*European Research Studies Journal*
*Volume XXIX, Issue 4, 2026*

*pp. 43-60*

# Digital Support for Communication and Information Flow in the Innovation Processes of SMEs

*Submitted 07/09/26, 1st revision 25/09/26, 2nd revision 18/10/26, accepted 01/11/26*

Elżbieta Gryko[1]

***Abstract:***

***Purpose:*** *This study assesses the extent to which digital tools support communication and information flows across different stages of the innovation process in small and medium-sized enterprises (SMEs) and examines the relationship between digital tool usage and innovation performance.*
***Design/methodology/approach:*** *Grounded in Organisational Information Processing Theory (OIPT), the study examines 400 SMEs operating in Poland. OIPT provides the theoretical basis for analysing how digital communication and information management tools support organisations in acquiring, processing and exchanging information under conditions of uncertainty throughout the innovation process.*
***Findings:*** *The results indicate that digital support for communication processes remains limited and declines across successive stages of the innovation process. At the same time, a positive relationship is observed between the intensity of digital tool usage and innovation performance. These findings highlight the relevance of digital communication and information management for supporting innovation activities in SMEs.*
***Practical implications:*** *SME managers should assess the availability and use of digital communication tools across all stages of the innovation process, paying particular attention to potential gaps in information exchange as innovation activities progress. More consistent use of digital tools may help improve information accessibility, coordination and knowledge sharing, thereby supporting innovation performance. The findings also provide a basis for developing digitalisation strategies that address communication needs throughout the innovation process.*
***Originality/value:*** *By applying Organisational Information Processing Theory to digital communication across the innovation process, this study links the extent of digital tool usage with innovation performance in SMEs. It highlights the importance of examining digital support across successive innovation stages rather than treating digitalisation as a uniform organisational capability.*

***Keywords:*** *Small and medium-sized enterprises (SMEs), innovation, digitalization, communication, information flows, Organisational Information Processing Theory (OIPT).*

***JEL classification:*** *O32, O33, L25, M15.*

***Paper type:*** *Research article.*

[1]*Assistant, Institute of Management, Pomeranian University in Słupsk, Poland, ORCID: 0009-0000-8926-1634, e-mail: elzbieta.gryko@upsl.edu.pl;*

## 1. Introduction

The contemporary economic landscape, characterised by rapid technological development, compels companies to continually seek out and implement innovations as a prerequisite not only for survival but also for growth. Joseph A. Schumpeter first defined innovation as the introduction of new combinations of factors of production that lead to economic change and growth. These included the introduction of new products, production methods, markets, sources of supply, and forms of business organisation.

Later, Schumpeter expanded his concept to include the idea of creative destruction, arguing that economic development rests on replacing existing solutions with new, more efficient ones. In this framework, innovations are not only a source of competitive advantage for firms but also a driving force behind structural changes in the economy[2].

Schumpeter attributed a key role to the entrepreneur, who, by implementing new combinations of factors of production, initiates the process of economic development. The contemporary approach broadens this perspective by emphasising the importance of knowledge, learning processes, organisational capabilities, and interactions between firms and their environment.

In this view, innovation is the result of complex processes of knowledge creation, absorption, and diffusion, rather than solely the effect of a single entrepreneur's actions. The innovation process, defined in the literature as a multi-stage path ranging from the identification of market opportunities through idea generation, competence development, and testing to final implementation and commercialisation, is one of the most important types of organisational change. On the one hand, it leads to the continuous creation of new, improved goods and services that create value for customers, generate profit for the company, provide a competitive advantage, and drive economic growth. On the other hand, it is a highly nonlinear, iterative, and risky undertaking[3].

The complexity of the innovation process means that its effective implementation requires efficient management of information flow and effective communication both within the company and between the company and its environment[4]. Innovation requires the collection, processing, and transmission of information. This

---

[2] *J. A. Schumpeter, Capitalism, socialism and democracy, Routledge London, 2003, s. 81-86.*
[3] *T. Nawrocki, Ryzyko działalności innowacyjnej przedsiębiorstw w kontekście ich wyników finansowych, „Nauki o Zarzadzaniu" 26/2016, s. 114-116.*
[4] *T. Temel, A Conceptual Framework for Managing Information Flow in Innovation Systems, International Journal of Agricultural Resources, „Governance and Ecology", 2007, vol. 6(2), s. 179-180.*

is particularly important in the small and medium-sized enterprises (SMEs) sector, where limited organisational and technological resources necessitate optimising communication processes and rapidly transferring knowledge; therefore, digital tools can help organise information. In the context of advancing digitalisation, companies increasingly need digital technologies to support innovation processes, coordinate team activities, and streamline information exchange.

In the SME sector, communication management faces specific challenges[5] . On the one hand, these entities are characterised by high structural flexibility, a lack of bureaucratic barriers, and a strong ability to adapt quickly; on the other hand, they face limited financial, human, and technological resources, as well as a relatively low degree of procedural formalisation. As a result, the flow of information is often intuitive, selective, and unsystematic[6].

Consequently, these organisations encounter so-called communication bottlenecks and communication asymmetry. These limitations can hinder information flow and coordination of activities in the innovation process, leading to implementation delays and difficulties in developing new solutions.

Digital transformation and the widespread adoption of specialised IT systems dedicated to innovation management - such as idea crowdsourcing platforms, project management tools, and AI-based analytics systems - help streamline many processes[7]. These tools enable the automation of data aggregation, the structuring of communication channels within distributed teams, and the facilitation of knowledge transfer.

Despite these advantages, research shows that the level of digitisation of innovation processes in Polish SMEs remains low and varies across industries. While technologically advanced and knowledge-intensive sectors systematically integrate IT tools into their development processes, traditional industries still rely on analogue and informal communication channels.

To clarify the role of digital technologies in improving communication in innovation processes, this article draws on the classic Organisational Information Processing Theory (OIPT), formulated by Jay Galbraith. Its main premise is that any organisation seeking to maintain a desired level of effectiveness must align its information-processing capabilities with the uncertainty generated by the tasks at

[5]*J. A. Welsh and J. F. White, A Small Business Is Not a Little Big Business, „Harvard Business Review", No. 81411, July–August 1981, s. 18-19.*
[6]*D. Jelonek, I. Chomiak-Orsa, Nadmiar informacji. Próba identyfikacji problemu w małych i średnich przedsiębiorstwach, [w:] Współczesne przeobrażenia procesów zarządczych przedsiębiorstwa, Wrocław 2011, s. 94-102.*
[7]*E. J. Biesaga-Słomczewska, Komunikacja wewnętrzna w erze cyfryzacji, „Ekonomiczne Problemy Usług", 117/2015, s. 17-18.*

hand and the volatility of the environment. Galbraith defines uncertainty as the difference between the amount of information necessary to perform a task properly and the amount of information the organisation possesses at a given moment.

This means that in conditions of volatility, complexity, and unpredictability, an organisation requires more sophisticated mechanisms for communication, coordination, and decision-making. According to Galbraith, an organisation can cope with the increased demand for information in several ways: by creating slack resources, building more self-sufficient task units, investing in vertical information systems, and developing lateral relationships.

The last two strategies are particularly important for the analysis of innovation processes. Information systems enhance an organisation's ability to collect and process information. At the same time, lateral relationships - such as direct contact, liaison roles, and task forces - enable a faster exchange of information among process participant [8]. Richard L. Daft and Robert H. Lengel expanded the perspective on organisational information processing, noting that organisations process information not only to reduce uncertainty but also to reduce information equivocality.

According to them, ambiguity fosters an exchange of views among managers to define problems and resolve conflicts by establishing a shared interpretation that can guide future actions. They emphasise that the effectiveness of organisational processes depends on both the amount of information and the ability to interpret it. In this context, the authors also pointed out that different communication channels vary in their ability to convey information of varying richness, which affects the effectiveness of reducing uncertainty and ambiguity as well as the efficiency of decision-making processes within the organisation.[9]

Contemporary applications of Organisational Information Processing Theory indicate that a company's ability to process information effectively depends on the availability of up-to-date, useful data and mechanisms that enable its effective processing. From this perspective, analytical tools enhance an organisation's ability to process information by collecting, organising, visualising, and analysing it, thereby enabling the generation of useful insights that support organisational processes.

From this perspective, the innovation process can be viewed as a task characterised by a high degree of uncertainty and ambiguity, as it involves generating new ideas, developing solutions, testing, modifying, and implementing solutions in a dynamic

[8] *J. R. Galbraith, Organization Design: An Information Processing View, „Interfaces". May 1974, Vol. 4 Issue 3, s. 28-36.*
[9] *R. L. Daft, R. H. Lengel, Organizational information requirements. Media richness and structural design, „Management Science", vol. 32, No. 5, May 1986, s. 556-557.*

market and technological environment. It therefore requires an intensive flow of information among employees, teams, managers, and external partners.

In this context, digital technologies can serve as tools that enhance SMEs' ability to process information, streamline communication, coordinate activities, and facilitate decision-making throughout the innovation process. From this perspective, digital tools that support communication and the flow of information can be viewed as modern organisational mechanisms that enhance information-processing capacity.

They are therefore not merely an element of a company's technical modernisation but also serve as organisational infrastructure, enabling the faster collection of data from the external environment, its distribution within the organisation, and the ongoing monitoring of the results of innovation activities (Velinov *et al.,* 2023). This is particularly important in SMEs, where limited human, financial, and technological resources can hinder the formalisation of innovation processes. Under such conditions, the digitisation of communication can partially compensate for organisational shortcomings by increasing the transparency of information flow and facilitating the coordination of activities undertaken at subsequent stages of the innovation process[10].

Despite growing interest in digital transformation in enterprises, previous research on the digitisation of the SME sector has focused primarily on assessing the overall level of digital technology adoption, an organisation's digital maturity, or the impact of digital transformation on business performance (Tyagi *et al.,* 2023). By contrast, digital support for specific communication and information processes carried out as part of the innovation process - and how these processes vary across the different stages of the process - has been analysed much less frequently.

In particular, knowledge regarding the level of digital support for processes such as information gathering, managing the flow of ideas, and monitoring the results of innovation implementations at successive stages of the innovation process in the SME sector remains limited. This limits the ability to identify which areas of the innovation process are more strongly supported by digital tools, as well as those that may constitute organisational "bottlenecks" hindering the effective processing of information and the implementation of innovative activities.

This article expands on previous discussions regarding the role of digital tools in managing innovation processes in two dimensions. First, the study applies Organisational Information Processing Theory to analyse the digital support for specific communication and information processes carried out at various stages of the innovation process in SMEs. Second, it highlights variation in the level of digital

[10]*Sz. Cyfert, W. Dyduch, W. Szumowski, G. Prause, Are we ready for digital transformation? The role of organizational culture, leadership and competence in building digital advantage, „Central European Management Journal" Vol. 33 No. 2, 2025, s. 223-224.*

support across the stages of the innovation process, identifying potential organisational constraints in information processing.

## 2. Theoretical Foundations and Research Hypotheses

To address this research gap, this article adopts the OIPT perspective, which holds that an organisation's effectiveness depends on its ability to acquire, process, and transmit information under conditions of uncertainty. In this framework, digital technologies serve as mechanisms that enhance an organisation's ability to process information by streamlining communication, coordinating activities, and facilitating the flow of knowledge among participants in the innovation process.

Consequently, this article aims to assess the level of digital support for selected communication and information processes at various stages of the innovation process and to determine whether this level of support is associated with the outcomes of innovation activities among SMEs. In this study, three processes particularly relevant from the OIPT perspective were analysed: gathering information from customers, managing the flow of ideas, and monitoring implementation results.

Based on the Organisational Information Processing Theory, two research hypotheses were formulated around this problem:

***H1:*** *The intensity of digital support for communication and information flow is highest in the early stages of the innovation process and decreases as the process progresses to later stages.*
***H2:*** *The intensity of digital support for communication and information flow is positively associated with the outcomes of innovation activities in SMEs.*

The rationale for the first hypothesis, H1, stems from the process-oriented nature of innovation and the tenets of Organisational Information Processing Theory. According to this theory, an organisation's need for information depends on the level of uncertainty and the complexity of the tasks being performed. The individual stages of the innovation process differ in this respect, generating varying requirements for the acquisition, processing, and transmission of information.

Initial innovation activities - including the identification of market opportunities, trend analysis, and monitoring of customer needs - rely on relatively straightforward, structured data collection. Digital tools supporting this stage are widely available, inexpensive, and do not require organisations to develop advanced technological capabilities or costly infrastructure[11].

[11] *K. Łobacz, R. Tylżanowski, Digitalisation levels of innovation management practices – pilot study of service SMEs in Poland, „Procedia Computer Science" 207(8), 2022, s. 3770-3779.*

In subsequent stages of the innovation process, however, communication and information complexity increase. Managing the flow of ideas, coordinating the activities of innovation process participants, and monitoring implementation results require integrating information from multiple sources and efficiently exchanging knowledge among process participants. At this level of advancement, SMEs encounter a structural barrier referred to in the literature as resource poverty[12].

Smaller entities struggle with a lack of financial capital, a shortage of specialised IT personnel, and a time deficit among decision-making managers[13] , which can hinder the consistent use of advanced digital tools at all stages of the innovation process. It can therefore be expected that the intensity of digital support for communication and information flow will vary across the different stages of the innovation process.

Hypothesis H2 is also supported by Galbraith's classical Organisational Information Processing Theory, according to which organisations operating under conditions of high uncertainty - which includes the innovation development process - must increase their capacity to process information by implementing mechanisms that streamline communication and data flow[14].

In this context, digital tools supporting information management serve as vertical information systems and platforms that integrate information and communication flows both within and outside the organization, thereby reducing operational uncertainty and streamlining decision-making processes[15]. The innovation process requires the continuous acquisition, processing, and exchange of information between a company and its environment.

A smooth flow of information enables faster identification of customer needs, more effective management of ideas, and more efficient monitoring of implementations. From the OIPT perspective, this means better aligning the organisation's capabilities with the information requirements generated by the innovation process[16]. At the

[12]*T. McIlveene, S. Nguyen, J. Batchelor, S. Keller, &E. Ranelli, Resource-Poor, Risk-Rich: Why Small Businesses Struggle to Turn AI Into Strategic Advantage, „Journal of Small Business Strategy", 36(2), 2026, s. 19–26.*

[13]*E. A. Khan, A. H. Mohammad, M. A. Jahed; A. L. Rowe, Poor resource capital of micro-entrepreneurs: the mediating role of entrepreneurial orientation Available to Purchase, „Management Research Reviev", vol. 44(10), s. 1366–1389.*

[14]*J. R. Galbraith, op. cit., pp. 28–36.*

[15]*S. Hassan S., K. Meisner, K. Barragan, L. Bzhalava, Is digitalization a source of innovation, Is digitalization a source of innovation? Exploring the role of digital diffusion in SME innovation performance, „Small Business Economics" 2024, vol. 62, nr 4, s. 1469–1491.*

[16]*R. Dubey, A. Gunasekaran, S.J. Childe, S. Fosso Wamba, D. Roubaud, C. Foropon, Empirical Investigation of Data Analytics Capability and Organizational Flexibility as Complements to Supply Chain Resilience, „International Journal of Production Research", 59(1), 2021, s. 110–128.*

organisational level, reducing uncertainty and improving communication can contribute to more effective implementation of innovation activities. Companies with an efficient, digital flow of information have greater capabilities to coordinate innovation processes, monitor their progress, and make effective use of available resources.

This can contribute to both increasing the scale of implemented innovations and improving the economic outcomes achieved. There is therefore both theoretical and empirical justification for expecting a positive relationship between the intensity of digital support for communication and information flow and the outcomes of innovation activities in SMEs.

## 3. Research Methodology

To verify the hypotheses, an empirical study was conducted using two research techniques: CATI and CAWI. Purposive quota sampling with elements of randomisation was applied, with the sample designed to reflect, as closely as possible, the diversity of SMEs engaged in innovation activities in Poland. The total sample size was N = 400 enterprises.

The sample selection took into account three criteria: geographic distribution, sectoral structure, and enterprise size. The study covered enterprises from all 16 voivodeships, ensuring the participation of entities representing each of the seven NUTS 1 regions. The sectoral structure of the sample was designed to reflect the sectoral diversity of SMEs in Poland, taking into account industries with varying degrees of susceptibility to digitisation. Diversity by enterprise size was also maintained, covering micro, small, and medium-sized enterprises[17].

To verify the research hypotheses, selected elements of the innovation process related to digital support for communication and information flow in SMEs were operationalised. The selection of variables was based on the assumptions of Organisational Information Processing Theory (OIPT), which holds that an organisation's effectiveness depends on its ability to acquire, process, and transmit information under conditions of environmental uncertainty.

[17]*The study and this article were carried out with funding from the Ministry of Education and Science as part of the project "Digital Tools in the Management of Innovation Processes in Small and Medium-Sized Enterprises" (NdS-II/SP/0359/2024/01). The study utilized a tool developed to measure the digitalization of the innovation process in SMEs, described in detail by Katarzyna Łobacz and Renata Szanter in: K. Łobacz, R. Szanter, "Measuring innovation process digitalization in SMEs – a methodological approach," "Procedia Computer Science," vol. 207 (2022): 3526–3535, DOI: 10.1016/j.procs.2022.09.411, and K. Łobacz, R. Szanter, "Digital Innovation Management for Sustainable Development – A Model Approach," "Journal of Modern Science," 2022, 61(1):643–668, DOI: https://doi.org/10.13166/jms/203128.*

Three variables related to different stages of the innovation process were selected for analysis: gathering information from customers, managing the flow of ideas, and monitoring the market and financial results of implemented solutions.

These variables reflect communication processes and information flows that specialised digital tools can support. Their selection was deliberate and stemmed from the study's focus on digital support for information exchange both within the organisation and in the company's relations with its market environment. All variables were measured on a five-point Likert scale assessing the intensity of use of specialised software supporting innovation processes. Table 1 presents the set of variables used in the analysis.

***Table 1.*** *Variables Used in the Analysis*

| Variable in the OIPT model | Survey questionnaire indicator | Description and measurement scale |
|---|---|---|
| Communication support (Stage 1: Opportunities) | Obtaining information about customers' needs directly from them | Specific independent variable; rated on a 1–5 scale |
| Information Flow (Stage 2: Ideas) | Managing the flow of ideas within and outside the company | Specific independent variable; rated on a scale of 1–5 |
| Information flow (Stage 6: Implementation) | Monitoring market performance and financial results related to the implementation of a new solution | Specific independent variable; rating on a scale of 1–5 |

***Source:*** *Own study.*

The selected variables correspond to the three key information-processing activities identified in OIPT: gathering information from the organisation's environment, the flow and integration of knowledge within the organisation, and the use of feedback to evaluate the results of actions. This made it possible to capture the digital support for communication and information flow at various stages of the innovation process.

The analysis of variables related to digital support for communication and information flow was conducted using individual companies' responses to specific measurement items for selected stages of the innovation process. This approach allowed for a more detailed identification of digital practices related to information gathering, managing the flow of ideas, and monitoring the effects of innovation implementations.

Statistical analysis of the collected data was performed using nonparametric methods. This approach was chosen due to both the ordinal nature of the data (a 1–5 Likert scale) and the rejection of the null hypothesis of normality for the distribution of the variables analysed in the Shapiro–Wilk test ($p < 0.05$). To assess differences in the level of digital support for communication and information flow between the individual stages of the innovation process, the Friedman test for dependent samples was applied.

When statistically significant differences were found, a post-hoc analysis was conducted using the Wilcoxon signed-rank test for pairs of observations. Due to the multiplicity of comparisons, the Bonferroni correction was applied, adopting an adjusted significance level of $\alpha = 0.0167$.

In turn, Spearman's $\rho$ rank correlation coefficient was used to examine the interdependence between the level of digital support for communication processes and the outcomes of innovation activities. To further analyse the relationship between digitisation levels and the outcomes of innovation activities, a comparative analysis was also conducted between companies with relatively high and low levels of digitisation. To this end, a binary variable was created to group companies by their level of digitisation, and the Mann–Whitney U nonparametric test was then applied.

The analysis focused on the variable relating to the financial outcomes of companies' innovation activities. Additionally, the magnitude of the effect was taken into account when interpreting the results, allowing an assessment not only of the statistical significance of the differences but also of their practical importance.

The study was cross-sectional in nature and based on self-reported data; therefore, the results should be interpreted as associations between variables rather than cause-and-effect relationships.

## 4. Research Results and Statistical Analysis

Companies were assessed by the intensity of their use of specialised software that supports communication and information flow in the innovation process. All variables were analysed using a five-point Likert scale, where a score of 1 indicated no use of specialised software, and a score of 5 indicated consistent use of specialised software supporting a given area of the innovation process. The analysis utilised basic descriptive statistics: the arithmetic mean (M), the median (Me), and the standard deviation (SD).

The presented results indicate a gradual decrease in the intensity of digital support for communication and information flow as the innovation process progresses through its stages. The highest values were recorded during the opportunity-identification stage, while the lowest were recorded during the implementation and commercialisation stages.

The results are consistent with the assumptions of Hypothesis H1 and suggest that the intensity of digital support for communication processes varies across the stages of the analysed innovation process.

***Table 2.*** *Means and Medians of Digitalisation Intensity for Selected Innovation Activities*

| Variable | Mean (M) | Median (Me) | SD |
|---|---|---|---|
| Stage I: Identifying opportunities for innovation -gathering information about customers (1.1) | 1.92 | 2.0 | 1.043 |
| Stage II: Idea Generation - Managing the Flow of Ideas (2.10) | 1.83 | 2.0 | 0.966 |
| Stage VI: Implementation and Commercialisation Monitoring Market and Financial Results of Implementations (6.6) | 1.79 | 2.0 | 1.044 |

***Source:*** *Own study.*

In all three cases, the median was 2.0, indicating a concentration of responses in the lower categories of the five-point scale. Low median values may suggest a so-called floor effect in the variables analysed. The highest level of digital support was recorded at the stage of identifying opportunities for innovation (M = 1.92), lower at managing the flow of ideas (M = 1.83), and lowest at monitoring market performance and the financial results of implementations (M = 1.79).

These results may indicate that the surveyed SMEs use specialised digital tools more often at the stage of gathering customer information than at later stages related to generating ideas and monitoring implementation results.

To formally verify Hypothesis H1, a Friedman test for dependent samples was conducted. The results of the analysis revealed statistically significant differences between the analyzed stages of the innovation process in terms of the intensity of digital support for communication and information flow ($\chi^2(2) = 8.68$; $p = 0.013$), which provides grounds for provides support for H1, indicating a gradual decrease in the intensity of digital support for communication and information flow as the innovation process progresses to subsequent stages. This means the use of specialised digital tools that support communication and information flow is not uniform across all analysed stages of the innovation process.

An additional post hoc analysis using the Wilcoxon signed-rank test, with a Bonferroni correction ($\alpha = 0.0167$), enabled the determination of the stages of the innovation process at which differences in the level of digital support for communication and information flow occur.

The results showed no significant differences between the stages of idea generation and monitoring implementation results ($Z = 1.499$; $p = 0.134$), nor between the stages of identifying innovation opportunities and idea generation ($Z = 1.441$; $p = 0.150$). However, a significant difference was observed between the stage of identifying opportunities for innovation and the stage of monitoring implementation results ($Z = 2.518$; $p = 0.012$).

The results indicate that the greatest variation in the level of digital support for communication and information flow occurs between the initial and final stages of the innovation process.

Hypothesis H2 was tested by analysing the relationship between the level of digital support for communication and information flow and the outcomes of SMEs' innovation activities. To empirically test Hypothesis H2, two complementary analytical approaches were used, corresponding to two operational hypotheses:

1. There is a positive relationship between the level of digital support for communication and information flow and the outcomes of innovation activities in SMEs.
2. There are differences in the outcomes of innovation activities between enterprises with high and low levels of digitisation.

Due to the lack of normality in the distribution of the analysed variables, confirmed by the Shapiro-Wilk test ($p < 0.05$), and the ordinal nature of the data, nonparametric statistical methods were used. Spearman's ρ rank correlation coefficient was used to analyse the interrelationships between the level of digital support for communication and information flow and the outcomes of innovation activities. Additionally, to supplement the correlation analysis and compare the effects of innovation activities between enterprises with relatively high and low levels of digitisation, the Mann-Whitney U test was applied.

To assess the outcomes of innovation activities, three indicators were used: the share of expenditures on innovation, the share of implementations of new or improved products, services, and processes, and the share of implementations that generate additional profits or cost reductions.

***Table 3.*** *Spearman's ρ rank correlation coefficients between digital support for communication and information flow and the effects of innovative activities in SMEs*

| Independent variable | Share of Expenditures (ρ) | Share of implementations (ρ) | Share of profitable implementations (ρ) |
|---|---|---|---|
| Identifying opportunities for innovation - gathering information about customer needs | 0.212*** | 0.180*** | 0.230*** |
| Generating ideas - managing the flow of ideas within and outside the company | 0.236*** | 0.231*** | 0.292*** |
| Implementation and commercialisation - monitoring market | 0.278*** | 0.238*** | 0.289*** |

| | | | |
|---|---|---|---|
| performance and financial results | | | |

***Note:*** *Spearman's rank correlation coefficients (ρ); N = 400; *** p < 0.001.*
***Source:*** *Own study.*

The results of the analysis indicate that all relationships between the variables analysed for digital support for the innovation process and the outcomes of innovation activities are positive. For the variable related to identifying opportunities for innovation, the correlation coefficients ranged from 0.180 to 0.230. For the variable concerning the management of the flow of ideas, values of ρ ranging from 0.231 to 0.292 were obtained, while for monitoring market performance and the financial results of implementations, the correlation coefficients ranged from 0.238 to 0.289. All correlation coefficients were statistically significant.

According to the accepted interpretation criteria, the strength of the observed relationships was weak, although the highest coefficient values (ρ = 0.292, ρ = 0.289) approached the lower limit of a moderate relationship. The strength of the relationships was interpreted based on the absolute value of Spearman's rank correlation coefficient (|ρ|). As an auxiliary interpretive criterion, the conventional thresholds used in correlation analysis were adopted: approximately 0.10 for a weak relationship, approximately 0.30 for a moderate relationship, and approximately 0.50 and above for a strong relationship.

Among the strongest observed relationships were those between digital management of the flow of ideas and the proportion of profitable implementations (ρ = 0.292), and between digital monitoring of implementation outcomes and the proportion of profitable implementations (ρ = 0.289). The obtained values indicate that companies that make more intensive use of digital tools supporting the flow of information and the monitoring of implementation outcomes tend to co-occur with more favourable innovation outcomes. According to the adopted interpretation criteria, the strength of the relationships was weak. It should be emphasised, however, that the observed relationships remain weak in magnitude, although they are close to the threshold for a moderate relationship.

The correlation coefficients indicate that digital support for communication and information flow is not the sole factor determining the outcomes of companies' innovation activities; however, it may be one of the relevant elements that support the effectiveness of innovation processes. The results obtained are consistent with the assumptions of Hypothesis H2, indicating a positive relationship between the intensity of digital support for communication and information flow and the outcomes of innovation activities in SMEs.

At the same time, the strength of the observed relationships ranges from weak to moderate; therefore, the results should be interpreted as co-occurrence among the analysed phenomena rather than as cause-and-effect relationships. The results

obtained provide positive verification of the first operational hypothesis, which posits a positive relationship between the level of digital support for communication and information flow and the outcomes of innovation activities in SMEs.

To deepen the analysis and further verify Hypothesis H2, an analysis of differences between enterprises with high and low levels of digitisation was also conducted. Accordingly, a binary variable was created to group enterprises by their level of digitisation (low vs high). Next, the nonparametric Mann-Whitney U test was applied to assess the significance of differences between two independent groups. The "Profits_Digitalization" variable, which reflects the financial outcomes of the commercialisation of enterprises' innovation activities, was analysed.

***Table 4.*** *Results of the Mann-Whitney U test for the financial effects of innovative activities in groups of companies with different levels of digitisation*

| Dependent variable | Comparison group | N | Sum of ranks | Mean rank | U | Z | p |
|---|---|---|---|---|---|---|---|
| Profits_Digitalization | High level of digitisation (Group 1) | 65 | 16,140 | 248.31 | 7,780 | 3.64 | 0.00027 |
| | Low level of digitisation (Group 2) | 335 | 64,060 | 191.22 | | | |

***Source:*** *Own study.*

The results of the Mann-Whitney U test indicate statistically significant differences between companies with high and low levels of digitisation in the financial effects of innovative activity ("Profits_Digitalization") ($U = 7{,}780$; $Z = 3.64$; $p = 0.00027$; $r = 0.18$). The effect size was calculated from the standardised test statistic Z using the formula $r = |Z|/\sqrt{N}$, where N denotes the total sample size of the compared groups.

The obtained value of $r = 0.18$ indicates a small effect size. Enterprises with a high level of digitisation (MR = 248.31) had a higher mean rank than those with a low level of digitisation (MR = 191.22), indicating that more digitally advanced entities achieved higher values on the analysed indicator of the financial effects of innovative activity.

The results obtained are consistent with the assumptions of Hypothesis H2, indicating a positive relationship between the intensity of digital support for communication and information flow and the outcomes of SMEs' innovative activities.

This means that enterprises that make more intensive use of digital tools that support communication and the flow of information are more likely to achieve more favourable outcomes from their innovative activities.

At the same time, the strength of the observed relationships remains relatively small and is primarily weak; therefore, the results should be interpreted as co-occurrence among the analysed phenomena rather than as cause-and-effect relationships.

## 5. Discussion of Results

The analyses provide a better understanding of variation in the level of digital support for communication and information flow across different stages of the innovation process in SMEs. The results indicate that this level remains relatively low, particularly in the later stages of the innovation process, which partially confirms earlier observations regarding the limited formalisation of communication processes and the lower capacity of SMEs to implement advanced information systems that support innovation activities.

From an OIPT perspective, this implies a potential mismatch between an organisation's demand for information and its actual capacity to process it, which may limit the efficiency of implementing innovative activities.

Of particular interest is the observed decline in the intensity of digital support as the innovation process progresses through its stages. The relatively higher values recorded during the stage of identifying innovation opportunities may stem from the greater availability of simple, relatively inexpensive tools that facilitate the collection of market information and communication with customers.

At the same time, the later stages of the innovation process - involving knowledge-flow management and the monitoring of implementation results - require more advanced organisational and technological capabilities, which may constitute a significant barrier to growth for many SMEs.

From the OIPT perspective, this may indicate organisational information bottlenecks, particularly at stages that require knowledge integration, coordination of activities, and ongoing monitoring of implementation outcomes.

Furthermore, the results of correlation analyses and the Mann-Whitney U test indicate that higher levels of digital support for communication and information flow are associated with more favourable outcomes for companies' innovative activities. This means that digital technologies can play a significant role in coordinating innovation activities, facilitating knowledge exchange, and monitoring implementation outcomes.

The results obtained are consistent with the assumptions of OIPT, suggesting that organisations with more developed mechanisms for digitally supporting communication and information flow may be better prepared to carry out innovative activities under conditions of uncertainty.

The theoretical contribution of this study lies in applying the Organisational Information Processing Theory perspective to analyse digital support for selected communication and information processes across various stages of the innovation process.

The results indicate that an organisation's ability to process information can be analysed not only at the level of the company's overall digitisation but also by evaluating specific practices for gathering customer information, managing the flow of ideas, and monitoring implementation outcomes. The results also suggest that the importance of digital support for communication and information flow is not uniform across all stages of the innovation process.

The study has several methodological limitations. First, the analysis was based on self-reported data from company representatives, which may introduce a risk of subjectivity in assessing the level of digitisation and the effects of innovation activities.

Second, the study was cross-sectional; therefore, the results should be interpreted as the co-occurrence of the phenomena analysed rather than as cause-and-effect relationships.

Third, the analysis focused exclusively on selected aspects of digital support for communication and information flow, represented by three communication and information processes located at different stages of the innovation process.

Fourth, the study was conducted exclusively among enterprises operating in Poland, which may limit the generalizability of the results to other economic and institutional contexts.

Fifth, purposive quota sampling with elements of randomisation limits the extent to which the results can be generalised to the entire population of SMEs in Poland.

However, it allows for the identification of significant relationships and trends within the group of enterprises studied. This means that the results obtained should not be interpreted as a comprehensive characterisation of all dimensions of the digitisation of the innovation process or the digital transformation of SMEs.

## 6. Conclusion

The study aimed to assess the level of digital support for communication and information flow in SMEs' innovation processes and to identify relationships between this support and the outcomes of innovation activities. The analyses conducted showed that the surveyed enterprises relatively rarely use specialised digital tools to support communication, information exchange, and knowledge flow management in the innovation process.

At the same time, it was observed that the intensity of digital support decreases as the innovation process progresses through its subsequent stages.

The results also indicate that higher levels of digital support for communication and information flow are associated with more favourable outcomes of innovation activities in SMEs. The findings underscore the importance of digital tools that support information gathering, the management of idea flow, and the monitoring of implementation results.

This study contributes to the field by demonstrating the importance of digital support for specific communication and information processes carried out at various stages of the innovation process. From a management perspective, the findings indicate a need to strengthen digital tools that support the coordination of innovation activities, particularly during the idea generation and implementation monitoring stages.

Future research could include longitudinal analyses and expand the study's scope to include companies operating in other countries.

**References:**

Biesaga-Słomczewska Elżbieta Jadwiga, Komunikacja wewnętrzna w erze cyfryzacji, „Ekonomiczne Problemy Usług", nr 117/2015.

Cyfert, S., Dyduch, W., Szumowski, W., Prause, G. 2025. Are we ready for digital transformation? The role of organisational culture, leadership and competence in building digital advantage. Central European Management Journal, Vol. 33, No. 2.

Daft, R., Lengel, R. 1986. Organizational information requirements. Media richness and structural design. Management Science, vol. 32, No. 5.

Dubey, R., Gunasekaran, A., Childe, S.F., Wamba, S., Roubaud, D., Foropon, C. 2021. Empirical Investigation of Data Analytics Capability and Organizational Flexibility as Complements to Supply Chain Resilience. International Journal of Production Research, 59(1).

Galbraith, J.R. 1974. Organization Design: An Information Processing View. Interfaces, May 74, Vol. 4, Issue 3.

Gareth, J.R. 1974. Organizational Theory, Design, and Change. Interfaces, May 74, Vol. 4, Issue 3.

Hanusch, H., Pyka, A. 2006. A roadmap to comprehensive neo-Schumpeterian economics. Volkswirtschaftliche Diskussionsreihe, no. 289, November.

Hassan, Sohaib, Meisner, Konrad, Barragan, Kevin, Escoz, Bzhalava, Levan. 2024. Is digitalization a source of innovation? Exploring the role of digital diffusion in SME innovation performance. Small Business Economics, 62(4).

Jelonek, D., Chomiak-Orsa, I. 2011. Nadmiar informacji. Próba identyfikacji problemu w małych i średnich przedsiębiorstwach. In: Współczesne przeobrażenia procesów zarządczych przedsiębiorstwa, red. Skalik Jan, Barabasz Adela, Wrocław.

Khan, Eijaz, Ahmed, Hossain Mohammad, Alamgir, Jahed, Mohammed Abu, Rowe, Anna Lee. 2021. Poor resource capital of micro-entrepreneurs: the mediating role of entrepreneurial orientation Available to Purchase. Management Research Reviev, vol. 44(10).

Łobacz, K., Tylżanowski, R. 2022. Digitalisation levels of innovation management practices – pilot study of service SMEs in Poland. Procedia Computer Science, 207(8).

McIlveene, T., Nguyen, S., Batchelor, J., Keller, S., Ranelli, E. 2026. Resource-Poor, Risk-Rich: Why Small Businesses Struggle to Turn AI Into Strategic Advantage. Journal of Small Business Strategy, 36(2).

Nawrocki, T. 2016. Ryzyko działalności innowacyjnej przedsiębiorstw w kontekście ich wyników finansowych. Nauki o Zarzadzaniu, 26/2016.

Schumpeter, J.A. 2003. Capitalism, socialism and democracy. Routledge, London.

Schumpeter, J.A. 1934. The theory of economic development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Cambridge.

Srinivasan, R., Swink, M. 2018. An Investigation of Visibility and Flexibility as Complements to Supply Chain Analytics: An Organizational Information Processing Theory Perspective. Production and Operations Management, 27(10).

Tugrul, T. 2007. A Conceptual Framework for Managing Information Flow in Innovation Systems. International Journal of Agricultural Resources, Governance and Ecology, vol. 6(2), 179-180.

Tyagi, P., Grima, S., Sood, K., Baluswamy, B., Ozen, E., Thalassinos, E. (Eds.). 2023. Smart analytics, artificial intelligence and sustainable performance management in a global digitalised economy. Emerald Group Publishing.

Van De Ven Andrew, H. 1986. Central problems in the management of innovation. Management Science, vol. 32, No. 5.

Velinov, E., Kadłubek, M., Thalassinos, E., Grima, S., Maditinos, D. 2023. Digital transformation and data governance: top management teams perspectives.

Verdes Cătălin-Alexandru, Mironescu Alexandra-Andreea, Mazăre Mădălina. 2024. The Impact of Digitalization on the Economic Performance of SMEs in the European Union: A 2022 Analysis. Proceedings of the International Conference on Business Excellence, Vol. 18. No. 1.

Welsh, J. 1981. White Jerry, A Small Business Is Not a Little Big Business. Harvard Business Review, No. 81411, July-August.

Włoch-Szymaniak, M. 2024. Digital innovation and artificial intelligence (AI) as a tool for building competitiveness of the SME sector. Management, Vol. 28, No. 1/2024.