee readiness • Lack of expertise • Lack of knowledge about I4.0 • Lack of qualified workforce • Needs for continued education of employees • Lack of appropriate competences and skilled workforce • Managers' competences • Employees' competences • Longer learning time (training of staff) • Needs of adequate training and development approaches • Qualification of employees for process planning and coordination responsibilities • Lack of planning skills and activities performance • Lack of a leader with appropriate skills, competencies and experience • Lack of proper, common thinking • Long-term employee loyalty against the background of skilled worker shortage • Too few human resources • Lack of understanding the interaction between technology and human • Working conditions • Lack of willingness to cooperate (at the supply chain level)
T – Technological	• Overall equipment effectiveness • Optimization of product and process quality • Higher productivity • Machine availability • Production process and output robustness • Lower scrap and failure rates • Self-optimization of machinery • Access to data and information • Flexible production • Tailoring the offer of products, services, and hybrid solutions to customer needs – customization	• Lack of data protection (cybersecurity) • Concerns about cybersecurity and data ownership issues • Unsafe data storage systems • Concerns about data ownership issues • Technological integration • Lack of a unified communication protocol • Lack of back-end systems for integration • Lack of standards incl. technology and processes • The need for large amounts of storage capacity • Regionally limited bandwidth and Internet transfer speed
E – Environ-mental	• Reduction of environmental impact • Efforts to save energy • Efforts to improve sustainability	
L – law	• Legal requirements • Changed legislation (e.g. CE labeling) • Customer requirements	• Legal regulations of data ownership • Legal regulations of security aspects

Source: own work.

3. Dimension of Industry 4.0 implementation and functional areas

The International Standard ISO 9001 issued in 2015 ("ISO 9001", 2015) defines the functional areas and describes the entire organization; from the establishment of the organization's structure, its processes, the required resources, through operational activities such as production, quality and logistics, to standardizing and managing changes. The map of the process and the interrelations between them help to define the functional areas: management processes (business management, quality management system, human resources management, environmental management, occupational health and safety, etc.), core processes (sales, marketing, design, product development, engineering, production management, customer service, etc.), and supporting processes (maintenance, purchasing, quality control/assurance, finance and accounting). Table 4 shows the established list of functional areas for further research.

In order to verify the scope of Industry 4.0 dimensions another literature study was carried out, this time on the maturity models and the readiness to implement Industry 4.0 solutions (Amaral, Peças, 2021; Ariffin, Ahmad, 2021; Aziz et al., 2018; Baumgartner, Ebner, 2010; Caballero et al., 2008; Colli et al., 2019; Dobrowolska, Knop, 2020; Grabowska, 2021; Grufman, Lyons, 2020; Hamidi et al., 2018; Kryukov et al., 2022; Lucato et al., 2019; Mittal et al., 2018; Soomro et al., 2021; Sreedhanya, Balan, 2023; Stawiarska et al., 2021; Torres da Rocha et al., 2022; Yadav et al., 2020). The previous analysis and the results of the literature research, led to the development of a set of Industry 4.0 dimensions and, based on the area of interest, responsibility and competence, assigned to the functional areas of the organization. The final result of this analysis is presented in Table 4.

Table 4.
Functional areas and dimensions of Industry 4.0 implementation

#	Functional areas	Dimensions
1	Company management	Business
		Business based smart operations
		Business model
		Change management
		Competitiveness perspective
		Corporate strategy
		Critical areas of intervention
		Digital business model and customer access
		Enact & Envision
		Governance
		Legal considerations
		Management
		Management strategy & organization
		Organization and democratization
		Organizational alignment
		Organizational structure
		Strategic level
		Strategy
		Strategy & organization
		Structure
2	CSR/ESG/EHS	CSR activities
		Environment
		Health and safety
		Society
		Socio-environmental level
		Sustainable development
3	Finance management	Asset management
		Financial level
		Law and tax

Cont. table 4.

4	HR management	Collaboration
		Communication
		Company culture
		Competences
		Culture
		Employee relationships
		Employees
		Employer branding
		Flexible working models
		HR development strategy
		Human resources
		Knowledge management
		Leadership
		Learning competence
		Organization employees' digital culture
		People
		Professional competence
		Resources
5	IT management	Acceptance and application of new technology and media
		Agile IT structure
		Application management
		Cross-sectional technology criteria
		Data and analysis as a key capability
		Data driven services
		Data governance
		Database integration
		Degree of networking
		Digitizing horizontal and vertical integration of the value chain
		Factory of the Future
		Horizontal integration
		Information
		Information and communication
		Information systems
		Integration
		IT security
		Location of data use
		Security
		Smart Factory
		Technology
		Time horizon of data analytics
		Vertical & horizontal integration
		Vertical integration
		Virtual world
6	Logistic management	Distribution control
		Inter-firm cooperation
		Logistic management
		Supply chain
		Value chain
7	Maintenance management	Physical world
		Resources
		Tool identification
8	Product management	Design
		Digital product development
		Digitalization of product portfolio
		Innovation ecosystem
		Innovation perspective
		Offered product and services
		Product innovation management
		Production management
		Products and services
		Smart product
		Technology based smart products

Cont. table 4.

9	Production management	Determining the residual tool life
		Enable
		Functional
		Manufacturing and operations
		Operational & process level
		Operations
		Organization of production & logistics
		Process
		Process orientation
		Process transformation
		Smart operations
		Technical aspects (production)
		Technology management
10	Quality management	Complaint handling
		Customers
		Degree of standardization
		Quality management

Source: own work.

4. Levels of implementation

The levels of maturity or readiness for implementing Industry 4.0 are defined differently in the subject literature, although a 5-point Likert scale is most commonly used (Ariffin, Ahmad, 2021; Baumgartner, Ebner, 2010; Caballero et al., 2008; Colli et al., 2019; Grufman, Lyons, 2020; Kryukov et al., 2022; Mittal et al., 2018; Stawiarska et al., 2021). Authors define the levels and their scope in different ways. An example of these definitions is shown in Table 5. (Ariffin, Ahmad, 2021) defined Level 1 as an "Initial" which was explained as: "There is a presence of the process, but it is unexpected with a weak control and reactive"; Level 2 – "Managed" as: "There is a project specified process but in reactive form"; Level 3 – "Defined" means: "There is an organizational process in a proactive form"; Level 4 – "Quantitatively Managed" – "The process is wholly measured and controlled" and Level 5 – "Optimizing" where "The process always focuses on improvement". (Grufman and Lyons, 2020) proposed to add Level 0 as an "Outsider" which "indicates that a company either does not know of Industry 4.0, thinks it is irrelevant or has not taken any steps towards an implementation"; Level 1: "Beginner" – "Company involves some steps taken towards Industry 4.0, such as doing pilot studies and having some system compatibility for industry 4.0."; Level 2: "Intermediate" – "Companies have implemented industry 4.0 to some extent into their strategies, and some investments are being made"; Level 3: "Experienced" – "Is assigned to companies that have an Industry 4.0 strategy, makes investments in more than a few areas. Also, necessary IT security is implemented, cloud is used for future expansions"; Level 4: "Expert" – "Companies already using and monitoring Industry 4.0, make investments in almost all areas, supported by interdepartmental innovation, IT-systems support almost all production and collect vast amounts of data also used for optimization"; Level 5: "Top performer's" – "Companies that have already implemented their Industry 4.0 strategy and monitor implementations of other projects in the company, which is supported by investments across the company. The innovation department is covering the entire company; IT systems are fully implemented along with autonomous processes, collecting vast amounts of relevant data. The infrastructure fulfills all needs for integration, across the company's system (…). The IT architecture is flexible, IT security is at a comprehensive level and the competencies in the company are all expertise they need". Kryukov et al. (2022) proposed to focus on digitization and provide the following definition: Level 1: "Initial – Infrastructure, systems and services do not allow to get business effects from process automation"; Level 2: "Performed – Infrastructure consolidated, basic automation systems implemented, processes formalized"; Level 3: "Managed – The infrastructure meets the needs of enterprise management, a corporate management system is implemented, processes are managed and controlled"; Level 4: "Predictable – A single corporate information space has been created, systems and services automatically generate reports and forecasts in real time, the state of processes is predictable"; and final Level 5: "Optimizing – Infrastructure, systems and services adapt to the needs of the enterprise, process management is digitized".

Table 5.
Level of maturity/readiness for Industry 4.0

Source	Level of maturity/readiness					
	0	1	2	3	4	5
(Caballero et al., 2008)		Initial	Defined	Integrated	Quantitatively managed	Optimizing
(Baumgartner, Ebner, 2010)		Beginning	Elementary	Satisfying – acc. to requirement	Exceeds requirements	Outstanding/ sophisticated
(Mittal et al., 2018)	Incomplete	Performed	Managed	Established	Predictable	Optimizing
(Colli et al., 2019)		None	Basic	Aware	Autonomous	Integrate
(Grufman, Lyons, 2020)	Outsider	Beginner	Intermediate	Experienced	Expert	Top performer
(Ariffin, Ahmad, 2021)		Initial	Managed	Defined	Quantitatively managed	Optimizing
(Stawiarska et al., 2021)		Digitalization initiation	Basic digitalization	Departmental digitalization	Interdepartmental digitalization	Full digitalization – Top level of I4.0
(Kryukov et al., 2022)		Initial	Performed	Managed	Predictable	Optimizing

Source: own work.

For further research also 5-point Likert scale will be used. The definition proposed by (Stawiarska et al., 2021) has been adapted as: Level 1 – Non or initiation, Level 2 – Basic implementations, Level 3 – Departmental implementations/reactive approach, Level 4 – Interdepartmental implementations / proactive approach, Level 5 – Full implementation/system approach.

5. Research tool – GRID model

The planned research of drivers and barriers in Industry 4.0 solutions implementation is to be performed in SME from automotive sector in Poland. Manufacturing companies especially in automotive area have to be competitive and flexible because of fast development and multiple requirements and regulations. Small and medium-sized enterprises in this sector often have difficulties with finance, time, pressure, staff competence. This industry needs new technological solutions. The planned study aims to verify the factors that make SMEs in this sector decide to implement technology 4.0 and to check the barriers that hinder the introduction of projects in this area. Systematizing the strength of the interactions on the various dimensions of implementing Industry 4.0 in each functional area is intended to identify aspects on which the organization should focus first.

The survey questionnaire has two parts: metric and main questionnaire. The main questionnaire contains three groups. The first group of questions relates to the actual technologies of Industry 4.0 and the technologies that are for future implementation. The second group of questions concerns the driving forces and barriers, broken down into political, economic, social, environmental, technological, and legal factors. The last part of the questionnaire is a matrix with levels of progress in implementing Industry 4.0 in a specific functional area and for a specific dimension of the implementation of new technological solution. Limitations of developed research questionnaire is the subjectivity of choice of the functional areas and the number of dimensions of the implementation. Pilot studies will bring additional value with the guidelines and possible corrections and improvements.

The authors plan to visualize all the results from the planned study based on the designed model: GRID – Goal, Resources, Indicators, Dimensions. Every project, and especially Industry 4.0 projects, should have specific goals. A company that decides to implement new elements must plan its activities accordingly in order to define the end state. The goals in the GRID model represent the target level of progress: level 1 to 5. New technological developments are specific for each of functional areas: logistic, quality, production, maintenance, etc. and should be appropriately selected. Thus, D in GRID model represents the dimension that this particular tool will address and what needs it will cover. Adequate Resources are needed to achieve the target state: staff with specific knowledge and experience, provision of financial resources, timetable, etc. Indicators should serve as metrics to verify each phase of the project, as well as to ultimately verify the effectiveness and efficiency of the measures put in place.

GRID can be a useful tool, as it allows visualization of the target state for each implementation dimension, as well as showing the current state. It can also be used as a tool to plan and monitor the implementation of technology solutions. In this case, the organization would need to define a target for the implementation of a specific technology, e.g. automation of production processes, increased productivity, etc. Another topic to plan and track would be to clearly define the functional areas and their dimensions. It is also important to plan resources accordingly, such as finances, team, infrastructure, etc. Summary and conclusion

The development of the research tool presented in this thesis is mainly based on literature research on topics related to the implementation of Industry 4.0 in small and medium-sized enterprises and models of organizational readiness and maturity. The analyzed literature provided the desired background data in terms of theoretical foundations. Described research tool will be used in planned research covering small and medium-sized production organizations operating in the automotive sector in Poland. Specifically, these companies are mainly suppliers of materials and components. They are all affected by the numerous requirements of the industry, needs of flexibility and competitiveness. Industry 4.0 may be the answer to increasing their efficiency and effectiveness. The proposed research tool will allow obtaining information on the specific driving forces – the reasons why these enterprises decide to implement Industry 4.0 solutions and those elements that significantly hinder these implementations. The results of the final study will rank the identified barriers and factors driving the implementation of Industry 4.0 in terms of the strength of interaction on various dimensions of the implementation of Industry 4. Visualization of the analysis results in individual functional areas using the proposed GRID model will illustrate the current state of the organization and the target state which, in turn, will give measurable utilitarian benefits. This tool can also be used for self-assessment of the organization at the time of making decisions related to the implementation. The limitation of this tool is the number and selected functional areas as well as selected dimensions. It is necessary to carry out a pilot study on the basis of which guidelines for its possible correction and improvement will be developed.

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