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AI implementation and organizational ambidexterity in the context of BPM: Polish service sector experience

Abstract

The development of modern organizations is determined by the generation of a system state in which they will leverage the advancement of modern information and communication technologies (ICT). Artificial Intelligence (AI) stands out as a game changer in this regard. Concurrently, organizations striving for market dominance tend towards ambidexterity, i.e. balancing activities related to exploitation (genotypic operations) and the exploration of innovative areas generating added value. Therefore, a research challenge arises, aimed primarily at increasing the knowledge of ambidexterity and its various forms of achievement through the perspective on leveraging AI potential in the Business Process Management (BPM) context. This paper presents the results of a study conducted among 340 large and medium-sized service enterprises in Poland. The main objective of this research is to identify the characteristics of service enterprises associated with the maturity level of AI implementation, including examining the importance of the ambidexterity approach. The study indicates the potential of implementing the ambidexterity concept balancing exploitative and explorative BPM in association with the level of AI implementation. Research methods include literature review, survey, and statistical analyses (correlation analysis, classification tree). The enterprises surveyed varied greatly in the level of AI implementation maturity. Among the enterprise characteristics available in the study, ambidexterity and its forms turned out to be

the most important factors associated with AI implementation maturity. This research contributes to the advancement of management theory by providing an integrative view of the role of artificial intelligence in achieving ambidexterity in organization.

Keywords: AI, Artificial intelligence, Ambidexterity, BPM.
JEL Classification: L1, L2

Introduction

In the realm of contemporary business dynamics, the concept of ambidexterity has been undergoing a transformation, moving towards a hybridization of approaches and the exploration of novel methods for its realization [Ossenbrink et al., 2019]. This evolution is closely related to the emergence of Industry 4.0 [Ed-Dafali et al., 2023] and the rapidly advancing Industry 5.0 [Chatterjee, Chaudhuri, 2024], which have ushered in a new era in which technology, artificial intelligence (AI) in particular, plays a pivotal role in reshaping the organizational ambidexterity [Van de Wetering, 2022; Wirtz, 2020]. This study explores this transformation, shedding light on the emerging landscape of ambidexterity within the domain of Business Process Management (BPM) substantially influenced by AI. The prominence of AI in contemporary business processes is discussed in the literature [Ahmad, Van Looy, 2020; Mendling et al., 2018; Paschek et al., 2017]. AI, with its machine learning algorithms and data analysis capabilities, provides a valuable tool for enhancing both exploitation and exploration efforts within organizations [Van de Wetering, 2022]. As organizations strive to strike a balance between these seemingly opposing activities, AI presents an opportunity to balance exploitation and exploration. It is worth noting the research indicating that artificial intelligence (AI) is primarily adopted for exploration, research, and development purposes [see: Johnson et al., 2022].

This paper explores the nuanced interplay between structural, contextual and hybrid ambidexterity and the AI implementation level, providing a holistic view of how AI is redefining the pursuit of ambidexterity in the context of BPM. It is within this dynamic landscape that a new era of BPM is emerging, where the fusion of human ingenuity and technological prowess strives to strike the perfect balance in decision making and execution. In the ever-evolving landscape of organizational studies, the convergence of BPM and ambidexterity has become an area of research interest related to BPM issues [see: Binci et al., 2022; Helbin, Van Looy, 2021; Rialti et al., 2018; Sliż, 2023]. While extensive research has delved into the intricacies of balancing exploitative and exploratory processes within organizations, there is a noticeable dearth of comprehensive studies that consider the support of Information and Communication Technologies (ICT), with a particular emphasis on the role of AI, in reshaping the concept of ambidexterity. This research gap underscores the need for an in-depth investigation of the potential of AI implementation for advancing ambidexterity, with a particular focus on different forms of ambidexterity strategies.

As a result, the research problem in the form of a question was formulated as follows: What enterprise characteristics, including ambidexterity approach, enterprise size, scope of operations, and number of market segments, are associated with AI implementation maturity in service organizations? The main aim of this study is to investigate the association between service enterprises characteristics and AI implementation maturity levels, with a special focus on ambidexterity approach. To achieve the objective, the research employs a methodology that includes literature review, survey study and statistical analysis. Through this research, the authors seek to shed light on the transformative potential of AI in redefining the traditional approaches of ambidexterity and its application in the context of BPM. This research topic aligns with the development direction of integrating BPM and ambidexterity outlined in the article (Helbin, Van Looy, 2021), which suggests that a promising avenue for future research is the further integration of concepts from digital innovation with BPM [Mendling, Recker, 2020; Helbin, Van Looy, 2021].

Ambidexterity and BPM: from now to next

The concept of ambidexterity

Ambidexterity, the ability of organizations to balance exploitation and exploration activities, has received considerable attention in both academic and business practice [Vrontis et al., 2017]. This concept, emphasizing the simultaneous pursuit of efficiency and innovation, has remained relevant since the 1970s [Abernathy, 1978] and continues to be a focus of contemporary BPM literature [Bresciani et al., 2017]. Ambidexterity refers to an organization's ability to simultaneously exploit and explore available resources, both internally and externally, to meet current business needs and adapt to market changes [O'Reilly, Tushman, 2013]. This approach recognizes that both exploitation and exploration activities, when performed simultaneously, contribute to an organization's growth and survival in the market [March, 1991].

Ambidexterity involves achieving a balance between exploitation, associated with refinement-related activities, and exploration, related to innovation-related activities [Andriopoulos, Lewis, 2009; Gupta et al., 2006; O'Reilly, Tushman, 2004]. This balance is essential for an organization to dynamically adapt to market changes [O'Reilly, Tushman, 2013]. This balance is crucial for organizational survival and innovation [Chang et al., 2009]. Researchers have proposed different criteria to classify organizational ambidexterity. This approach primarily adopts the classification based on the methods of balancing exploitation and exploration as presented by Constant et al. [2020]. This choice is based on the theoretical perspective of achieving duality at the level of managing business processes, concerning the comparison of exploitation and exploration processes in the organizational system's structure.

The typology, based on ways of balancing exploitation and exploration, distinguishes four key forms of organizational ambidexterity: structural, contextual, sequential and managerial

[Constant et al., 2020]. In this study, the following forms of achieving ambidexterity were identified:

- Structural ambidexterity, the spatial separation of exploitative and exploratory activities, is the key to achieving balance. This involves establishing distinct organizational units for each type of activity. For example, a unit focused on exploitation may have characteristics such as high formalization, strong typicality of activities, and centralization of decision-making authority. In contrast, a unit dedicated to exploration may exhibit low typicality, less formalization, decentralized decision-making, and a greater emphasis on direct employee interactions [Zakrzewska-Bielawska, 2015]. This spatial separation allows each unit to tailor its processes, competencies, and culture to the specific demands of either exploitation or exploration.
- Contextual ambidexterity balances exploration and exploitation within different contexts or environments, complements structural ambidexterity, as they are not seen as alternatives but rather as two elements that can coexist within the same organization [Zakrzewska-Bielawska, 2018]. Contextual ambidexterity recognizes that organizational structure and integration mechanisms should align with the nature and characteristics of exploitative and exploratory activities within the organization. This contextual perspective emphasizes the microfoundations of ambidexterity and how they depend on the daily work activities carried out by employees [Zakrzewska-Bielawska, 2018].
- Hybrid ambidexterity in the context studied is understood as the integration of two types of ambidexterity strategies: structural and contextual. It should also be noted that hybrid ambidexterity includes the possibility of integration with managerial and sequential ambidexterity strategies.

While numerous empirical studies have examined structural and contextual ambidexterity separately, there is currently a deficiency in integrated studies that include both types [Ossenbrink et al., 2019]. In this study, it is adopted from [Ossenbrink et al., 2019] that hybrid approach constitutes a combination (integrated perspective) of structural and contextual ambidexterity. However, organizations employing solely either structural or contextual ambidexterity find themselves constrained in their strategies, which necessitates a fusion of both approaches [Chen, 2017; Jöhnk et al., 2022; Ossenbrink et al., 2019].

The Intersection of BPM and Ambidexterity: Exploring Common Ground

Ambidexterity is characterized by a dynamic equilibrium, which the management system must strive to achieve and maintain by adapting to exogenous and endogenous factors. In the literature, there is a noticeable emphasis on the directions of ambidextrous BPM development, considering that Business Process Management has significantly matured over the last two decades. The techniques, methods, and systems available for scoping, modeling, analyzing,

implementing, executing, monitoring, and even mining a process have been scientifically researched and, in most cases, can be used in practice. In fact, many of these BPM capabilities are nowadays considered commonplace. However, an opportunity-rich environment and rapidly emerging digital disruptions require new BPM capabilities. In the context of BPM, exploitation involves optimizing and improving existing processes, while exploration focuses on exploring new opportunities and innovations [Atuahene-Gima, 2005]. Exploitation aims to enhance current knowledge and efficiency to facilitate incremental innovations. Exploration, on the other hand, seeks to generate new knowledge and identify changes necessary for more radical innovations [Atuahene-Gima, 2005]. Ambidextrous BPM requires a shift in focus from exploitative to explorative BPM [Rosemann, 2014]. This also aligns with the premises of ambidextrous BPM, which concern balancing exploitative and exploratory processes [Sliż, 2023]. Consequently, the pursuit of ambidexterity in BPM involves achieving a dynamic balance between exploitation and exploration activities, leading to the concept of an ambidextrous organization. In more complex concepts, the ambidexterity serves as a platform for collaboration not only among processes but also among projects. An example of such a solution is the principles of process-project organization [Sliż, 2021]. Referring to the premises of the ambidextrous organization concept, BPM can be identified as a dynamic capability reflecting an organization's ability to model, implement, manage, and optimize processes, taking the changes occurring in the organization's environment into account [Ortbach et al., 2012; Helbin, Van Looy, 2021]. In this paper, ambidextrous BPM is understood as a state of equilibrium balance between explorative and exploitative processes [Helbin, Van Looy, 2020]. The direction of research on ambidextrous BPM was already indicated in 2014 by M. Rosemann [Kohlborn et al., 2014; Rosemann, 2014]. As pointed out by Helbin and Van Looy [2021], the researchers' work in this area was noticeable in two streams: "(1) in the context of BPM methods and techniques, inquiring how to grow explorative processes, and how to resolve the resulting tension between exploration and exploitation, and (2) within the broader organizational capability, where BPM capabilities support the organization in becoming ambidextrous." To date, the majority of researchers analyzing the balance between exploitation and exploration have focused on two types of strategies: spatial (structural) and sequential [Helbin, Van Looy, 2021]. In this study, an attempt is made to extend the current state of knowledge by examining both structural and contextual strategies.

Study design

The survey study was conducted using the computer-assisted web interview (CAWI) in 2022. A sample of 340 enterprises was selected non-randomly, using the convenience sampling method. With this in mind, statistical inference methods were not used in the analysis. The sample consisted of service enterprises, of which 53% were medium-sized (50–249 employees) and 47% were large (250 employees or more). The criterion for defining medium and large

organizations was based solely on the declared number of employees. Similarly, in the survey, respondents declared the main company's business profile: services, manufacturing or trade. 35% of the enterprises operated in one market segment and the remaining 65% in more than one segment. The sample included enterprises with different geographical scope of operation: 22% local (e.g. the area of one voivodeship), 10% regional (e.g. the area of several neighboring voivodeships), 30% national, 18% European and 20% global. The majority of organizations achieved ambidexterity (83%). The following approaches to ambidexterity were identified among the surveyed enterprises: contextual only (25%), structural only (17%) and hybrid (41%). The respondents were informed about the anonymous nature of the survey and were also assured of confidentiality, stating that the results would be presented only in a summarized form.

The AI implementation maturity level was measured on the ordinal scale from 1 to 5 (Table 1). The median of this maturity was 2. The enterprises varied greatly in this regard (coefficient of variation = 55%).

Table 1. AI technology implementation maturity levels descriptions

Level	Description of AI implementation maturity level
Level 1	The AI technology is not implemented. There are no plans for implementation
Level 2	There are plans to implement AI technology in the long term (2–5 years)
Level 3	The AI technology is not implemented, but steps have been taken to implement it within 2 years
Level 4	The AI technology is being implemented in the organization
Level 5	The AI technology has been implemented in the organization

Source: based on Sliz et al., 2024.

Next, respondents were asked to assess the performance of exploitative, exploratory, and ambidexterity activities in the context of BPM. The respondents were asked to rate each of the statements presented on 5-point Likert scale (1 – strongly disagree, 2 – disagree, 3 – hard to say, neither yes nor no, 4 – agree, 5 – strongly agree). Table 2 presents the statements that respondents could use to indicate the level of exploitative BPM.

Table 2. The statements characterizing exploitative BPM in the survey

Exploitative BPM
The organization operates with the concept of exploitative processes (not related to the exploitation of machinery, equipment, or vehicles).
Process management focuses on generating short-term profits.
Process management focuses on improving existing processes (e.g., increasing efficiency, effectiveness, etc.).
Processes in the organization are modeled over a long time period (perspective of more than 1 year).
The organization seeks solutions and tools aimed at increasing process efficiency or effectiveness.
The organization undertakes actions to increase market share for current products and/or services.
The supplier selection in the organization is influenced by the reduction of production costs (products/services).
Customer surveys in the organization focus on assessing satisfaction with delivered products/services.

Exploitative BPM
Actions are taken in the organization to reduce the production costs of products/services while maintaining the same level of quality.
Material consumption is analyzed in the organization to find solutions to reduce consumption.
Process management focuses on increasing market share for the process outputs produced.
Process management focuses on improving processes related to the genotypic activity of the organization (core activity).

Source: based on Sliz et al., 2024.

In the study, an attempt was made to identify whether the surveyed organizations use ambidexterity principles in their implementation of explorative BPM assumptions within the organization (Table 3).

Table 3. The statements characterizing explorative BPM in the survey

Explorative BPM
The organization operates with the concept of exploratory processes.
Process management focuses on long-term profit generation.
Process management focuses on modeling new processes enabling the generation of new products and/or services.
Processes in the organization are dynamically modeled in response to changes within the organization or its environment.
The organization seeks solutions and tools to increase process flexibility (ability for dynamic reconfiguration).
The organization undertakes actions to create new products and/or services.
The supplier selection in the organization is dependent on the potential to increase the innovation of the products and/or services offered or to create new products and/or services.
Customer surveys in the organization focus on identifying customer needs in the context of creating new products and/or services.
Actions are taken in the organization to implement ICT technologies in order to reduce process execution parameters (e.g., cost, time, etc.).
Material consumption is analyzed in the organization to find technologies aimed at increasing the quality of the products and/or services offered.
Process management supports the exploration of areas aimed at generating new added value in the organization.

Source: based on Sliz et al., 2024.

The results obtained from Tables 2 and 3 enabled the assessment of whether the organizations surveyed are focused on exploitation and/or exploration in the context of BPM. Then, the survey attempted to identify the forms of achieving ambidexterity based on the statements presented in Table 4.

Table 4. The statements characterizing ambidextrous BPM in the survey

Ambidextrous BPM
In the organization, activities related to the creation of products and/or services are conducted simultaneously with developmental (research, innovative) activities.
In the organization, activities related to the creation of products and/or services are interrupted due to the implementation of developmental (research, innovative) activities.
In the organization, activities related to the creation of products and/or services and developmental (innovative) activities are carried out within the same functional areas (departments, divisions, etc.).

cont. Table 4

Ambidextrous BPM
In the organization, activities related to the creation of products and/or services and developmental (innovative) activities are separated within the organizational structure (e.g., innovation activities are handled by a separate department).
In the organization, activities related to the creation of products and/or services and innovative activities are conducted in separate processes.
In the organization, activities related to the creation of products and/or services and innovative activities are conducted within the same process space.
Knowledge flows from innovative activities to activities related to the creation of products and/or services in the organization.
Knowledge flows from activities related to the creation of products and/or services to innovative activities in the organization.
In the organization, employees can engage in both activities related to the creation of products and/or services and participate in innovative activities.
Separate (distinct) organizational roles exist for core business processes and innovation in the organization.
External competencies are used for the execution of innovative activities in the organization (e.g., consulting firms).

Source: own study based on the literature: O'Reilly, Tushman,2013; Sliż, 2023; Zakrzewska-Bielawska, 2018.

For responses on the 1–5 scale, separate assessments were made for question sets regarding exploitative and exploratory processes. The median was used for this purpose. If the median response for the areas surveyed (exploitation and exploration) was equal to or greater than 4, it was qualified that the organization conducts exploitative, or exploratory processes or is characterized by simultaneous exploitation and exploration. If the organization met the criteria positively enabling classification in both exploitation and exploration areas, Table 4 was used to determine whether the organization operates according to the assumptions of the ambidexterity concept. Additionally, the statements from Table 4 were used to assess whether the organization applies structural or contextual ambidexterity. If the organization met the criteria for both structural and contextual ambidexterity, it was concluded that it implements hybrid ambidexterity.

Results

Table 5 presents the AI implementation maturity level (5-point scale, see Table 1) by organization size, number of market segments, scope of operation and ambidexterity approach. Cramer's V was used to measure the association between the enterprise characteristics and the AI implementation maturity level (Cramer's V values are shown in Table 5).

This study shows that the AI implementation maturity level is not related to the enterprise size, the number of market segments, or the scope of operation (see Cramer's V values in Table 5). On the other hand, there is a clear, but weak relationship with ambidexterity (Cramer's V = 0.225). Ambidexterity in the form of hybrid (24.3% of enterprises with the 5th level of AI implementation maturity) and structural (20.7% of enterprises with the 4th level of AI implementation maturity) stands out positively.

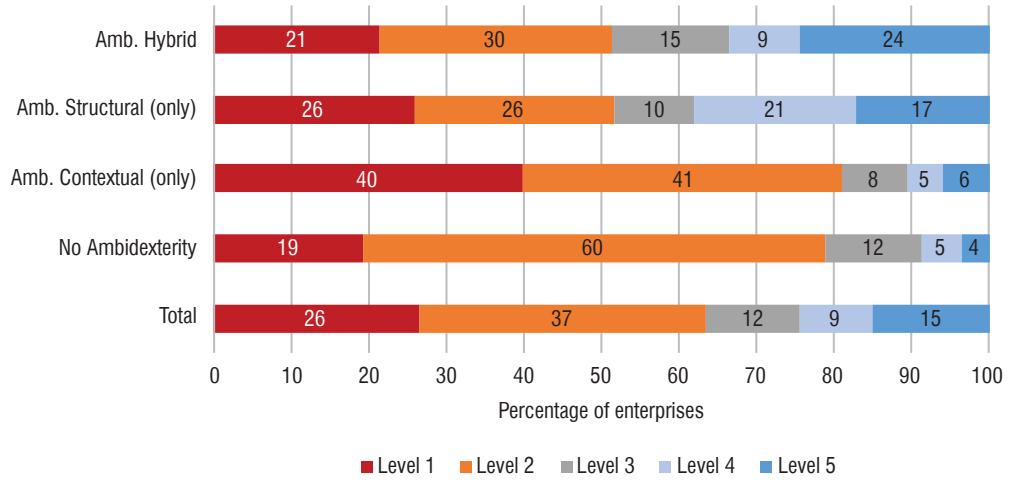
Table 5. AI implementation maturity level by enterprise characteristics

	Level 1	Level 2	Level 3	Level 4	Level 5	Total
Total	26.5	37.1	12.1	9.4	15.0	100.0
Enterprise size (Cramer's V = 0.087)*						
Medium	24.9	37.0	11.0	9.4	17.7	100.0
Large	28.3	37.1	13.2	9.4	11.9	100.0
Number of market segments (Cramer's V = 0.106)*						
One	20.8	41.7	13.3	8.3	15.8	100.0
Many	29.5	34.5	11.4	10.0	14.5	100.0
Scope of operation (Cramer's V = 0.118)*						
Local	22.7	38.7	8.0	8.0	22.7	100.0
Regional	23.5	29.4	20.6	5.9	20.6	100.0
National	25.7	39.6	12.9	11.9	9.9	100.0
European	25.8	29.0	16.1	12.9	16.1	100.0
Global	33.8	42.6	7.4	5.9	10.3	100.0
Ambidexterity approach (Cramer's V = 0.225)*						
No Ambidexterity	19.3	59.6	12.3	5.3	3.5	100.0
Amb. Contextual (only)	40.0	41.2	8.2	4.7	5.9	100.0
Amb. Structural (only)	25.9	25.9	10.3	20.7	17.2	100.0
Amb. Hybrid	21.4	30.0	15.0	9.3	24.3	100.0
Ambidexterity (Cramer's V = 0.230)*						
No	19.3	59.6	12.3	5.3	3.5	100.0
Yes	27.9	32.5	12.0	10.2	17.3	100.0

* Cramer's V – a measure of the association between a given qualitative variable and the AI implementation maturity level.

Source: calculations based on own survey.

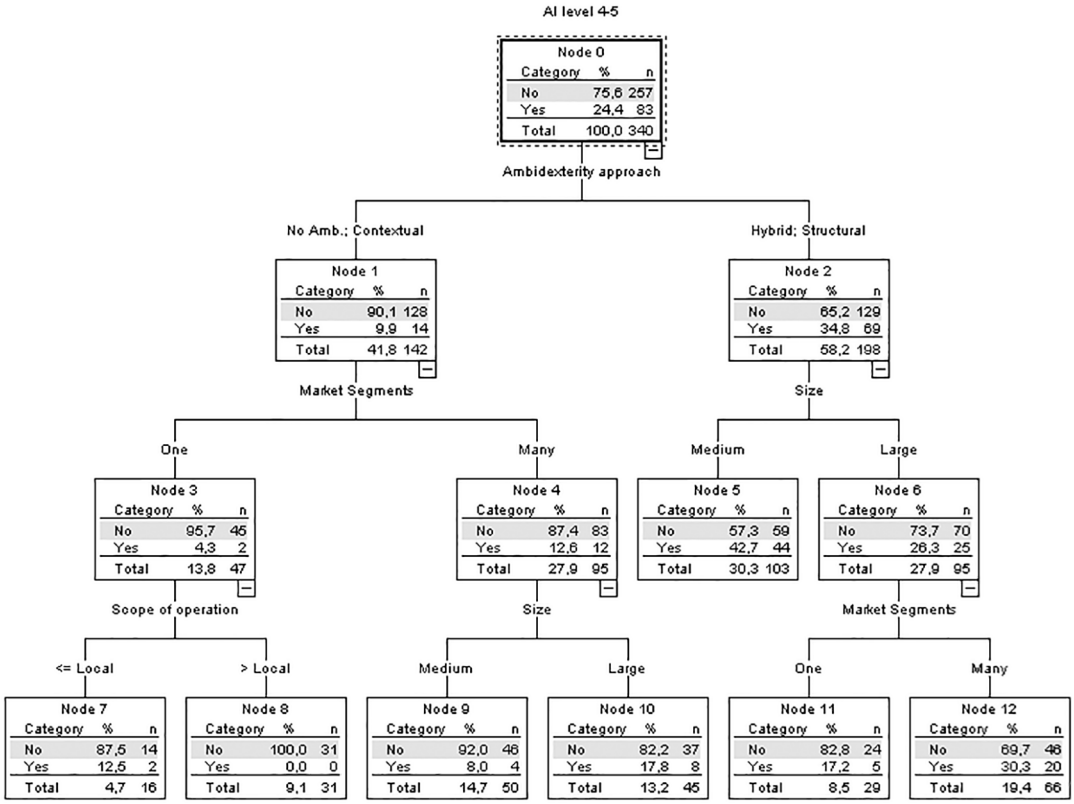
Figure 1. AI implementation maturity level by ambidexterity approach



Source: calculations based on own survey.

Figure 1 shows the AI implementation maturity level by ambidexterity approach. 24.4% of the surveyed enterprises have implemented or were in the process of implementing AI technology (level 4 or 5). The percentage of AI implementations at levels 4 and 5 is low in the groups of enterprises that do not use ambidexterity or use ambidexterity in the form of contextual only (9% and 11% respectively), while in the other two groups, AI is implemented (level 4 or 5) in more than 1/3 of enterprises using ambidexterity in the form of structural only or hybrid (38% and 34% respectively).

Figure 2. Classification tree explaining AI implementation maturity (No: level 1–3, Yes: level 4–5) using enterprise characteristics



Source: calculations with IBM SPSS Statistics 29 based on own survey.

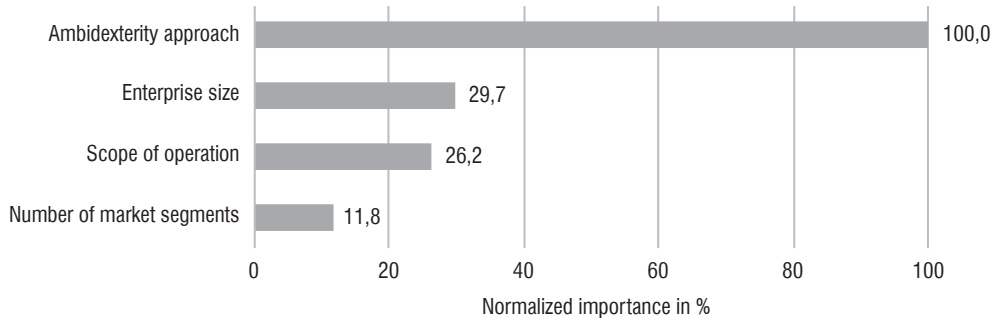
A binary classification tree (Figure 2) was used to explain AI implementation maturity depending on enterprise characteristics (see Table 5). AI implementation maturity was defined by a dichotomous variable indicating whether the AI technology was in the process of being implemented or had been already implemented in the enterprise (implementation maturity level 4 and 5). Binary classification trees are a multivariate exploratory method that allow to explain a categorical variable depending on a set of quantitative and qualitative variables. Trees are built through recursive binary splits using independent variables, in such a way as to maximize the homogeneity of the child nodes (after splitting) due to the dependent variable.

The tree was built using the Classification and Regression Tree (CART) algorithm, using the Gini Index as a measure of the split quality (a measure of node impurity). The following criteria were used to limit the growth of the tree: maximum tree depth 3, minimum number of observations in the parent node (before splitting) 10% of observation units, minimum number of observations in the child node (after splitting) 4% of observation units. The purpose of building the tree was not to make predictions, but to find decision rules and explanatory variables in the dataset that are important for AI implementation maturity.

Enterprises using ambidexterity in the form of structural or hybrid (right branch of the tree) stood out positively, among which the 4th or 5th level of AI implementation maturity was most common in medium-sized enterprises (42.7% of enterprises in node 5), followed by large enterprises operating in many market segments (30.3% of enterprises in node 12).

In enterprises that did not use ambidexterity or used ambidexterity in the form of contextual, the percentage of enterprises with the 4th or 5th level of AI implementation maturity was much lower, in particular in enterprises operating in one market segment (4.3% of enterprises in node 3). If the enterprises met the previous two conditions and operated in a market broader than just local, they fell into "pure" node, which included only enterprises with a low level of AI implementation maturity (0% of enterprises with level 4–5 in node 8).

Figure 3. Importance* of independent variable in classification tree



* The measure of importance is normalized to be 100% for the most important variable.

Source: calculations with IBM SPSS Statistics 29 based on own survey.

The construction of the classification tree allowed for determining the importance of variables explaining the AI implementation maturity (Figure 3). The ambidexterity approach was found to be the most important one. The enterprise size and scope of operation were also assessed as important, though to a lesser extent. On the other hand, the number of market segments was found to be of little importance.

Summary

The enterprises surveyed varied greatly in respect of AI implementation maturity. Among the enterprise characteristics available in the study, ambidexterity and its forms turned out to be the most important factors associated with AI implementation maturity. Enterprises using ambidexterity in the structural or hybrid form stood out positively, while enterprises not using ambidexterity or using it in the contextual form stood out negatively. Additionally, the remaining available characteristics of enterprises allowed to distinguish groups with the highest (42.7%) and the lowest (0%) percentage of enterprises that had already implemented or were in the process of implementing AI technology. The first group consisted of medium-sized enterprises using ambidexterity in the structural or hybrid form, and the second group consisted of enterprises not using ambidexterity or using ambidexterity in the contextual form and operating in one market segment that was broader than the local one.

Limitations and future research

A limitation of the study is the non-random sampling, which makes it impossible to draw conclusions about the population of service enterprises in Poland. Furthermore, it should be noted that the study focused only on service enterprises, excluding commercial and manufacturing enterprises. These outlined limitations have set the direction for further research aimed at expanding the research sample to include all activity profiles, and investigating not only the implementation of AI technology, but also considering AI tools used in processes as well as supporting process management. Additionally, the development of Al in organizations, along with the increasing degree of operationalization of this technology, raises the question of expanding the form of achieving ambidexterity to AI-powered ambidexterity, which constitutes an automated form or complement to managerial ambidexterity, thereby using AI to balance exploitation and exploration within business processes and their management.

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