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Dear 'e-mentor' readers,

I am delighted to present the latest collection of papers, which continues to reflect the redefined scope of 'e-mentor': higher education in management and economics, together with emerging trends shaping contemporary organisations.

The section dedicated to trends in education brings together three complementary perspectives on teaching and learning. The first article examines how generative AI is transforming business process controlling education by replacing manual process modelling with AI-supported model generation and enabling broader process analysis. The second compares students' perceptions of AI-generated and human-created content, focusing on clarity and credibility. The third explores communities of practice at the Maria Grzegorzewska University, offering insights into the perspectives of academic teachers and trainers.

The trends in management section presents five studies addressing contemporary organisational and economic challenges. The contributions examine the role of workplace design in enhancing workforce productivity, the relationship between economic freedom, entrepreneurial innovation and business growth, and organisational approaches to measuring knowledge sharing. The section also explores the retention of Generation Z employees through the interplay of organisational virtuousness, work-life balance and psychological capital, and concludes with an analysis of AI transformation in Polish organisations, highlighting the gap between individual adoption and organisational maturity.

We encourage members of our academic community to contribute to 'e-mentor' not only as authors but also as reviewers. Our editorial strategy is built on close collaboration with committed and experienced reviewers whose constructive feedback plays an important role in helping authors develop their manuscripts. Our goal is to further strengthen 'e-mentor' as a forum for the presentation and discussion of research and ideas related to teaching and learning in higher education in the fields of management and economics. We aim to provide a platform for the exchange of knowledge and insights on the use of technology in education, including e-learning, teaching and learning methods, the assessment of learning outcomes, and the integration of emerging trends in management and economics into higher education.

Moreover, following the successful completion in October 2024 of the project financed by the Polish Ministry of Science and Higher Education (RCN/SP/0361/2021/1), we continue to expand our collaboration with organisers of academic events in support of the journal's internationalisation. More information about these conferences is available in the 'We recommend' section.

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Transformation of Business Process Controlling Education in the Era of Generative Artificial Intelligence: From Technical Modelling to Critical Data Analysis

Abstract

This article presents a modification of a long-standing curriculum in business process controlling, delivered at the Krakow University of Economics, developed in response to the growing importance of Generative Artificial Intelligence (GAI) tools. Drawing on a review of the literature concerning the scale and consequences of students' use of GAI in higher education, the authors discuss the original course programme implemented in 2018 as well as the changes introduced in 2025. The most important modification consisted in replacing the manual modelling of processes in BPMN 2.0 notation with the automatic generation of models using GAI tools. The educational intervention demonstrated that integrating these tools shortens task completion time, enables students to analyse a larger number of scenarios, and increases students' awareness of the importance of input data quality. The article also outlines directions for the further development of the course, encompassing the use of GAI at every stage of the work, from data acquisition, through process analysis and simulation, to the creation of interactive controlling reports. The authors argue that the conscious and proactive incorporation of GAI tools into academic programmes can constitute an appropriate response by higher education institutions to the dynamic technological changes taking place in the contemporary business environment.

Keywords: generative artificial intelligence, process controlling, management controlling, BPMN 2.0, educational programme, higher education, process management, academic teaching, process modelling, educational innovations

Introduction

The emergence in recent years of the tools referred to as Generative Artificial Intelligence (GAI) has brought about significant changes in many areas of social and economic life. The impact of these technologies is particularly visible in both enterprise operations and the education sector, including higher education. The rapid development of GAI tools and their widespread availability have led students to use them in their everyday academic work on an unprecedented scale.

In the academic community, this phenomenon was initially perceived above all as a potential threat to the teaching process and to the integrity of assessing learning outcomes. In response to these challenges, numerous studies focused on identifying the scale of students' use of GAI and the consequences arising from it. Research conducted at Chinese universities (Guo et al., 2025) showed that, in 2023–2024, more than 60% of students used GAI tools in their learning. In turn, analyses carried out in Ukraine and Lithuania (Prohorovs et al., 2026) confirmed a comparable level of use of these technologies, while also pointing to students' reluctance to disclose their use of GAI to instructors. Studies conducted in the Italian academic environment (Stöhr et al., 2024) broadened this issue by identifying differences in the way GAI is used, resulting, among other things, from respondents' demographic characteristics, including gender.

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Subsequent research began to focus not only on the scale of GAI use but also on its impact on learning outcomes and academic performance (Pallant et al., 2026). Emphasis was also placed on the need to redefine existing teaching methods and to redesign some of the tasks performed by students which, in the face of GAI development, proved too formulaic and susceptible to full automation (Lindell & Stöhr, 2025).

As a result, there is an increasingly frequent call for the conscious, controlled and active incorporation of GAI tools into the teaching process as part of preparing students to function in the contemporary business environment (Ma et al., 2025). The technology offers many new possibilities for shaping new curricula, but it can also be a source of numerous risks, including the possibility of presenting false content and introducing it into teaching programmes.

It is therefore postulated that the use of GAI in higher education should be governed by clear ethical, pedagogical, and assessment-related guidelines (Kumar et al., 2024; Xia et al., 2024).

Recent systematic reviews indicate that higher education institutions increasingly redesign curricula to integrate generative AI not only as an object of study but also as a tool supporting learning activities and competency development (Batista et al., 2024; Belkina et al., 2025; Ogunleye et al., 2024). Furthermore, the integration of GAI into higher education is increasingly associated with the need to develop AI literacy competencies, including the ability to critically evaluate AI-generated outputs, understand the limitations of AI systems, and use AI responsibly in educational and professional contexts (Caspari-Sadeghi, 2026). These developments are accompanied by broader curriculum reforms that shift educational objectives from procedural task execution towards analytical, evaluative, and problem-solving competencies that are difficult to automate (Ma et al., 2025). Consequently, the role of academic education is gradually evolving from teaching students how to perform specific technical tasks towards preparing them to critically supervise, interpret, and validate the results generated by artificial intelligence systems. Similar trends have been identified in recent reviews of AI-supported education, which emphasise the transition from traditional task execution towards higher-order cognitive and evaluative competencies (Bouguettaya et al., 2025; Deroncel-Acosta et al., 2025; Salhab & Aboushi, 2025).

The authors of this article faced a similar challenge, having taught classes in business process controlling for many years at the Krakow University of Economics. The previous course model, based, among other things, on the manual modelling of business processes in BPMN 2.0 notation, required adaptation to new technological realities and to students' changing competencies.

The aim of the article is to demonstrate the benefits that a long-standing and proven curriculum can derive from the introduction of evolutionary, controlled

changes, specifically, the incorporation of GAI as a tool supporting the execution of selected tasks without compromising the curriculum's established didactic objectives. Adopting a quantitative, exploratory approach based on task-completion time measurements collected against a multi-year historical baseline, the study addresses the following research questions: (RQ1) To what extent does the use of GAI tools reduce the time required to build a business process model on the basis of process-analysis data, compared to the manual modelling applied consistently in the 2018–2024 editions of the course? (RQ2) To what extent does GAI similarly reduce the time required to build a model of an improved (optimised) process? (RQ3) How do students allocate the time saved through GAI-supported modelling, and does this reallocation support the deeper analytical engagement, such as testing multiple process scenarios, that constitutes a core didactic objective of the programme?

Assumptions and Structure of the Traditional Curriculum (2018–2024)

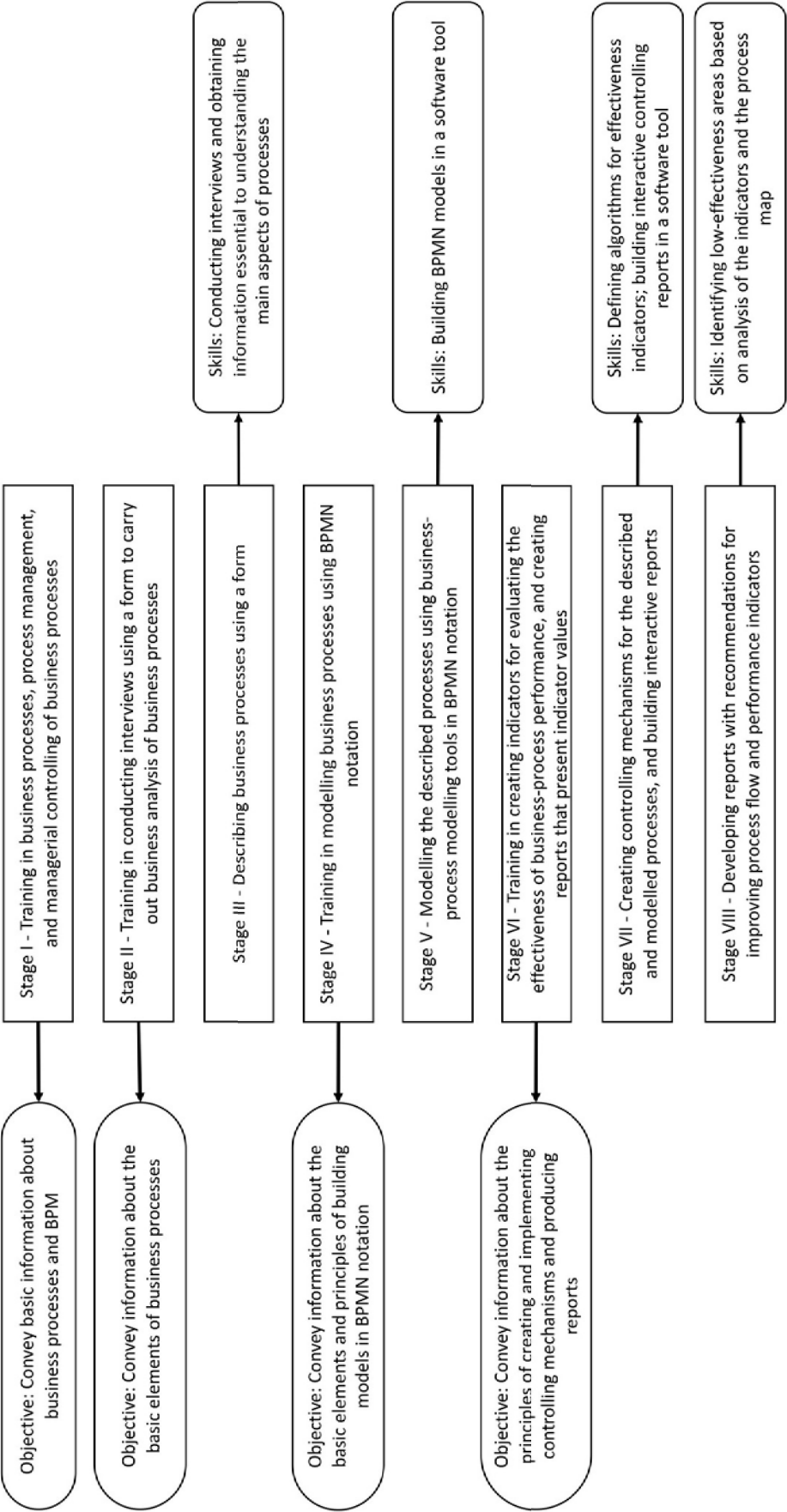
The authors developed and implemented a curriculum aimed at equipping students of the Accounting and Controlling field of study, controlling specialisation, with competencies related to the practical use of controlling in process management. With minor modifications, this programme was delivered at the Krakow University of Economics for eight years, until 2024. During the period under analysis, the changes introduced were primarily technical in nature and served to streamline students' work while carrying out projects.

The structure of the curriculum is presented as a diagram in Figure 1.

The training programme comprised eight stages, integrating a variety of teaching methods such as lectures, practical exercises and team projects carried out by students. The overarching aim of both the programme as a whole and its individual stages was to convey to participants concise, practical knowledge concerning management controlling and the process management that supports it. An important assumption of the programme was also the development of competencies related to the use of selected methods and tools serving to implement the process approach in organisations. In addition, the programme aimed to familiarise participants with the possibilities of using commercial IT tools that support the design and implementation of the process management concept in management controlling.

The first stage was delivered as a lecture devoted to the definitions of business processes and to the fundamental issues related to process management and management controlling. During the lecture, key concepts concerning business processes were discussed, including the process life cycle, process resources and business objectives. Participants were introduced to the typology of business processes and to their significance for the functioning of an enter-

Figure 1
Diagram Of the Original Baseline Training Programme Designed to Prepare Employees to Perform Tasks Related to the Practical use of Business Process Management Mechanisms



Transformation of Business Process Controlling Education...

prise. The main principles of process management were then presented, encompassing the identification, documentation, analysis, monitoring and optimisation of processes. Selected concepts and methods supporting process improvement, such as BPM (Business Process Management), Lean Management and Six Sigma, were also discussed. Attention was paid to the importance of the process approach for increasing the efficiency and flexibility of organisations operating in a dynamically changing business environment.

The remainder of the lecture focused on the role of management controlling as an integral element of process management. It presented how controlling supports managerial decision-making by providing up-to-date information on the efficiency of the processes being carried out. The basic controlling tools were discussed, including budgeting, cost analysis, management accounting and KPIs (Key Performance Indicators). The theoretical part was complemented by case studies presenting practical applications of controlling in various sectors of the economy. The interactive format of the classes, comprising discussions and case analysis, fostered active engagement and a deeper understanding of the issues discussed.

The second stage was a lecture and focused on the practical application of business analysis methods used to identify and describe the course of business processes. In the original version of the course, its aim was to provide participants with knowledge of the principles of conducting interviews within business analysis. In the modified version of the programme, this stage was extended to include the use of a dedicated questionnaire form supporting and structuring the process of conducting interviews with respondents describing the course of the processes being analysed.

The third stage comprised practical exercises consisting in describing the process under study by means of an interview supported by a specially prepared research form. The form made it possible to gather information about the course of the process systematically and to record the interviewer's observations relating to its individual elements. As part of the exercises, participants conducted interviews with people involved in carrying out the business processes being analysed in the organisations under study. This made it possible to obtain detailed information on the structure of the processes, the way they function, and potential problems and areas requiring improvement. These exercises allowed the practical application of the research methods learned earlier and the development of analytical and communication competencies.

The fourth stage comprised a lecture combined with practical exercises concerning the use of BPMN 2.0 notation and the IBM Blueworks Live tool for modelling business processes. The theoretical part presented the basic elements of BPMN 2.0 notation, such as events, activities, gateways and process flows. The practical aspects of using the IBM Blueworks Live platform to create business process models were then

discussed. Participants had the opportunity to model selected processes on their own, which allowed for the practical application of the knowledge acquired. The exercises also included analysing the models developed, identifying potential improvements and optimising business processes.

The fifth stage was practical in nature and focused on the independent creation of graphical models of the business processes under analysis. Participants used the modelling methods and tools learned earlier to develop models relating to real business cases. The exercises included not only creating process diagrams but also identifying bottlenecks, analysing organisational problems and formulating improvement proposals. An important element of this stage was teamwork, which fostered the exchange of experience and a multifaceted analysis of the problems under study. The instructors acted as moderators supporting participants in solving more complex issues.

The sixth stage was delivered as a lecture with elements of practical exercises. Its aim was to provide participants with knowledge of the application of controlling mechanisms in relation to specific business processes. The classes covered both methods of defining process performance indicators and the practical use of IT tools for creating controlling reports, such as IBM Cognos Analytics. In the practical part, participants developed KPIs and learned to interpret them in the context of achieving organisational objectives. In addition, the possibilities of using IBM Cognos Analytics to create reports and analyses supporting the process of managerial decision-making were presented. These classes developed both analytical competencies and the technical skills related to the use of controlling tools.

The seventh stage comprised project exercises that resulted in the preparation of reports presenting the course of the processes under analysis from a controlling perspective. Participants used IT tools, including IBM Cognos Analytics, to create analyses incorporating key process performance indicators. These exercises helped participants develop skills in interpreting data and formulating recommendations to improve the processes under analysis. The results of the work were then presented and discussed in the group forum, which fostered the exchange of experience and a critical evaluation of the proposed solutions.

The eighth stage was delivered as exercises aimed at developing the ability to identify and formulate proposals for improving the business processes under analysis. Participants worked on real case studies, which allowed for the practical application of the knowledge and competencies acquired. During the classes, areas requiring improvement were identified, and proposals for improvement measures were developed, together with possible strategies for their implementation.

Summarising the teaching and research process presented, it should be emphasised that, despite the multifaceted nature of the activities carried out, the

main aim of the programme remained unchanged. It focused on analysing the relationship between the quality and maturity of process management in an organisation and the effectiveness of management control. An important factor affecting the efficiency of process management remains the way it is implemented in the enterprise. The choice of an appropriate method for implementing the process approach therefore constitutes one of the key challenges facing the management of contemporary organisations.

Rationale and Concept for Integrating GAI Tools into the Course

The curriculum described above was intended to introduce controlling students to issues related to process management and the practical use of controlling tools. The rapid development and growing popularity of Generative Artificial Intelligence (GAI) tools, however, created new challenges that prompted the programme's authors to substantially redesign both the structure of the course and the rules governing students' project work.

The widespread use of GAI tools by students has become one of the most significant challenges facing contemporary higher education. The ability to generate texts, analyses or solutions to tasks automatically has been recognised as a factor undermining the effectiveness of traditional teaching methods and ways of verifying learning outcomes. In many academic disciplines, the development of GAI is perceived above all as a threat to existing educational models. In the case of the management sciences, and particularly controlling and process management, it nevertheless seems more justified to treat these technologies as a natural element of the contemporary work environment that should be considered in the educational process. The incorporation of GAI into curricula should be seen not as a sign of the weakening of the role of higher education, but as an expression of its capacity to adapt to the technological changes taking place in the business environment. The growing presence of GAI tools in enterprises indicates that solutions of this kind will, in the future, be a standard workplace tool. For this reason, the authors decided to modify the course programme to consider both the possibilities and the potential benefits arising from the use of GAI. It should, of course, be noted that other approaches to modifying curricula, prompted by the widespread use of GAI tools by students, are being pursued in parallel. An example is research focusing on methods (Khlaif et al., 2025) of assessing students' work that consider the possibility of task results being co-created with GAI.

The process of designing the changes began with an analysis of the individual stages of the programme in terms of their labour-intensiveness and the substantive value they brought to the projects carried out. The analysis showed that the most time-consuming stage is the analysis of the business process and the acquisition of information about its course. At the same time, this stage proved crucial for the quality

of the whole project, since the reliability of the data gathered determines the correctness of subsequent analyses and studies. The next stage, consisting in modelling the process in BPMN 2.0 notation, also required considerable effort, yet the value of the result remained disproportionate to the time devoted to creating process models manually. For this reason, this area was chosen as the starting point for implementing GAI-based solutions.

The development of tools supporting the automatic generation of BPMN 2.0 models based on business process descriptions made it possible to partially automate this stage of project work. In recent years, many solutions have emerged that enable process models to be created from unstructured textual data, and the quality of the generated models has reached a level that allows them to be used in practice in the teaching process. An analysis of the relationship between the time needed to develop a model manually and the possibility of obtaining a comparable result using GAI clearly justified modifying this element of the programme.

Consequently, the authors decided to incorporate GAI tools into the programme, enabling the automatic generation of process models based on materials prepared during the analysis of the process under study. This decision stemmed from both organisational and pedagogical considerations. The use of GAI made it possible to significantly reduce the time devoted to the technical modelling of processes, while also enabling students to acquire new competencies related to the practical use of artificial intelligence tools in carrying out analytical tasks.

An important effect of the changes introduced was also drawing students' attention to the importance of input data quality in projects related to the analysis and improvement of business processes. The use of GAI allowed course participants to observe the direct relationship between the quality of the prepared process description and the quality of the generated BPMN model. Students were able to experiment on their own with modifying process descriptions and to analyse the impact of these changes on the result generated by the GAI tools. As a result, the teaching process was extended not only by an element of work automation but also by practical experience related to assessing data quality and critically analysing the results generated by artificial intelligence.

Implementation Process and Educational Outcomes of Generative Artificial Intelligence

The Impact of Generative AI on the Efficiency of Business Process Modelling in BPMN Notation

Business process modelling in BPMN notation is a key component of education in process analysis, automation, and organisational improvement design. The traditional approach to teaching BPMN focuses on manual diagram creation, which is time-consuming and cognitively demanding, especially for beginners. In recent years, tools based on Generative AI (GAI) have

emerged, enabling automatic generation of models from textual descriptions. The introduction of such tools can significantly change how process analysts work and how academic instruction is structured.

The study was conducted with 42 students who performed a process modelling task both in the traditional format and using a GAI-based tool (lucid.app). The results were compared with historical data from 2018–2025, covering 50 to 100 students per year. Each student worked on an identical process description, allowing direct comparison of efficiency between the two approaches. In both cases, the instructor measured the time required to complete the task, using the point at which more than 50% of students had completed their model as the completion criterion. Additionally, the quality of final projects was assessed, including AS-IS and TO-BE models, identification of weaknesses, recommendations for improvement, automation level, metrics, and cost-benefit analysis. The average project grade was 4.3 on a scale from 2 to 5.

Research Design and Case Description

The study was designed as a case study of a pedagogical intervention implemented within a long-standing business process controlling curriculum. The analysis adopted a comparative and exploratory approach based on task-completion time measurements and historical benchmark data collected from previous editions of the course. Students first completed the task in the traditional format and then, after a short break, performed the same task using the GAI tool.

Table 1
Project Evaluation Criteria (100 points)

No.	Criterion	Max. points	What to look at when assessing
1	Process scope and description (AS-IS)	10	Clearly defined trigger, outcome, process boundaries, participants and their roles; no blurring of scope; a quantitative description of the current state.
2	AS-IS model in BPMN	15	Correct notation (pools/lanes, start/end events, gateways, flows), completeness of paths, readability, and consistency with the textual description.
3	Diagnosis of weaknesses	15	Specificity and connection to the process (not generalities), identifying causes rather than only symptoms, and linkage to metrics.
4	Recommendations / proposed changes	10	Whether each change addresses an identified weakness; feasibility; no technology for technology's sake.
5	TO-BE model in BPMN	15	Correct notation, consistency with AS-IS, correct representation of automation (system vs. manual tasks), and a new system/ERP lane.
6	Level of automation and maturity logic	10	Justification of the AS-IS -> TO-BE transition; an appropriate choice of technology (OCR, KSeF, workflow, ERP integration); removing dependence on manual work.
7	Metrics / KPIs	10	Measurability, relevance to the process objectives, preferably with a baseline and a target value.
8	Cost-benefit analysis	8	An attempt at quantification, realism, stated sources/assumptions, consideration of the scale of the organisation, and inclusion of benefits/ROI.
9	Quality of presentation, structure and language	7	A logical narrative, linguistic correctness, slide readability, and the visual quality of the diagrams.
Total		100	

This approach allowed the researchers to isolate the effect of technology while maintaining constant conditions: the same process description, instructor, and student group.

Project evaluation was based on nine criteria covering both technical correctness of BPMN models and the quality of process analysis. Table 1 below presents the full set of criteria.

Experiment Results

The most striking effect of using GAI was the dramatic reduction in task completion time. In the traditional version, students needed between 55 and 75 minutes to complete a basic BPMN model. In the GAI-assisted experiment, the same task took only 8 minutes. This represents a reduction of over 80%, constituting a breakthrough improvement in efficiency. Table 2 summarises the results.

Table 2
Average Task Completion Time

Student Group	Average Time to Complete the Task
Students 2018–2025	55–75 min
Students 2026 (traditional version)	55–65 min
Students 2026 (GAI version)	8 min

The reduction in time did not result from task simplification – students worked on the same process description, and the completion criterion remained

unchanged. The difference stems solely from the use of GAI technology.

Results Analysis

The introduction of GAI changed the structure of students' work. In the traditional format, much of the time was spent manually drawing BPMN elements, ensuring notation correctness, and fixing technical errors. In the GAI format, students could focus on process analysis: diagnosing weaknesses, designing improvements, defining automation logic, setting KPIs, and conducting cost-benefit analysis. This shift moves the educational focus from manual tasks to analytical reasoning, fostering the development of skills essential in business practice.

Despite the drastic reduction in time, the quality of final projects remained high. The average grade of 4.3/5 indicates that students not only completed the task faster but also delivered projects of high analytical value. GAI tools support BPMN notation accuracy, eliminating common beginner errors such as missing flows, incorrect gateways, or inconsistencies between the model and textual description.

Discussion

Integrating GAI into BPMN education enables shorter exercises, more iterations, and work on more complex processes. Students are more engaged, as removing manual work increases satisfaction and motivation. The technology promotes the development of analytical, technological, and design competencies that are crucial for process analysts.

The study has certain limitations: it involved a single group of students and one type of process. Future research should expand the experiment to include different process types, various GAI tools, and long-term analysis of skill development.

Educational Implications of the Empirical Findings

The experiment clearly demonstrates that using Generative AI in business process modelling significantly increases student efficiency, reduces task completion time by over 80%, and maintains high-quality results. The technology shifts the educational focus from manual modelling to analytical thinking, leading to deeper process understanding and more mature improvement proposals. GAI is a valuable educational and practical tool that can transform how process analysis is taught and performed.

Directions for the Evolution of the Curriculum in the Context of AI Technology Development

The results achieved during classes conducted according to the modified version of the curriculum confirmed the validity of the decision to incorporate GAI tools into the stage of creating process models in BPMN 2.0 notation. At the same time, the results obtained by students while carrying out projects became the basis for developing further directions for the programme's development.

Proposals were prepared for further modifications envisaging the extension of the use of GAI tools and of algorithms co-created by students to further areas of process analysis. The planned changes include, among other things, the use of GAI to analyse data describing business processes, identify potential improvements, design organisational changes, and support the creation of controlling mechanisms. A further area envisaged for integration with GAI tools is the simulation of the course of the designed business processes.

From the perspective of students in fields related to controlling and business analysis, the possibility of broadening their competencies in process management and process life-cycle management is of considerable practical importance. Traditional curricula, which require the simultaneous mastery of numerous IT tools and analytical techniques, considerably limit the time that can be devoted to developing skills related to interpreting results, designing improvements or formulating managerial recommendations.

The conscious use of GAI tools makes it possible to manage more effectively the time devoted to carrying out the individual stages of the course. Thanks to the automation of selected technical activities, students can analyse a larger number of process variants in a shorter time and test different organisational scenarios. This changes the way educational objectives are defined in the curricula being designed. The use of GAI makes it possible to focus the teaching process not only on acquiring technical skills but, above all, on developing analytical competencies, critical thinking and the ability to design solutions corresponding to real organisational problems.

The ability to quickly generate and analyse multiple process variants means that students gain considerably more practical experience in a relatively short time. In this situation, the role of the academic teacher partly changes and increasingly focuses on supporting students in the conscious, critical and responsible use of the knowledge obtained through GAI tools and the experience gained while carrying out teaching projects.

Comparative Analysis of the Training Programme's Development Stages

The data presented in Table 3 set out the successive stages in the development of the curriculum, considering the gradual broadening of the scope of use of Generative Artificial Intelligence tools. The first phase of modifying the programme covered two stages of the course, in which traditional, manual process modelling was replaced by GAI-based solutions. In the next phase, a considerably broader deployment of artificial intelligence tools is planned, encompassing practically all stages of the programme delivered.

Ultimately, each stage of the course is to be supported by GAI-based solutions, beginning with the phase of acquiring information about the course of the business process under analysis. In addition to the widely available functions offered by GAI tools, such

Table 3
Stages of the Programme Delivered in Classes Devoted to Business Process Controlling

Stage	Original programme	Programme modification I (2026)	Programme modification II – plan (2027)
Stage I	Training in process management		
Stage II	Training in conducting interviews		
Stage III	Interviews with process stakeholders supported by a form in MS Word	No change	Conducting interviews using audio recorders, with transcription to text. Using video analysis to document production processes.
Stage IV	Training in business process modelling		
Stage V	Creating process models in the Blueworkslive.com tool	Automatic generation of BPMN models using GAI based on documentation collected in Stage II	No change relative to the modified programme
Stage VI	Training in creating indicators and dashboards		
Stage VII	Creating a dashboard and analyses in a BI tool (Cognos/Watson)	No change	Creating dashboards and analysing processes using GAI
Stage VIII	Identifying process weaknesses and proposing changes to improve efficiency	Identifying process weaknesses and proposing changes using GAI	Simulating the flow of the designed processes using GAI Preparation of interactive reports using GAI

as the automatic transcription of audio recordings or the generation of process models from unstructured textual descriptions, the authors plan to draw on experience from earlier research (Monzon & Hays, 2025). This concerned, among other things, the use of artificial intelligence tools to analyse video recordings of processes carried out at traditional production workstations.

The stage of data analysis and of developing recommendations for improving business processes will also be modified (Xia et al., 2024). The main aim of the planned changes is to enable students to analyse multiple alternative scenarios for redesigning and optimising processes. In the previous version of the programme, due to time constraints and the need to enter changes into process models manually, students were able to develop only a single improvement variant. The use of GAI tools will make it possible to significantly broaden the range of scenarios analysed and to increase the scope for experimenting with different process configurations.

The most significant changes, however, are planned for the final stage of the curriculum. Thanks to the integration of GAI tools, students will be able not only to create controlling reports but also to develop them based on the results of business process simulations (Francis et al., 2025). The inclusion of simulation models supported by GAI will make it possible to extend the programme to include an analysis of the effects of the proposed organisational changes and an assessment of their impact on process efficiency. Such an approach will allow course participants to gain experience that closely resembles real-world process design and improvement in business organisations.

Conclusions

Modifications to a long-standing curriculum, delivered both in academic studies and in the form of business training, constitute an attempt to flexibly adapt education to the technological changes taking place in the contemporary economic environment. The main impulse for redesigning this course was the spread of generative artificial intelligence tools and their increasingly strong position in everyday professional practice. The emergence of these technologies initially provoked considerable variation in attitudes: the business world quickly saw in them an opportunity to automate routine tasks and streamline decision-making processes, whereas in higher education concerns arose about the integrity of traditional forms of verifying learning outcomes. The experience described in the article suggests, however, that the appropriate response of universities is the conscious incorporation of GAI solutions into study programmes, rather than perceiving them solely in terms of a threat. This integration makes it possible to clearly shift the focus of education – from time-consuming, repetitive technical activities towards the development of analytical skills, critical thinking and the independent design of improvements.

In an educational process shaped in this way, the role of the student evolves: students cease to be merely executors of repetitive tasks and become people who critically verify and evaluate the results of artificial intelligence. Although automation relieves course participants of the burden of drawing diagrams manually, theoretical knowledge of BPMN 2.0 notation by no means loses its importance. Its purpose changes, however, since it becomes the basis for assessing the

correctness of models generated by artificial intelligence, which is crucial given the risk of errors or inaccuracies in automatically created diagrams. The significant reduction in the time devoted to technical modelling made it possible to save time that students could devote to a more thorough analysis of bottlenecks and to the search for creative optimisation solutions. This redesign redefines the educational objectives, linking the academic experience with the ability to solve real, complex organisational problems rather than with mere proficiency in operating software. Consequently, the role of the academic teacher evolves from that of a traditional lecturer to that of a mentor supporting students in the responsible and critical use of the resources provided by technology.

The findings suggest that the educational value of GAI lies not only in process automation and efficiency gains but also in supporting the development of AI literacy competencies. In the redesigned curriculum, students are required to critically evaluate AI-generated process models, identify inconsistencies, verify compliance with BPMN standards, and assess the relationship between input data quality and model outputs. As a result, the educational focus shifts from technical model construction towards the development of analytical judgement, critical thinking, and responsible interaction with AI systems. This observation is consistent with recent studies emphasising AI literacy and the critical evaluation of AI-generated content as emerging core competencies in higher education (Caspari-Sadeghi, 2026; Ma et al., 2025).

The study also provides answers to the research questions formulated in the introduction. With respect to RQ1, the findings indicate that the use of GAI tools substantially reduces the time required to build a business process model based on process-analysis data, reducing average completion time from approximately 55–75 minutes to 8 minutes. Regarding RQ2, a similar reduction was observed in activities related to developing improved process models, indicating that GAI can significantly reduce the time devoted to technical modelling tasks. Finally, in response to RQ3, the evidence suggests that the time saved through GAI-supported modelling can be reallocated to higher-value analytical activities, including diagnosing process weaknesses, evaluating alternative scenarios, defining performance indicators, and designing process improvements.

The educational intervention presented has certain limitations, arising from the fact that it covered a specific group of students of the Controlling specialisation who already possessed high analytical competencies from the outset. Bearing this in mind, the authors have outlined a perspective for the further development of the curriculum through the successive implementation of GAI tools in subsequent stages of process analysis. The planned innovations include the use of algorithms to interpret process data, to design organisational changes, and to support the construction of controlling mechanisms. A key element of the forthcoming phase of the course's development will be the imple-

mentation of AI-supported simulation models. This will allow students to run simulations and accurately assess the impact of the designed transformations on the efficiency of the entire enterprise. Such a path for the development of teaching will make it possible to equip graduates with unique market skills aligned with the realities of contemporary business, in which the collaboration of humans with artificial intelligence is becoming a standard element of an analyst's work.

It should be acknowledged that, notwithstanding the multi-year historical baseline described above, the present design does not constitute a randomised controlled experiment: no parallel control group was maintained during the 2025 implementation, cohort-level differences across the 2018–2024 period may have influenced completion times independently of GAI use, and the reported time reductions have not yet been subjected to formal statistical significance testing (e.g., the Mann–Whitney U test). Future research should investigate the relationships between the use of GAI tools and several educational outcomes, including task-completion time, project quality, analytical performance, AI literacy development, and students' ability to critically evaluate AI-generated outputs. Further studies should also examine how different levels of GAI integration influence learning outcomes and engagement, preferably using larger samples, comparison groups, and formal statistical analyses.

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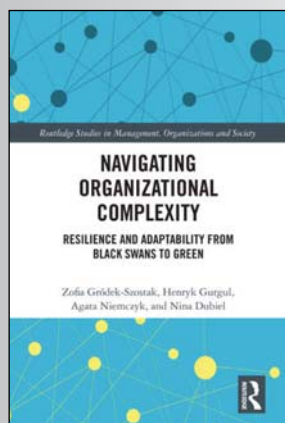
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WE RECOMMEND



Zofia Gródek-Szostak, Henryk Gurgul, Agata Niemczyk, Nina Dubiel
Navigating Organizational Complexity. Resilience and Adaptability from Black Swans to Green

Drawing on Nassim Taleb’s metaphor of the “black swan”, this book expands this concept to include a typology of transformative events: Black Swans (negative and unexpected), White Swans (positive and unexpected), Gray Swans (known but neglected threats), and Green Swans (long-term environmental megatrends). Through interdisciplinary analysis, it examines how organizations can build resilience, adapt to uncertainty, and thrive in the face of disruption. It offers practical tools and frameworks for strategic foresight, leadership, and risk management, making it an essential resource for navigating the complexities of the modern business environment.

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Clarity and Credibility: A Comparative Study of Students' Perception of AI-Generated and Human-Created Content

Abstract

The growing popularity of AI across various fields affects students' decisions. Since one of the modalities of AI is clarification and explanation of more complex phenomena, the focus of this paper is on how knowledge processing differs between AI- and human-generated texts, which texts readers trust more, and why. This study investigates how university students perceive the clarity and credibility of explanations produced by AI in comparison to those written by humans. Using a quasi-experimental, mixed-methods design, 298 students from universities in Croatia and Poland participated in a survey assessing their ability to recognise the source of short academic texts and evaluate their reliability, usefulness, and comprehensibility. The results reveal a high level of AI adoption among students, as well as an emerging ability to distinguish between AI- and human-authored content based on linguistic and stylistic cues. Notably, students who reported frequent AI use were more confident in their evaluations and more trusting of AI-generated explanations. Disciplinary background, gender and topic familiarity also influenced content preferences and recognition accuracy. Across both logic and neurobiology tasks, students showed a marked preference for hybrid explanations that combine AI-generated precision with human-authored contextual clarity. These findings contribute to the growing field of AI literacy and offer practical implications for the design of trustworthy, pedagogically effective AI-supported learning materials.

Keywords: clarity, credibility, AI-generated content, human-created content, student perceptions

Introduction

Considering the changes (technological, social, demographical etc.) ongoing in the current world, the understanding of diverse concepts from various disciplines seems a crucial element of living and actively participating in society. Explanatory elements are observable not only in everyday life but also in professional fields. This is why understanding is also key for decision-making processes and for shaping critical reasoning and perceptions of the surrounding world.

Just as they are applied in other disciplines, explanations also play an important role in the learning and teaching process. Constructing a valid explanation is not solely a framework for understanding; it also includes many factors that contribute to its clarity and validity, such as logical structure, exemplifications and transparent cause-and-effect thinking (Moore & Wright, 2023).

One of the most transformative developments in this regard is the emergence of generative artificial intelligence (AI). AI-powered tools are increasingly capable of producing coherent, structured, and seemingly authoritative explanations across a range of topics. As these tools become embedded in educational environments, they raise important questions about how students perceive and evaluate the clarity, reliability, and trustworthiness of AI-generated versus human-created content. Human-computer interaction in this context is not only a matter of usability or interface design but also a cognitive and epistemological concern: how do learners distinguish machine-gener-

ated from human-authored explanations, and how does this influence their trust and learning?

This study aims to examine students' ability to critically evaluate the credibility of AI-generated content, a skill that may prove crucial in the future. The primary objective of this research is to determine whether students possess sufficient linguistic and critical awareness to distinguish between AI-generated and human-authored texts, thereby enabling informed and responsible content consumption.

Literature Review

Explanations – Definition, Types and Structure

Every explanation is deeply connected to the way people perceive and interpret the world. The concept of explanation itself is multidimensional, and its definition has long posed challenges for researchers. An explanation can be defined in various ways depending on the perspective adopted, leading to different interpretations and misconceptions (Tan, 2022). Josephson and Josephson (1996) define explanations as 'assessments of causal responsibility,' thereby situating explanation within the domain of cause-and-effect reasoning.

Considering the latter definition, Miller (2019) states that an explanation is based on bridging the gap between the explanandum and explanans. An explanation can also be understood as the result of a cognitive process and, as such, can be perceived as a product. Finally, it is also a result of 'knowledge transfer' between an explainer and explainee (Miller, 2019). Poggiolessi (2024) identifies causal explanations as those that illuminate the causes of phenomena, in opposition to conceptual explanations, which focus on the reasons for those phenomena. Following the terminology introduced by Leinhardt and Steele (2005), explanations used in educational contexts are instructional explanations; they serve the cognitive needs of learners (Keil & Wilson, 2000). Moore and Wright (2023) shift the perspective and strongly emphasise the importance of a well-posed question in the explanatory process, rather than the type of explanation itself; however, explanations should answer the questions of how and why, rather than what (Federer et al., 2015).

Human Explanations – Features

Miller (2019) discusses the characteristics of human explanations based on an analysis of recent literature on the topic. What distinguishes human explanations is their contrastive nature, which highlights the phenomenon being explained through contrast (Woodward, 2005). Furthermore, human explanations are inherently biased, as they rely on selecting the most likely option. Although reality and probability are crucial for explaining phenomena, for humans, they are less valuable than presenting the causes of a given situation or phenomenon. Finally, explanations are based on knowledge construction, which means

they are dependent on the explainer's and explainee's belief systems (Miller, 2019). Lombrozo and Liquin (2023) highlight the selectivity and incompleteness of human explanations as some of their greatest strengths. Selectivity responds to epistemic curiosity, enabling individuals to process new information effectively and integrate it into existing cognitive structures. Moreover, selectivity often reflects an individual's motivations, purposes, and intentions (Kim et al., 2023).

However, a lack of clarity and precision in explanations may reduce their perceived credibility and trustworthiness. This issue is particularly relevant in the context of artificial intelligence, where users often rely on AI-generated explanations to understand complex information. When such explanations are vague, ambiguous, or insufficiently transparent, they can undermine users' trust in AI systems and reduce their willingness to accept or act on the information provided (Chan & Hun, 2023; Pitts et al., 2025). An experiment conducted by Rago et al. (2024) confirmed a correlation between the format and clarity of an explanation and the level of trust in it; full experimental details are provided in Appendix A.

AI-Generated Explanations

The scope of AI implementation continues to expand in response to evolving needs, ranging from simple conversational interactions to increasingly complex tasks. As the number of human–technology interactions grows and technological capabilities advance, new challenges emerge that require effective solutions. AI is increasingly used to facilitate understanding, support decision-making processes, and enhance efficiency across various domains. This trend is particularly visible in education. According to the Digital Education Council's (2024) global survey, 86% of students use AI in their studies, with 69% employing it for information searches and 42% for grammar checking. Similarly, a survey conducted at the Hong Kong University of Science and Technology found that 96% of students use AI tools, primarily for academic purposes (Jingwei He et al., 2025).

Markowitz et al. (2024) suggested analysing the features of AI-generated texts, using writing analysis to measure how thoughts and content are transmitted. Initial findings revealed that non-academic abstracts were simpler and more approachable in terms of language complexity; full experimental detail is provided in Appendix A. Markowitz et al. (2024) observed that simpler and clearer presentation was associated with greater trust in, and understanding of, the topic, which was identified as a key advantage of AI-generated explanations. The findings were also confirmed by an independent study on the trustworthiness of AI creations conducted by Kim et al. (2024).

Feher et al. (2025) list the features of AI-generated explanations, highlighting their smooth language and high linguistic flexibility, as well as their tendency toward generalisation. What fosters trust and cred-

ibility is their high level of adaptability to the target audience through an appropriate choice of vocabulary and register. The above points lead to the conclusion that AI-generated explanations are explanations automatically produced by Large Language Models, designed to present information in a clear, coherent, and audience-oriented manner.

Credibility and Clarity

Important criteria for explanation in terms of perception are credibility and clarity, as both affect how receivers perceive the content. Credibility incorporates three elements: the sender of the message (source credibility), the channel of the message (media credibility), and the form and way in which the message is conveyed (message credibility) (Hellmueller & Trilling, 2012). This aspect constitutes the level of understanding and trust in the received content. Clarity, in turn, refers to the degree to which the message is comprehensible and unambiguous to its intended audience.

Rae (2024) conducted mixed-method experiments in which participants evaluated content created either by a computer or by humans. The findings revealed that labelling content as AI-generated reduced the creator's trustworthiness and overall positive perception to a much greater extent than in the case of human-made content. However, the trustworthiness of the content itself remained unchanged, which shows the still huge gap that exists with respect to understanding the cognitive mechanisms of trustworthiness and perception. Nazaretsky et al. (2024) explored how automated systems can effectively assess the quality of students' reasoning, detect misconceptions, and deliver personalised feedback. The study underscores the importance of explanations as indicators of conceptual understanding and highlights their potential to support more effective teaching and learning. Farrell (2025) emphasises the role of education and the theoretical background for recognising and trusting AI-generated explanations. The observation in the research is that students with advanced linguistic training are more sensitive to textual coherence, tone and discourse appropriateness, which helps them cope with explanations more critically and selectively.

Zhang et al. (2025a) found that students placed greater trust in feedback co-produced by AI together with human-generated content than in purely AI-generated material. The key determinant of trust in AI-generated content appears to be experience and critical reasoning, both of which enable deeper analysis of the resulting texts. This finding is supported by Lermann Henestroza and Kimmerle (2024), who similarly observed that knowledge of (or even the slightest suggestion about) the authorship of an AI-generated explanation significantly affects readers' trust in its validity. The researchers suggest further research on trustworthiness and credibility, particularly by contrasting human- and AI-generated content,

especially for broader audiences. An interesting finding of the paper is that AI explanations are based on the probability and frequency of specific data, which probably makes them more reliable and trustworthy than human-made content. In this respect, a comparison of groups with different national backgrounds and attitudes to AI-created content might be of great value for future research on the topic.

Research Gap and Research Questions

The study described in the following paper refers to Poland and Croatia as two countries struggling with the rapidly growing popularity of AI across many sectors, including education. To fill the existing research gap mentioned in the previous paragraph, and referring, on the one hand, to the lack of comparative studies on AI vs human explanations, and, on the other hand, to the under-researched element of the trustworthiness and reliability of AI- and human-created explanations, the following research questions were posed.

Poland and Croatia were selected on both practical grounds (the authors' institutional affiliations enabled access to comparable undergraduate cohorts) and theoretical ones (both represent underrepresented Central and Eastern European higher education systems in AI-in-education research); a detailed discussion of the national and policy context is provided in Appendix A.

The constructs in this study are positioned within a coherent conceptual framework as follows. Explanation type (AI-generated, human-created, or hybrid) is the primary independent variable; clarity, credibility, usefulness, and engagement are outcome dimensions; trust in AI-generated content functions as a mediating variable between explanation type and content preference; and student characteristics (AI use frequency, disciplinary background, gender) operate as moderating variables. This framework, reproduced in full in Appendix B, guided construct operationalisation and the sequencing of all inferential analyses.

- RQ1: How do students rate the clarity, usefulness, and credibility of AI-generated, human-created, and hybrid explanations, and which type do they prefer as a learning resource?
- RQ2: What factors influence students' trust in and preference for AI-generated versus human-created explanations?
- RQ3: What are students' perceptions of the strengths and weaknesses of different content types, and what improvements do they recommend for AI-generated content?

Based on the above research questions, the following hypotheses were formulated:

- H1: Students will rate human-created explanations as significantly clearer and more credible than AI-generated explanations.
- H2: Frequency of AI use will be positively associated with higher trust in and more favourable evaluation of AI-generated content.

H3: Students' disciplinary background will significantly influence their ability to distinguish AI-generated from human-created content, with language-specialised students performing differently from STEM students.

Methodology

The study adopted a comprehensive quantitative research methodology to check the reliability and clarity of AI-generated versus human-created explanations. The data were collected through surveys distributed to participants in Poland and Croatia. The questionnaire was available via Google Forms and was completed by 298 participants between April and May, 2025.

The choice of a quasi-experimental mixed-methods design was motivated by the multi-dimensional nature of the constructs under investigation. The quantitative strand, comprising Likert-scale ratings, forced-choice source identification tasks, and preference questions, enabled statistical testing of group differences and associations across disciplines, genders, and national backgrounds. The qualitative strand, comprising open-ended responses analysed thematically, allowed students to articulate their evaluative reasoning in their own words, capturing nuance that closed-scale items cannot fully represent. These two strands were integrated at the interpretive level: quantitative results identified patterns and tested the study's hypotheses, while qualitative data explained the mechanisms and contextual factors underlying those patterns. The quasi-experimental character of the design derives from the use of controlled stimulus texts (matched pairs of AI-generated and human-created explanations on the same topic) presented to participants under standardised conditions, without random assignment.

Each construct was operationalised through specific survey items; full definitions and item wording are provided in Appendix B (Table B.1). All Likert items used a 5-point response scale (1 = strongly disagree / not at all, 5 = strongly agree / very much).

Item wording was developed based on established frameworks for assessing credibility, clarity, and trust in educational contexts (Hellmueller & Trilling, 2012; Lermann Henestroza & Kimmerle, 2024) and adapted to the specific task of evaluating short explanatory texts. Single-item operationalisation was adopted as a pragmatic compromise given survey length constraints, with face validity established through the pilot phase ($N = 15$). The limitations of this approach regarding construct validity and internal consistency are explicitly acknowledged in the Limitations section.

The primary aim of the survey was to assess university students' ability to identify the source of explanatory texts (AI-generated vs. human-created) and to evaluate those texts along dimensions of clarity, credibility, usefulness, and engagement. The target group consisted of undergraduate students

enrolled in higher education institutions in Croatia and Poland, selected on the basis of availability and voluntary participation (convenience sampling). This non-probability sampling approach was chosen to facilitate data collection within the institutional constraints of both universities; however, it should be noted that this limits the generalizability of findings to broader student populations. The final sample comprised 298 respondents (198 from Poland, 100 from Croatia). Prior to the survey, a pilot test was conducted with a small group of students ($N = 15$) to evaluate clarity of instructions and item comprehension; no significant issues were identified. Participation was entirely voluntary and anonymous, and no minimum sample size was predefined; the achieved $N = 298$ is considered adequate for the non-parametric statistical tests applied (Wilcoxon signed-rank, Mann-Whitney U, Kruskal-Wallis, chi-square).

Participants

Participation was voluntary, and all participants provided informed consent after being informed about anonymity and data-handling procedures. The analysis was conducted on 298 people, including 198 from Poland and 100 from Croatia. In the survey, 135 male participants took part, 152 female, and 11 who preferred not to state their gender. The vast majority of the participants belonged to the age group 18–21, 71 to the group 22–24 and 13 to the group 25 and older. 90.9% ($N = 271$) of the participants were at the bachelor level. 90.3% ($N = 269$) of the participants were enrolled at a public university. 38% of the survey participants study Computer Science, 37% Modern Languages, 17% Applied Linguistics, 6% Business, 1% Management and Medicine and 0% Psychology.

Data Analysis

Quantitative responses were analysed using descriptive statistics and non-parametric inferential tests (Wilcoxon signed-rank, Mann-Whitney U, Kruskal-Wallis and chi-square tests), appropriate for ordinal data and subgroup comparisons. Open-ended responses were subjected to thematic analysis, which identified recurring patterns in students' evaluative reasoning and perceptions of AI versus human authorship.

Figure 2 presents the study's analytical framework, explicitly mapping each research question and hypothesis to its corresponding construct, statistical test, and variable(s). This framework guided the selection and sequencing of all inferential analyses reported in the Results section. The analytical framework is reproduced in full in Appendix B.

Results

This section presents the study's findings, structured around five analytical themes that collectively address the three formal research questions stated above.

Terminology note: 'credibility' refers to text-level perceived accuracy; 'trust' to the broader disposition toward AI as a source type; full definitions and effect sizes for all significant tests are provided in Appendix D.

The survey results revealed that 88.3% of the student sample actively integrates AI technologies into their everyday activities, driven primarily by efficiency, convenience, and their role as study aids. The remaining 11.7% cited a lack of personal need, concerns about misinformation, or a preference for independent inquiry as reasons for non-use. A full categorisation of AI usage patterns and reasons for avoidance is provided in Appendix D.

A Wilcoxon signed-rank test ($N = 298$) was conducted to compare students' perceived difficulty in understanding explanations created by humans and generated by AI. The test yielded a significant result ($Z = -3.263$, $p = .001$) with 120 students (40.3%) finding AI-generated material easier to understand, 73 (24.5%) reporting greater difficulty, and 105 (35.2%) noticing no difference.

A subsequent Mann-Whitney U test assessed differences between daily AI users ($N = 263$) and non-users ($N = 35$) in perceived comprehension of AI-generated content. Daily students reported significantly lower difficulty ($U = 3035.500$, $z = -3.492$, $p = .000$), suggesting that frequent exposure may enhance students' ability to comprehend AI-generated content, possibly due to increased familiarity with the structure, language patterns and limitations of such content. Similarly, daily students exhibited greater trust in AI-generated content ($U = 1784.500$, $z = -6.287$, $p = .000$).

Cross-national comparisons (Mann-Whitney U) revealed no significant differences between Polish and Croatian students in either perceived difficulty of AI-generated explanation ($U = 9259.500$, $z = 0.973$, $p = .330$) or trust in AI as a source of academic knowledge ($U = 9102.00$, $z = -1.214$, $p = .225$); full cross-national analysis is provided in Appendix D.

A within-group Kruskal-Wallis test revealed significant discipline-based variation among the Polish students ($X^2(6, N = 198) = 12.152$, $p = .002$). Post-hoc pairwise comparisons (with Bonferroni correction) showed that students in Philology and Applied Linguistics found AI-generated content significantly more difficult than students in other fields ($p = .015$ and $p = .016$, respectively).

Discussion

This study examined university students' perceptions of AI-generated versus human-created explanations by exploring three central research questions: how students assess and prefer different content types; what factors influence their trust and preferences; and how they perceive the strengths and weaknesses of each, along with suggestions for improvement. The findings provide valuable insights into how students engage with AI tools in educational contexts and offer

implications for both AI literacy development and the design of AI-supported instructional content.

The first research question addressed how students rate the clarity, usefulness and credibility of explanations depending on their source and which type they ultimately prefer. The analysis revealed that human-created content was consistently rated as clearer, more useful and more credible than AI-generated content, particularly in logic-related tasks. Students appreciated the accessible language, personal tone and practical examples found in human-authored texts, which facilitated comprehension and engagement. However, AI-generated content was valued for its depth, precision and structured presentation, attributes that were particularly appreciated in more technical subjects such as neurobiology. One possible explanation is that AI-generated content often uses simpler, more structured and more concise language, which may reduce cognitive load and make complex concepts more accessible. In contrast, human-created content may include more nuanced or context-dependent expressions, which, while potentially richer in meaning, can be harder to process for some learners. This pattern aligns with the findings of Nazaretsky et al. (2024). Despite these perceived strengths, the AI-generated explanations were sometimes seen as overly formal or linguistically rigid, especially by students with advanced language training. Interestingly, across both domains and regardless of national background, students most frequently expressed a preference for hybrid content - explanations that combine human contextual clarity with AI-generated precision. This suggests a growing awareness of the complementary strengths of both content types and a preference for a balanced integration that maximises both clarity and informational value.

The second research question focused on the factors shaping students' trust in and preferences for AI-generated versus human-created content. Several key variables emerged from the analysis. First, the frequency of AI use was strongly associated with more favourable evaluations of AI-generated content.

Students who reported daily or frequent use of AI tools found such content easier to understand and more trustworthy, echoing findings by Zhang et al. (2025b) and Nazaretsky et al. (2024) on the role of exposure in reducing cognitive load and increasing tool trust, i.e. the more students engage with AI, the more adept they become at parsing its linguistic structure and content delivery.

This indicates that regular exposure to AI tools may contribute to a greater sense of reliability and confidence in AI as a source of academic information. The findings are consistent with prior research (Zhang et al., 2025a), which suggests that frequency of AI use is positively associated with both perceived usefulness and trust in AI-generated educational materials. Second, disciplinary background emerged as a significant factor influencing both perception and recognition. Philology and Applied Linguistics students rated AI-generated content as more difficult to understand

than students in other fields. Our result aligns with Farrell's (2025) research. These findings suggest that students with strong backgrounds in language and textual analysis may be more sensitive to the limitations or unnatural features of AI-generated texts, such as a lack of nuance, coherence or pragmatic appropriateness. Their academic background likely enables them to detect subtle inconsistencies or unnatural phrasing that may be overlooked by peers from other disciplines. Our result aligns with Farrell's (2025) research, which highlights that language-specialised students engage more critically with machine-produced texts. These results imply that while most students may perceive AI-generated explanations as accessible or even preferable, those with deep linguistic expertise may remain cautious. This underscores the importance of enhancing the communicative clarity and authenticity of AI-generated educational materials, especially when used in language-focused academic contexts.

In contrast, Computer Science students not only evaluated AI explanations more positively but also outperformed other groups in source identification tasks. This may reflect their greater exposure to AI tools and conceptual familiarity with algorithmic logic, enabling more accurate evaluations and increased receptivity toward machine-generated content. These findings highlight the influence of academic training on students' critical engagement with AI-produced content. Third, gender also influenced perception and comprehension, although to a lesser extent. Female students reported lower difficulty in understanding AI-generated materials, a finding that resonates with studies identifying greater comfort and trust in digital tools among women in academic settings (Zhang et al., 2025a). However, no significant gender differences were found in trust ratings overall. Interestingly, male students perceived the human-created neurobiology explanation as significantly easier to understand and more useful, indicating possible content-specific confidence or greater prior knowledge in technical subjects.

Taken together, the findings of the present study both confirm and extend existing research in important ways. The preference for hybrid content aligns with Shankar et al. (2024), who argue that incorporating human oversight into AI-generated material enhances its pedagogical credibility. Similarly, the strong association between frequent AI use and more favourable content evaluations resonates with Zhang et al. (2025a), who found that students accustomed to AI tools perceive their output as more objective and useful, a pattern consistent with technology acceptance theory, which posits that familiarity reduces perceived risk. However, our findings diverge from Huschens et al. (2023), who reported higher clarity ratings for AI-generated texts; in our study, human-created content was consistently rated as clearer and more engaging. This discrepancy may reflect differences in participant profiles or task design, and warrants replication across broader populations. Furthermore, while prior research (e.g., Clark et al.,

2021; Waltzer et al., 2024) has reported relatively low accuracy in identifying AI-generated text, our students achieved markedly higher accuracy (86% in the logic domain), suggesting that the level of AI familiarity in a given cohort may be a critical moderating variable – one that the existing literature has not yet fully addressed. Future research should examine whether AI literacy programs can be designed to capitalise on this emerging competence, and whether similar patterns hold across different text genres, languages, and educational systems. Longitudinal designs are particularly needed to track how student perceptions and detection abilities evolve as AI tools themselves continue to develop.

A further dimension that warrants reflection concerns the potential role of cultural differences between the Polish and Croatian respondents. Although the cross-national statistical comparisons yielded no significant differences, a null result does not preclude the possibility that cultural factors shape students' engagement with AI-generated content in ways not captured by the measures employed. While the two countries share a Central and Eastern European educational heritage, they differ in language family, digital infrastructure, and institutional AI policy frameworks, all of which may influence AI-related attitudes through channels not covered by this study. Future research should incorporate culturally sensitive instruments and qualitative follow-up to examine whether the apparent equivalence of responses masks more nuanced cross-cultural differences in how students interpret and trust AI-generated academic content.

Limitations

While the results are promising, the study is not without limitations. The sample was limited to Croatian and Polish university students, which may constrain the generalizability of the findings to other cultural and educational contexts. The content used in the source recognition task was deliberately short and focused, which may have facilitated higher identification rates than would occur with more complex or ambiguous material. Self-reported data may also be subject to bias or variability in interpretation. Future research should extend these findings through longitudinal studies, cross-cultural comparisons and the inclusion of additional academic disciplines to better understand how students' perceptions of and interactions with AI evolve over time.

Several additional limitations merit acknowledgement. The sample is uneven across disciplines (Computer Science and Modern Languages together account for 75% of participants), so comparisons involving smaller subgroups should be interpreted with caution. The high rate of reported AI use (88.3%) may reflect self-selection bias, limiting generalizability to less AI-literate populations. The exceptionally high source-identification accuracy (86%) is partially attributable to the use of short, topically constrained texts and a binary forced-choice format, which may

have inflated accuracy relative to more naturalistic conditions. All constructs were measured using single self-report items rather than validated multi-item scales, which limits construct validity; future studies should develop and validate multi-item instruments for this context. Finally, the study does not account for participants' prior topic knowledge, which may have influenced source recognition independently of disciplinary background.

Conclusion

This study explored university students' perceptions and evaluations of AI-generated versus human-created explanation, their ability to distinguish between the two, and how factors such as discipline, gender, and frequency of AI use influence these perceptions. The results revealed a high rate of AI integration in the students' academic and personal lives, coupled with a predominantly pragmatic attitude toward its use. While students recognised the efficiency and depth of AI-generated explanations, they consistently valued the clarity, relatability and authenticity of human-created content. A clear preference emerged for hybrid explanations that combined the strengths of both sources.

One of the most significant findings was the students' high accuracy in identifying the source of explanations, challenging the common assumption that AI-generated texts are difficult to detect. This accuracy appeared to be closely linked to their familiarity with AI tools, critical evaluation skills and perceptions of clarity, usefulness and trustworthiness. However, the ability to distinguish between AI-generated and human-created content was shown to be domain-sensitive, with higher performance in familiar, logic-based tasks and reduced accuracy in more complex, specialised fields such as neurobiology.

With respect to trust (a central concern of the study), the findings present a nuanced picture. Students did not unconditionally trust AI-generated content; rather, trust was conditional and context-dependent. It was strongest among frequent AI users, in technically complex domains where AI explanations were perceived as authoritative (e.g., neurobiology), and when AI-generated content was framed as reviewed or validated by a human expert (as supported by 167 respondents). Trust was lower for unfamiliar or evaluatively demanding content and among students with strong linguistic training. These patterns suggest that trust in AI-generated explanations is not simply a function of technological acceptance, but is mediated by domain familiarity, AI literacy, and the perceived presence of human oversight. This has direct implications for educational practice: designing AI-supported learning environments that include transparent human curation or validation mechanisms may be the most effective strategy for building appropriate, calibrated trust in AI-generated educational content.

While the results offer promising insights into students' emerging competencies in navigating AI-

supported learning environments, the study is limited by its focus on students from only two national contexts and its reliance on short-form texts. Future research should expand to include a broader range of disciplines, educational settings and text genres. Longitudinal and intervention-based studies would also help to clarify how evaluative skills and trust in AI evolve over time and with targeted training.

The appendices are available in the online version of the journal.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical standards of the authors' higher education institutions. All participants were informed about the purpose of the research, their rights as participants, and data protection measures. Informed consent was obtained from all individual participants involved in the study.

Availability of data and material

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. Any data shared will be anonymised to ensure participant confidentiality.

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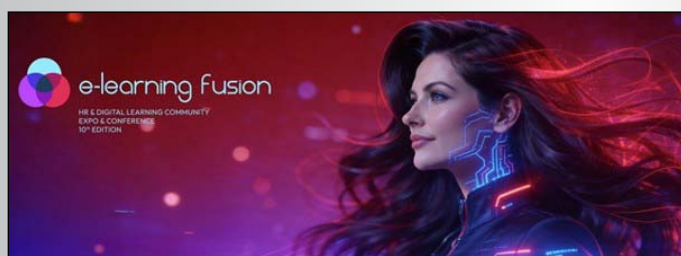
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WE RECOMMEND



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Monika
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Magda
Lejzerowicz

Communities of Practice at the Maria Grzegorzewska University: Academic Teachers' and Trainers' Perspectives

Abstract

This article explores how two institutional innovations implemented at the Maria Grzegorzewska University – the 'Masters of Didactics' tutoring programme and the 'Learning and Development Centre' training programme – have contributed to the emergence of communities of practice, particularly in training activities related to support for students with special needs. The study aimed to examine the relationship between the introduction of tutoring methods at the university, the implementation of specialised training for tutors, academic staff, and administrative employees, and the development of a collaborative academic culture. The research applied a qualitative, survey-based approach using an evaluation study design. Data were collected in early and late spring 2023 from 40 participants (both trainees and trainers) through open-ended questionnaires focused on educational adjustment and well-being at work. The findings indicate that the changes initiated by the tutoring programme and continued by the Learning and Development Centre trainings led to the emergence of a new culture of professional relations, increased collaboration, and subsequently to the creation of communities of practice among the University employees. These developments were particularly visible in areas related to accessibility and the support of diverse student needs. There is one unexpected educational added value: topics concerning students' special needs allowed the academic and administrative staff to talk about their own special needs. Although the Learning and Development Centre trainings primarily focused on educational accessibility for students, they were highly interactive and workshop-based, requiring academics and administrative staff to co-create solutions together. Through this collaborative action, a genuine community of practice began to emerge, which we could 'observe' in the responses of the participants at the final phase of the survey.

Keywords: higher education, tutoring, communities of practice, university teaching excellence centre, special needs

Introduction

The theoretical framework for categories used in this text is the social theory of learning. The underlying logic of communities of practice shares much with notions of learning communities. The concept of communities of practice emerged earlier than learning communities as a form of educational practice and programming – particularly in the United States – although not always under that specific name. In the 1960s and early 1970s, universities experimented with collaborative student learning models, such as integrated curricula, team-taught courses, and residential learning arrangements where students lived and studied together. Learning communities originated as innovative pedagogical approaches and only later became the subject of theoretical interest. In parallel, but independently, Jean Lave and Étienne Wenger (1991) introduced the concept of communities of practice. Their work provided the first formal definition of communities of practice within the framework of situated learning theory, which emphasised learning through participation in social practices. Wenger further elaborated the concept (1998). He enumerated the conditions that should be met in order for a given group of workers to be called an established community of practice: when there is (1) a common domain (interest), (2) a community (a group of collaborat-

ing people) and (3) a common practice in this domain (Wenger, 1998). This model has been widely applied in academic contexts, especially in analysing how university staff collaborate, share expertise, and co-create institutional cultures.

A related and similarly influential concept – the learning organisation – was proposed by Peter Senge (1991). Although developed independently from communities of practice theory, Senge's idea highlights the role of informal and collective learning processes within organisational settings, aligning with key principles of both communities of practice and learning communities.

The notions of communities of practice and learning communities also resonate with the concept of empowerment – understood here as a continuous process of enabling participants to become emancipated agents of educational processes, capable of discovering and realising their own potential (Hashmi, 2014; Lave & Wenger, 1991). Historically, the term community was first introduced into sociology and the social sciences by Ferdinand Tönnies in 1887 (2001). Over time and in the context of working and educational settings, in the form of learning communities and communities of practice, the concept has evolved in response to social changes. Today, it offers a meaningful counterbalance to the pressures of mass university education, the atomization of social life, and the dominance of individualistic culture.

Another issue that complements the topic of building a community at the university is the extent of cooperation between teaching staff and students, which expresses the level of organisational academic culture. To achieve the goal of collaborative culture at the university, several conditions should be fulfilled: there is a necessity (1) for students to be agents in their process of learning with support from tutors, (2) of establishing cooperation between academics and students with the active participation of the latter, who could autonomously decide about directions of their tutoring process (Lejzerowicz & Podstawka, 2021), (3) of making tutoring a work method with students with special educational needs, gifted students, but with some barriers, who need support and personalized approach (Dziedziczak-Foltyn et al., 2020).

Institutional Innovations at Maria Grzegorzewska University: Tutoring and The Learning and Development Centre

In many countries for decades, and in Poland only for a few years (enabled by EU-funded programmes launched in 2018), large-scale activities aimed at improving the quality of teaching and assessment have been carried out. At The Maria Grzegorzewska

University (MGU), there were two programmes financed within this programme: 'The Masters of Didactics' (2020–2022) and 'Excellence in Didactics' (2022–2023), which enabled the MGU to accelerate the process of teaching excellence. Before these projects were fully developed, there was a recognized (via surveys) need 1) to strengthen the existence of cooperation between the MGU employees (researchers, teachers, administrative staff) and support its quality based on trust; 2) to inspire small teams of mutually supportive colleagues who would share knowledge, and both of these directions would allow members of the institution's community to identify with the mission of the MGU (Czyżewska et al., 2022), according to the belief that the better well-being, the better education. The mission of the University is to provide opportunities for development and use of participants' potential in educational processes by realising it within the institution.

Knowledge sharing in the form of collaborative learning (called 'team learning' in Peter Senge's terminology¹) is a unique opportunity to solve problems that cannot be solved by one person alone. A university operating on such a foundation becomes a learning organisation (Senge, 1991) – one that uses the richness of bottom-up processes to improve the culture of dialogue by taking advantage of the human need for interaction. Some of these processes at the MGU began with the introduction of the tutoring method.

Based on solutions popularized in the cradle of tutoring work, Oxford University, where work with an individual student (or with a group of up to 4 students) takes various forms, such as tutorials with a tutor or a fellow, meetings with the director of studies, at the MGU the following formula has been used: developmental tutoring, academic (scientific) tutoring, blended (developmental and scientific) tutoring, and peer tutoring (amongst teachers), in a group of 4 (up to 8) persons.

Tutoring as part of the study programme was introduced at the MGU in 2020. However, about 7 years earlier, some teachers, on their own and unofficially, introduced some elements of that type of method. Only a few groups had the opportunity to work this way. The supervisor of one of the groups was Magda Lejzerowicz – the co-author of the article, and this example can be representative. The group was born out of Disability Studies classes. When the course started, the participants had a long discussion about how and on what topic they would want to work. The decision was made by the majority of the participants and also the moderator. They started working in the form of scientific tutoring. One of the results of the tutoring work was a publication of the article 'Accessibility in culture – a participatory perspective' (Ciechomska et al., 2022).

¹ Four other from all five disciplines named by Peter Senge are: shared vision, mental models, personal mastery and systems thinking (Senge, 1991).

Officially, tutoring in the shape of a 3–5 semester programme „Masters of Didactics’ (which first phase meant training of 30 selected teachers in the field of teaching and instruction at 5 European universities and then granting them a tutor’s certificate) started in spring 2020 and was financed by the Polish Government – the Ministry of Education and Science. In the second phase, there were one-on-one tutorials with students. All participants were invited to join freely, but under certain conditions. During the first year of this practice, the programme was joined by 20 certified tutors and 75 tutees, chosen according to the principles agreed in the contract with the Ministry. In the second year (Autumn 2021), 30 tutors and 112 tutees participated in the programme. The programme lasted till the end of 2022. Such examples of good practice encouraged the authorities of the MGU to continue the course towards implementing tutoring into its curricula.

A further step in teaching improvement at MGU emerged from bottom-up initiatives led by tutoring programme participants. Their activities led to the Rector’s decision to establish a university-wide teaching excellence unit, a kind of university teaching excellence centre, whose purpose would be supporting and improving academic teachers’ competences, with a further and long-term aim of making students responsible for their own learning process. In other words, to enable both groups to engage in self-regulated learning and functioning at work. The Learning and Development Centre (LDC) was founded in Autumn 2022.

The Learning and Development Centre’s First Training Project

The LDC won a public grant for organising intensive training for teachers, tutors and administrative staff (who play a crucial role in the delivery of a high-quality educational process). The LDC’s leaders were conscious of the notion of ‘learning communities’ and the design work was directed in such a way that the features and manifestations of behaviour mentioned by Senge (1991) and Wenger (1998) could emerge and develop within teachers and administrative staff of the MGU. The idea of the project for a participant (who might be a tutor, an academic teacher or an administrative employee) was to connect with another participant and create a so-called ‘dyad’, which was intended to be the starting point for all subsequent project activities, alongside the far-sighted aim of initiating and establishing communities of practice: accompanying each other in classes (or in other daily activities) and then providing feedback (of the supporting type, on demand), conducting ‘developmental conversations’ based on the peer mentoring model, providing mutual assistance and advice on all next steps of the project. In order to examine the needs of teaching and administrative employees, a staff needs study was carried out, which included pre-training analyses to select the desired subject

areas and adapt the final design of the training programme to them. The chosen topics of training and workshops included the following topics and their subthemes:

Teaching methods:

- Academic mentoring,
- Activating methods of learning and cooperation in a class group,
- Feedback in the university – towards dialogue and attentiveness,
- Jigsaw method in didactic work,
- Oxford debate,
- Peer tutoring and peer instruction methods,
- Supervision of the teaching process,
- Supervision of the tutoring process.

Diversity:

- Accessibility in teaching and in administrative service process,
- Diverse needs of students and staff,
- Gender equality policy in HE,
- Inclusive design.

Well-being and sustainability:

- Activating empathy in case studies – a proposal for imaginative work,
- Activating methods and methods with elements of the project method in academic practice, i.e. ‘how to work with students so that they not only believe they have wings, but also have the courage to fly’,
- Application of Non-Violent Communication (NVC) and Solution-Focused Brief Approach (SFBA) in HE,
- Integrating sustainability goals into teaching/tutoring processes,
- Quality of narration and quality of life – from content to making sense, i.e. writing for health,
- Relaxation as an antidote to professional burn-out.

Office work development:

- Basics of using a spreadsheet in office work,
- The Planner Programme introduction – a specialised course for administrative staff.

Human resources:

- Development of teaching staff,
- The ‘teal management’ principles in HE.

Teaching technologies:

- Opportunities and risks of using ChatGPT in education: seminar and practical workshop.

We asked participants and trainers of the above-mentioned workshops and trainings to take part in an evaluation survey on educational adjustment. Educational adjustment in this study is defined as achieving an inclusive environment which requires creating spaces and programmes that accommodate and meet the needs of students with diverse needs, including those with disabilities. Implementing adjustments can help remove barriers and promote equitable participation at university for all students and staff (International Finance Corporation, 2024).

Data obtained from this survey are the subject of analysis in this study. After trainings and workshops the dyads were given the opportunity to participate in 4-hour supervisions (during their work and at the end of that process), which were aimed at helping participants look at how they work, whether there is a balance of power, what areas require special attention in the dyad, and what development tasks arise for each person thanks to this – unusual in the academic environment – form of cooperation.

Studies show that inclusive education is intertwined with learning communities through shared principles such as collaboration, diversity, participation (or engagement) of all stakeholders, and reflective practices that aim to improve educational outcomes (Solis-Grant et al., 2023). Inclusive HE involves collective efforts within learning communities to address diverse student needs through various strategies, including different types of assessment, motivational techniques, and environments that value diversity and accessibility.

Methodological Aspects of the Research

The aim of the research was to examine the connection between the introduction of two teaching innovations (i.e., the tutoring programme and the LDC with its training programme provided to tutors, academics and administrative staff) and the emergence of communities of practice. A research problem was formulated: What is the relationship between the implementation of the tutoring programme at a university, the delivery of specialised training by the LDC to tutors, academics, and administrative staff, and the subsequent formation and sustenance of communities of practice?

The research material used for the analysis consisted of data from a two-fold diagnostic evaluation study conducted in early (initial evaluation) and late spring of 2023 (follow-up evaluation) among trainees and trainers (1) on their perception of the concept and practice of educational adjustment, and (2) on the level of their well-being at work, which was examined here as a relational aspect of the outcome of professional support and institutional accessibility. Well-being in this study is defined not only as 'feeling good', but also as belonging to a support group (community of teachers or administrative employees).

In the initial survey, future 40 participants of the training in the process of teaching and administrative services were asked several open questions (in the form of online surveys) regarding self-assessment of their own teaching, their attitude to tutoring method, their expectations towards the quality of interpersonal relationships within their colleagues, their own needs as teachers and their assumptions regarding students, their understanding of the concept of 'accessibility' and perceived difficulties in teaching and administrative work related to own and others' special needs.

Similarly, after the training, participants were asked to fill in a follow-up survey – two months after

the initial survey. An online questionnaire was sent with open-ended questions, including: What are your reflections after the training? Which of your needs expressed before the training were met? How did you improve your skills in inclusive design? Which elements of the training do you intend to implement in your work? How have you engaged so far, and how would you like to engage in the future within the University community?

Thematic Analysis of Qualitative Data

To investigate the specific impact and interplay of professional development trainings conducted by the LDC on the development of a 'cohesive learning community' within the MGU community, we employed a qualitative approach. To analyse the data from the open-ended question responses collected during the initial and final survey phases, we used thematic analysis, based on the method framework developed by Braun and Clarke (2026). Its reflexive direction seemed most appropriate to the research issues we addressed in our study – identification of core themes within the participants' reflections, the changing nature of their attitudes to certain areas during the whole process of the study and the evaluation of the whole project assumptions.

Results

Based on the analysis of the initial survey results conducted with training participants, the data were identified, analysed, and meanings emerging from these responses were captured. Results were grouped into logical areas, and a number of themes appeared: needs, competencies, community building, well-being. The most frequently reported needs concerned: addressing the diverse needs of students. One of the study participants described his/her needs with questions: 'How can I use the potential that comes from the diversity of people in the group? How can I adapt tasks/forms of assessment to a diverse group? How can I engage a diverse group? Specific examples of proven solutions for a broadly defined diverse group would be valuable' (Respondent No. 1); understanding academic *savoir-vivre* in relation to individuals with special needs: 'How can I work with people in gender transition?' (Respondent No. 2), 'I believe that competencies related to openness, a willingness to help, understanding the problem, and empathy would be very important to me. I think these are elements that would help me in my day-to-day work. Simply put, how to be 'accessible' to others, how to listen to others and respond' (Respondent No. 1); access to technical support. Respondent No. 4 indicated: 'What I find difficult is the unpredictability of what I'll find in the classroom, such as missing or non-functioning equipment (e.g., disconnected cables, a burned-out lamp in the projector, missing updates on the computer, etc.)' and, finally, the desire to connect with colleagues and share best practices from their own professional experience:

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'There is often a lack of friendly cooperation with other departments. We need more openness to help from other departments. We need a better, more efficient flow of information' (Respondent No. 11).

Such declarations demonstrate shared responsibility for the quality of education, redefining the role of the employee as an active member of the community of practice. Understanding others' needs improved organisational culture (well-being). The opportunity to exchange challenging professional experiences and the sense of not being alone with pedagogical difficulties directly translated into the participants' workplace well-being, making them feel more confident and institutionally supported. It left them with a reassuring notion that they know where to seek for help and answers, even to awkward questions.

The analysis of the follow-up survey results revealed several competences and elements of the training that participants intend to incorporate into their professional practice. These include enhanced sensitivity to their own needs and those of their students – manifested through efforts to gather information about students' expectations (e.g., using surveys or collaborative assignments). One of the respondents wrote that he/she is going 'to adapt presentations and asking open-ended questions about students' needs' (Respondent No. 9). Another one noticed, 'I realise after the workshop that it's not always possible to fully meet all needs or prepare materials that are 100 per cent universally accessible. I am going to avoid falling into a routine when preparing materials for students, ask them more frequently about their needs in this regard, and cultivate mindfulness and sensitivity to the needs of others' (Respondent No. 11) and adjusting both materials and the format of learning activities accordingly: 'I have got competency in the field of communication with students, for example how to ask students about their needs regarding the adaptation of course materials, as well as (to the extent possible) the format of classes (e.g., regarding breaks, etc.)' (Respondent No. 11).

Participants also emphasized the importance of developing effective communication skills 'I learned how to talk to people with various disabilities, how to behave in different situations, and how to calm someone who is having, for example, a panic attack. I found out that my colleagues from other departments had similar experiences' (Respondent No. 22) greater understanding: 'I introduce good, friendly communication in the employee-manager relationship, and I take advantage of the good advice from my colleagues who have been working here for a long time' (Respondent No. 4), and empathy toward individuals with diverse needs: 'I started asking students about their needs using a form (e.g., as an assignment in Teams)' (Respondent No. 10).

Proposed adjustments included improving the readability of presentations, ensuring accessible publication formats, choosing fonts that support readability, and providing support to students' individual needs and limitations in administrative issues: 'I think another important effect of the workshop is giving workers the possibility to meet, discuss, and

share their problems' (Respondent No. 22), 'I try to be mindful – I mentioned this in my summary – and take a personalized approach. I've come to realise that there's nothing to be afraid of when it comes to creating accessibility, so I ask my students and colleagues – because some know exactly how they want to be treated, while others have diverse experiences and great ideas. And also, I get to work with amazing people :)' (Respondent No. 8), 'In my work, I apply the knowledge I've gained about creating presentations and showing consideration for people who face challenges related to autism' (Respondent No. 4).

The experience of cooperative problem-solving in accessibility (educational adjustments) has become the foundation of common practice, which, according to Wenger's theory, is a condition for the creation of communities of practice. It was precisely this exchange of experiences and the shared challenge of addressing similar issues – whether administrative or related to teaching – that allowed participants to engage with one another. Through collaborative problem-solving, participants ceased to be merely individual recipients of procedures and became members of a supportive academic community. This transformation of individual emotions and experiences into a network of mutual support constitutes key evidence of the formation of a stable community. The proposed technical and administrative changes represent a form of reification – giving experiences and empathy the form of concrete tools or courses of action (Wenger, 1998).

Other post-training reflections indicated that the participants highly valued the opportunity to discuss the conduct of the classes to make them more inclusive and accessible. One of the respondents indicated that for him/her it was very important to get to know 'aspects related to adapting methods and formats in instructional classes for people with diverse needs' (Respondent No. 6). As a result, the need for adjustments in working with students with diverse needs was consistently observed.

One of the participants highlighted the added value of the training as the chance for in-depth discussions among peers, exchange of real-life experiences, all of which served as a valuable insight: 'the collaborative search for effective solutions, the Totupoint app, practical exercises on how to assist a blind person, the tour of the university, and the unforgettable look of surprise on the students' faces when they realized, 'The people from Student Affairs Office are getting trained, too!' (Respondent No. 22). Other participants appreciated the participatory concept of the training – especially the co-leading role of students, the practical approach to the topic, and the shared engagement which was important in assignments requiring effort in finding answers or solutions: 'The workshop on people on the autism spectrum was very valuable to me – I think it's fantastic that it was led by a student!!! That's how the academic community should function' (Respondent No. 8). 'The female students' involvement in co-leading the workshops, the practical approach to the topic, the intergenerational team' (Respondent

No. 22). A key aspect was also the openness and willingness to cooperate among participants: 'I'm really happy to be able to share my experience and learn from the experiences of others' (Respondent No. 3).

This intergenerational collaboration, which involves students as co-facilitators, serves as an excellent example of transcending the boundaries of traditional roles in academic culture, thereby redefining the participants' identities within the university community. The joint search for solutions (such as text-editing guidelines or the Totupoint app) expands the group's repertoire of activities, transforming theoretical knowledge into action-grounded practice. At the same time, acknowledging the need to take care of employees' well-being shows that negotiating meanings around accessibility involves not only technical procedures but also emotional costs and the limits of mutual engagement.

An unexpected yet significant outcome emerged from the analysis of two complementary initiatives explored in the study. Among the responses and during discussions about students' special needs, academic and administrative staff started to reflect on and share their own special needs. One of respondents wrote: 'I'll remember the conversations about my challenges as a teacher-educator and the exercise of putting myself in the shoes of people with various disabilities' (Respondent No. 1). This may be attributed to the personalized nature of these initiatives: the tutoring programme, grounded in one-on-one dialogue, and the LDC initiative, which was developed in response to the pre-training survey that captured participants' individual expectations and needs. The staff's discovery of their 'own needs' is key evidence of empowerment or emancipation – which was conceptualised as a manifestation of maturing into a community of practice in the theoretical introduction.

The results of the analyses showed convergence in the needs of all groups participating in the educational process at the higher education level. The needs related to the educational process design, adapting materials and the form of communication to the various needs of students and academic staff and administrative employees were reported by all surveyed trainees.

The results of the research confirm that the formation of learning communities was possible among academics of the MGU.

Summary

The goal of the first innovation, the Tutoring Programme, was to strengthen students' confidence in independent learning (a symptom of self-regulated learning) and to cultivate a culture of collaboration between academic teachers and students. Student success stories, such as increased participation in conferences, the founding of student-owned educational startups, and voluntary participation in research, emphasise the programme's positive impact. Our research confirms the crucial role of trust and collaboration (both making education more relationship-oriented) between tutors and students in achieving these outcomes.

Second innovation – the Learning and Development Centre organized intensive training for teachers and tutors, the purpose of which was to establish 'learning communities' of teachers (which focus on self-education groups and the supportive role of mutual feedback).

The results of the research show that the changes initiated by the tutoring programme and continued by the LDC have led to the emergence of a new culture of professional relations, manifested in new research and teaching initiatives, the creation of rules for cooperation and integration of the academic environment, and the creation of a 'learning community'.

The outcomes of our survey showed that people working at the MGU would like to get to know each other, cherish support and alliances, and would like to belong to what they call a 'supra-university community'.

Moreover, the unexpected result emerged from student engagement as co-trainers during the trainings, facilitating a deeper understanding of student perspectives and fostering cross-participant exchange. This student involvement has significantly contributed to improving the quality of education and work effectiveness.

An unexpected added value was that academic and administrative staff, while working during the training sessions on how to best adapt teaching and learning conditions for students, came to realise that they themselves have special needs. They discovered their own unique combinations of traits and challenges that also deserve recognition and support. Through exploring topics related to inclusion, MGU staff began to better understand their own situations – both as lecturers and as administrative professionals.

The outcomes of these programmes, which happened to be innovative for the MGU, highlight the establishment of strong teacher-student and teacher-teacher relationships, representing an investment in the Polish society in the broad sense: by nurturing tutor-tutee relations and promoting proactive student engagement, these initiatives counteract the devaluation of diplomas (which occurs due to massification of HE) and empower students to enter the job market with greater confidence and awareness of their strengths.

Another benefit was the inter-university nationwide tutoring network: the coordinator of the tutor team from the MGU invited coordinators from universities all over Poland – during the pandemic lockdown, representatives of several universities shared ideas on methods and literature, helped each other to understand organisational and financial issues, supported each other in grant-seeking for continuation of the tutoring programme.

According to Wenger's characteristics of communities of practice (1998), the community of the MGU has established one: we, the members of the community have shared common domain – it is the quality of higher education (teaching and learning); we belong to the same community which shares practice – our university staff, during the academic year 2022/23 shared time on excellence in teaching and on talking

about best teaching resources, varied experiences and problems that mattered teachers, tutors and administration. Through regular collaboration and shared experiences, participants have cultivated a vibrant community dedicated to continuous improvement in teaching excellence and professional development.

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Increasing Workforce Productivity through Workplace Design: Empirical Evidence

Abstract

This research analyses how workplace design facilitates workforce productivity by considering various aspects, including the physical work environment, ergonomic working conditions, employee autonomy, job rotation, and social interaction. Applying concepts from the Job Characteristics Model and the Socio-Technical Systems Approach, a theoretical model of workplace design as a predictor of employee productivity is developed and empirically tested through five dimensions: the physical work environment, ergonomics, job autonomy, job rotation, and social interaction. To carry out the study, a quantitative research design based on a questionnaire, supported by a comprehensive literature review, was adopted. The sample consisted of 350 employees working in organisations in the Republic of North Macedonia. The empirical findings show that all workplace design dimensions have a positive and statistically significant relationship with productivity. The regression model is statistically significant at the 0.01 level, with an explanatory power of 61% for workforce productivity ($R^2 = .61$; adj. $R^2 = .59$; $p < .001$), where the social interaction dimension has the largest standardised coefficient, followed by ergonomics and the physical work environment.

Keywords: workplace design, workforce productivity, ergonomics, autonomy, job rotation, social interaction, organisational performance

Introduction

Workplace design has increasingly become an important topic in Human Resource Management, Organisational Behaviour, and Strategic Management. In current organisations, productivity is not only about the use of technology and task allocation; it is also a consequence of the quality of the workplace environment, employees' autonomy, role significance, and socio-political circumstances that allow cooperation and involvement.

Historically, job and workplace design have been rooted in classic economic theory and management theory. For instance, Smith (1776) discussed productivity in terms of the importance of specialisation and division of labour, whereas Babbage (1832) argued for the productivity implications of specialisation through mechanisation and cost-efficiency. Finally, Taylor's scientific management (1911) included standardised task performance and vertical division of labour. Even though these concepts were instrumental in boosting productivity, they were also associated with dangers such as monotony and employee alienation when used exclusively.

Subsequent theories expanded the scope from simplifying tasks to designing work around humans. Herzberg et al. (1959) discussed the importance of intrinsic work characteristics in terms of motivation, while Hackman and Oldham's (1976) Job Characteristics Model highlighted five critical factors – skill variety, task identity, task significance, autonomy, and feedback – that make a job meaningful and engaging. At the same time, the Socio-Technical Systems theory highlighted the interconnectedness between technical structure and social relations within organisations (Trist & Bamforth, 1951).

Increasing Workforce Productivity through Workplace...

In today's organisations, workplace design decisions are not limited to job structure. Factors such as the work environment, ergonomics, employee autonomy, job rotation, flexibility, and social interaction are all relevant. Such variables affect fatigue, motivation, communication, learning, and performance at work. Hence, it is important to view workplace design as a multifaceted organisational process rather than an administrative issue.

The COVID-19 pandemic has transformed the way organisations perceive workplace design. Remote and hybrid working have expanded the concept of workplace design beyond the physical office space (Nediari et al., 2021). These changes increasingly require organisations to create spaces that support both physical and virtual collaboration (Gocer et al., 2026). Although the current study focuses primarily on traditional workplace environments, these changes underscore the importance of workplace design in increasing employee productivity.

Although research on workplace design is growing, most existing studies have investigated individual dimensions of workplace design. For example, several studies have investigated social interaction (Mittal & Rani, 2022; Oktavia & Permana, 2025), ergonomic workplace conditions (Miska & Azzahra, 2025), employee autonomy (Jaafar & Rahim, 2022; Johannsen & Zak, 2020), job rotation (Eriksson & Ortega, 2006; Sunday & Gabriel, 2024), and the physical work environment (Hamed et al., 2023; Zhenjing et al., 2022) as specific dimensions of employee performance and productivity. Empirical research that includes multiple dimensions of workplace design in relation to productivity remains largely limited (Mosquera et al., 2025), particularly in developing and transition economies, where evidence on the relationship between workplace design and workforce productivity is still scarce (Shamusideen & Ukpomwan, 2014). For example, Čizmić et al. (2022), in a study of public and private sector organisations in Bosnia and Herzegovina, highlighted the importance of workplace design dimensions for improving employee satisfaction and effectiveness. However, empirical evidence integrating multiple workplace design dimensions and workforce productivity in developing countries remains limited.

Addressing this gap, the current research aims to explore the connection between workplace design and workforce productivity in organisations located in the Republic of North Macedonia. The proposed paper seeks to contribute to existing research by integrating work design theories with information on workplace design practices in organisations today and their impact on workforce productivity.

This study contributes by extending the existing literature in three ways. First, the study incorporates five dimensions of workplace design into a regression equation with employee productivity. Second, it provides empirical evidence from a developing country such as the Republic of North Macedonia, where studies in this area are notably lacking. Third, the study

findings provide practical implications for managers to improve workforce productivity.

Research Objectives

The main objective of this study is to examine the influence of workplace design on workforce productivity. Specifically, this research aims to explore which dimensions of workplace design have the greatest correlation with productivity and determine whether the empirical findings confirm the existence of a multidimensional workplace design model.

The objectives of this study include:

- Exploring the theoretical basis for job and workplace design in terms of their effects on productivity.
- Evaluating employees' views of different aspects of workplace design.
- Examining the relationship between workplace design and workforce productivity.
- Formulating recommendations aimed at enhancing organisational productivity by means of human-centred workplace design.

Literature Review

Work entails not only economic transactions where labour and payment are exchanged but also social, psychological, and organisational processes wherein people help achieve common objectives, acquire skills, and construct their occupational selves. Work is defined in management studies as a process involving activities performed to accomplish organisational ends (Schermerhorn, 1993).

Job design is defined as the arrangement of task content, methods, responsibilities, and relationships to meet the requirements of technology, organisations, society, and individuals (Davis, 1966). It encompasses the design of both the technical and social elements of the work activity (Umstot et al., 1976). Workplace design is more inclusive than job design since it covers both job content and other factors related to the physical environment in which work occurs.

Effective workplace design requires balancing the objectives of organisations, including productivity, efficiency, and quality, with those of employees, which include autonomy, competence, safety, and meaningfulness of work. According to Armstrong & Taylor (2014), there should be consistency between roles, organisational structure, and employees' abilities. Likewise, Mathis et al. (2017) suggest that job design could be modified to improve production results and job satisfaction.

In today's business environment, employee well-being is increasingly recognised as a key factor in enhancing productivity. Recent studies on workplace design suggest that it extends beyond the physical work environment and encompasses psychological and social dimensions that significantly influence employee performance and organisational outcomes (Mosquera et al., 2025; Voordt & Jensen, 2023). Furthermore, Hamed et al. (2023), in a study conducted in Malaysia

among employees from different organisational sectors, found that physical work environment positively affects employee motivation, satisfaction, and productivity. Supporting this view, Zhenjing et al. (2022), in an empirical study involving 314 academic staff and using PLS-SEM analysis, found that a positive workplace environment significantly improves employee performance, which in turn contributes to higher productivity.

However, the relationship between workplace design and employee outcomes is not always positive. Some workplace design practices can also have negative consequences, depending on the nature of the work and individual employee preferences. For example, although open-plan office layouts create opportunities for communication and collaboration, they sometimes lead to increased noise, frequent interruptions and even decreased concentration, thereby reducing employee productivity (Bernstein & Turban, 2018; Gerlitz & Hülsbeck, 2024). Therefore, it is very important that workplace design adapts to the characteristics and nature of the work rather than being applied uniformly.

Ergonomics is concerned with designing workplaces, tools, and processes according to human abilities and limitations. Through ergonomics, one eliminates superfluous effort and ensures that workers do their jobs in a safer and more comfortable environment. When applied in office and knowledge-related environments, ergonomics addresses matters such as seating, desk arrangements, monitor positioning, movement, lighting, and minimising repetitive strain injury.

Recent studies emphasise the importance of ergonomic factors in the workplace in improving employee performance and productivity. A study applying a systematic literature review conducted between 2020 and 2025 found that ergonomic elements of the workplace, including lighting, ventilation, workspace organisation, and ergonomic furniture, increase productivity by improving focus and physical comfort (Miska & Azzahra, 2025).

Autonomy is one of the main dimensions of Hackman & Oldham's (1976) Job Characteristics Model, increasing employees' responsibility for their work. Autonomy denotes the level of control employees exercise over how and when to carry out their duties. Autonomy is important in the Job Characteristics Model because it enhances employees' sense of responsibility and ownership over their work.

Employee autonomy has been widely studied in relation to employee motivation (Hackman & Oldham, 1976; Karasek, 1979; Matei & Veith, 2023), employee commitment (Fernet et al., 2012; Gebregiorgis & Xuefeng, 2021), and job satisfaction (Jing et al., 2021; Rizwan et al., 2014; Soegiarto et al., 2024; Zychová et al., 2024;). However, empirical studies that directly examine the relationship between employee autonomy and workforce productivity remain relatively limited. Johannsen and Zak (2020) conducted an experimental study at Claremont Graduate University involving 100 participants, primarily undergraduate and graduate students, as well as members of the local community. The study found that increased perceived autonomy

significantly improved both individual and group productivity, significantly increasing employee well-being. Another empirical study further supports the importance of employee autonomy in increasing productivity. With a sample of 155 telecommuting employees, the study found through the PLS-SEM model that autonomy positively affects employee productivity by giving employees greater responsibility over time management and work tasks (Jaafar & Rahim, 2022).

Nevertheless, autonomy must be coupled with proper communication from managers, appropriate training and performance management systems. Otherwise, lack of clear objectives and necessary feedback may become problematic. In other words, autonomy should become part of organisational processes.

Job rotation is understood as reassignment of an individual from one task, job or department to another. Job rotation can help eliminate boredom, promote skill diversity, add flexibility and increase employees' awareness of related tasks. It is especially effective in cases where companies aim to develop versatile and less specialised employees.

There are multiple reasons behind the significance of job rotation as cited in the literature: employees will have greater access to information, the employer will have a clearer understanding of their staff's skills, and motivation levels will improve due to the lack of monotony (Eriksson & Ortega, 2006). Furthermore, job rotation can promote organisational commitment by enhancing employees' understanding of how their tasks fit into the bigger picture of organisational functioning. Empirical studies in recent years also support the positive role of job rotation in increasing employee performance and productivity. A study conducted by Sunday and Gabriel (2024) among 134 employees in manufacturing firms in Rivers State, Nigeria, found a strong positive relationship between job rotation and productivity, suggesting that job rotation contributes to improved employee performance and organisational outcomes.

Nonetheless, job rotation is not equally suitable for all jobs. In the case of a very specialised job position, constant rotations will lead to higher training costs and decreased efficiency when staff members need much time to learn and master the required skills (Hsieh & Chao, 2004). Therefore, job rotation should be implemented by adapting to the nature of the work, taking into account the complexity of the work, employee competencies, and organisational needs, rather than being implemented as a universal workplace design practice.

The physical work environment entails factors such as lighting, noise, temperature, spatial layout, accessibility, and general comfort in the workplace setting. These factors affect employees' concentration, communication opportunities, and performance throughout the workday (Hamed et al., 2023; Vischer, 2007; Voordt & Jensen, 2023).

Another important aspect in design is social interaction. Workplaces that encourage teamwork, communication, and trust can enhance the coordination

of information exchange among workers. This is consistent with socio-technical systems theory, which is well-suited to the topic at hand. Recent empirical studies support the positive relationship between social interactions and productivity. Mittal and Rani (2022), in a study of independent professionals working in co-working spaces in Chandigarh and Mohali, India, found a significant positive relationship between workplace social interactions and productivity. Similarly, Oktavia and Permana (2025), in a study conducted among 115 employees at HP Care Tangerang, Indonesia, using the PLS-SEM method, reported that social interactions significantly improve employee productivity.

Although previous empirical studies support the importance of workplace design dimensions, such as physical work environment, ergonomics, autonomy, job rotation, and social interactions, these factors have generally been examined separately. Studies investigating these dimensions simultaneously within a single model remain limited. This is even more evident in developing countries, where empirical evidence on workplace design and workforce productivity is still scarce (Shamusideen & Ukpomwan, 2014). For example, Ćizmić et al. (2022) highlight the

importance of job design on employee productivity for developing countries by analysing the impact of workplace design dimensions on employee satisfaction and effectiveness in a sample of 125 respondents from public and private sector organisations in Bosnia and Herzegovina. Therefore, this study aims to contribute to the literature by examining these dimensions simultaneously within a single empirical model.

Conceptual Framework and Hypotheses

This theoretical model involves both the structural aspects and human aspects of work design. According to the Job Characteristics Model, an analysis can be done in relation to how task characteristics affect performance and motivation (Hackman & Oldham, 1976). The Socio-Technical Systems theory stresses that there must be a match between the technical system and social interaction (Trist & Bamforth, 1951).

The workplace design model in this research is based on five components.

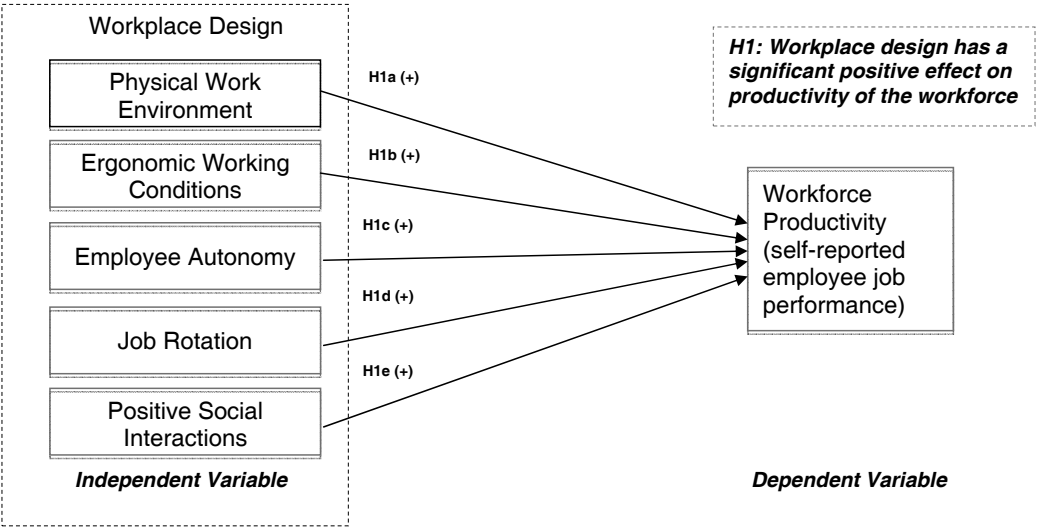
Based on these theoretical foundations, Figure 1 presents the proposed conceptual framework and hypothesised relationships between workplace design dimensions and workforce productivity.

Table 1
Theoretical Foundations of Workplace Design Dimensions and Expected Productivity Outcomes

Table with 3 columns: Workplace design inputs, Theoretical basis, and Expected outcome. It lists three inputs: Physical environment and ergonomics, Autonomy and job rotation, and Social interaction, each with its corresponding theoretical basis and expected productivity outcomes.

Note. Author's compilation based on "Motivation through the design of work: Test of a theory" J. R. Hackman and G. R. Oldham, 1976, Organizational Behavior and Human Performance, 16(2), pp. 250–279 (https://doi.org/10.1016/0030-5073(76)90016-7) and "Some social and psychological consequences of the longwall method of coal-getting" E. L. Trist and K. W. Bamforth, 1951, Human Relations, 4(1), pp. 3–38 (https://doi.org/10.1177/001872675100400101), and the ergonomics literature.

Figure 1
Proposed Conceptual Model of Workplace Design and Workforce Productivity



Research Hypotheses

Based on the theoretical models presented in Table 1 and supported by the findings of recent empirical studies discussed in the literature review, this study proposes the following hypotheses regarding the relationship between workplace design dimensions and workforce productivity.

Overall hypothesis

Workplace design is positively associated with workforce productivity.

Sub-hypotheses

H1a: The physical work environment is positively associated with workforce productivity.

H1b: Ergonomic working conditions are positively associated with workforce productivity.

H1c: Employee autonomy is positively associated with workforce productivity.

H1d: Job rotation is positively associated with workforce productivity.

H1e: Positive social interaction is positively associated with workforce productivity.

Methodology and Model Specification

Research Design

This study adopted a quantitative research design supported by a comprehensive literature review. Quantitative data were collected through a survey administered to employees working in private sector organisations in the Republic of North Macedonia. The study targeted respondents from three organisational levels, namely operational staff, middle-level management, and top-level management, in order to obtain diverse perspectives on workplace design and workforce productivity.

The research design was both descriptive and explanatory. The descriptive component reviewed current perspectives on workplace design, whereas the explanatory component examined the influence of workplace design dimensions on workforce productivity.

Sample and Data Collection

Primary data were collected using structured questionnaires distributed among a sample of 350 respondents comprising operational personnel, middle-level management, and top-level management. These respondents came from diverse organisational backgrounds. The questionnaire comprised closed-ended Likert-scale statements measuring work environment features and productivity perceptions.

Secondary data were collected from books and journal articles concerning human resources management, job design, ergonomics, and organisational behaviour. The original questionnaire consisted of 72 items covering several dimensions of human

resource management and organisational practices. For the purpose of this study, only the items corresponding to the six constructs investigated in this research (physical work environment, ergonomic working conditions, employee autonomy, job rotation, positive social interaction, and workforce productivity) were retained for statistical analysis. In this study, workforce productivity refers to employees' perceived ability to perform their jobs effectively, achieve work objectives, and maintain a high level of performance at work. Workforce productivity was measured using self-reported attitudes or perceptions from employees collected through multiple Likert-scale questions included in the questionnaire. The measurement items were adapted from established studies in the workplace design and organisational behaviour literature and were modified to fit the organisational context of North Macedonia. All construct items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), where higher scores indicate more favourable perceptions of workplace design and higher perceived workforce productivity. So, the data were collected through a structured questionnaire administered to employees working in private sector organisations in North Macedonia. The study targeted employees at three organisational levels, operational staff, middle-level management, and top-level management, to obtain diverse perspectives on workplace design and workforce productivity. A total of 400 questionnaires were distributed to eligible respondents; of these, 350 were returned and deemed complete and suitable for statistical analysis, yielding a response rate of 87.5%. The study employed a convenience sampling technique, whereby respondents were selected based on their accessibility and willingness to participate. This non-probability sampling approach was considered appropriate because it enabled data collection from employees across various private-sector organisations within the available time and resource constraints.

Variables and Regression Model

The dependent variable is workforce productivity (WP). The independent variables are physical environment (PE), ergonomics (ER), autonomy (AU), job rotation (JR), and social interaction (SI). Gender (GEN) was included as a control variable to account for potential demographic differences in workforce productivity.

$$WP = \beta^0 + \beta^1 PE + \beta^2 ER + \beta^3 AU + \beta^4 JR + \beta^5 SI + \beta_6 GEN + \varepsilon^*$$

In this model, β^0 represents the constant term, β^1 through β^5 represent the regression coefficients of the independent variables, β_6 represents the regression coefficient for the control variable (gender) and ε represents the error term. The hypotheses were tested at a 95% confidence level using regression coefficients and significance values.

* The findings of this study should be interpreted as evidence of statistical associations rather than causal relationships. Given the cross-sectional design and the limitations inherent in observational survey data, the estimated coefficients should not be interpreted as establishing causality.

Results

Descriptive Statistics

The descriptive statistics in Table 2 indicate that all variables recorded relatively high mean values, ranging from 3.61 to 4.05, suggesting positive perceptions among respondents regarding the physical work environment, ergonomic conditions, employee autonomy, job rotation, social interaction, and workforce productivity. The standard deviation values (0.63–0.82) demonstrate moderate variability in respondents' answers. The minimum and maximum values indicate that all constructs covered the full range of the measurement scale. Furthermore, skewness values ranged from –0.61 to –0.28, while kurtosis values ranged from –0.52 to 0.25, indicating that the data distribution does not significantly deviate from normality, as the values remain within the commonly accepted range of ± 2 .

Reliability and Validity

To assess the internal consistency and reliability of the measurement scales, Cronbach's Alpha coefficient is calculated for each construct included in the study. Cronbach's Alpha values above .70 are generally considered acceptable, indicating satisfactory internal consistency among the items measuring each construct. The results presented in Table 3 demonstrate that all constructs achieved acceptable reliability levels, with Cronbach's Alpha coefficients ranging from .78 to .89. The highest reliability value was observed for positive social interaction ($\alpha = .89$), followed by Ergonomic Working conditions ($\alpha = .86$)

and workforce productivity ($\alpha = .85$). The lowest alpha value was recorded for Job rotation ($\alpha = .78$), which still exceeds the recommended threshold of .70. These findings confirm that the measurement instruments used in this study demonstrate good internal consistency and are reliable for further statistical analysis.

Variance Inflation Factor (VIF) and Tolerance statistics were calculated to assess potential multicollinearity among the independent variables. The VIF values ranged from 1.24 to 1.56, while tolerance values ranged from .64 to .81. Since all VIF values are well below the commonly accepted threshold of 5.0 (and considerably below the more conservative threshold of 3.0), and all tolerance values exceed 0.20, multicollinearity is not considered a concern. These findings indicate that each workplace design dimension contributes unique explanatory information to the regression model and that the estimated regression coefficients are stable and reliable.

As shown in Table 4, Variance Inflation Factor (VIF) and Tolerance statistics were calculated to assess potential multicollinearity among the independent variables. The VIF values ranged from 1.24 to 1.56, while tolerance values ranged from .64 to .81. Since all VIF values are well below the commonly accepted threshold of 5.0 (and considerably below the more conservative threshold of 3.0), and all tolerance values exceed .20, multicollinearity is not considered a concern. These findings indicate that each workplace design dimension contributes unique explanatory information to the regression model and that the estimated regression coefficients are stable and reliable.

Table 2
Descriptive Statistics for Study Variables

Variable	Mean	Std. Dev.	Minimum	Maximum	Skewness	Kurtosis
Physical Work Environment	3.82	0.71	1.5	5	–0.42	–0.31
Ergonomic Working Conditions	3.95	0.68	1.8	5	–0.55	0.12
Employee Autonomy	3.74	0.76	1.6	5	–0.36	–0.45
Job Rotation	3.61	0.82	1.4	5	–0.28	–0.25
Positive Social Interaction	4.05	0.63	2	5	–0.61	0.25
Workforce Productivity	3.88	0.7	1.7	5	–0.47	–0.18

Table 3
Reliability Analysis of Study Constructs

Construct	Number of Items	Cronbach's Alpha (α)	Interpretation
Physical Work Environment	5	.82	Good reliability
Ergonomic Working Conditions	5	.86	Good reliability
Employee Autonomy	4	.81	Good reliability
Job Rotation	4	.78	Acceptable reliability
Positive Social Interaction	5	.89	Very good reliability
Workforce Productivity	5	.85	Good reliability

Table 4
Multicollinearity Diagnostics

Predictor	Tolerance	VIF
Gender (Control Variable)	.56	1.08
Physical Work Environment	.69	1.45
Ergonomic Working Conditions	.66	1.52
Employee Autonomy	.73	1.37
Job Rotation	.81	1.24
Positive Social Interaction	.64	1.56

Common Method Bias Assessment

Since the data for all variables were collected through a self-administered questionnaire from the same respondents, the possibility of common method bias (CMB) was considered. Common method bias may occur when the measurement method rather than the actual relationships among constructs influences the observed correlations. Therefore, Harman's single-factor test was conducted to assess whether a single factor accounted for the majority of the covariance among the study variables. All measurement items representing the independent variables (physical work environment, ergonomic working conditions, employee autonomy, job rotation, and positive social interaction) and the dependent variable (workforce productivity) were entered into an exploratory factor analysis without rotation. The results indicated that six factors with eigenvalues greater than 1 were extracted, and the first factor accounted for 32.47% of the total variance, which is below the recommended threshold of 50%. Therefore, no single factor dominated the variance explained by the measurement items, suggesting that common method bias is unlikely to represent a serious concern in the present study.

Table 5
Harman's Single Factor Test Results

Test	Result
Number of factors extracted (Eigenvalue > 1)	6
Variance explained by the first factor	32.47%
Recommended threshold	< 50%
Conclusion	No significant common method bias detected

Table 6
Correlations between Workplace Design Factors and Workforce Productivity

Relationship	Correlation (<i>r</i>)	Interpretation
Physical environment and productivity	.58	Positive, significant
Ergonomics and productivity	.62	Positive, significant
Autonomy and productivity	.55	Positive, significant
Job rotation and productivity	.41	Positive, significant
Social interaction and productivity	.64	Positive, significant

Correlation Analysis

A correlation analysis was performed to determine the extent to which each of the workplace designs correlates positively or negatively with workforce productivity. The statistical significance of the correlation coefficients was assessed using Pearson's correlation test (two-tailed) at the 95% confidence level. All correlations are positive and statistically significant. The highest correlation coefficient belongs to social interactions, where $r = .64$, ergonomics, where $r = .62$, and the physical environment, where $r = .58$. The lowest correlation coefficient is $r = .41$, which belongs to job rotation.

The multiple regression approach was adopted to establish the extent of influence of each factor on the productivity of the labour force

As shown in Table 7, the regression model is statistically significant ($F(5,194) = 61.32, p < .001$), indicating that the set of workplace design predictors significantly explains variations in workforce productivity. The coefficient of determination ($R^2 = .61$) indicates that approximately 61% of the variance in workforce productivity can be explained by the five workplace design dimensions included in the model.

The adjusted coefficient of determination (Adjusted $R^2 = .59$) further confirms the robustness of the model after accounting for the number of predictors. The results presented in Table 8 demonstrate that all five workplace design factors show statistically significant positive relationships with workforce productivity. Among the predictors, positive social interaction emerged as the strongest predictor

Table 7
Model Summary

Model Statistics	Value
R	.781
R ²	.61
Adjusted R ²	.59
F-statistic	61.32
Degrees of freedom	F(5,194)
Model significance (p-value)	<.001

Table 8
Regression analysis

Predictor	Standardised β	Standard Error (SE)	t-value	p-value	Interpretation
Gender (Control Variable)	0.34	0.06	5.67	.001	Significant control variable
Physical work environment	0.21	0.07	3.12	.002	Positive and significant
Ergonomic working conditions	0.24	0.06	4.01	.001	Positive and significant
Employee autonomy	0.19	0.08	2.47	.014	Positive and significant
Job rotation	0.12	0.06	2.16	.032	Positive and significant
Positive social interaction	0.27	0.07	4.36	.001	Positive and significant

($\beta = 0.27$, $p < .001$), followed by ergonomic working conditions ($\beta = 0.24$, $p < .001$) and the physical work environment ($\beta = 0.21$, $p = .002$). Employee autonomy also had a significant positive contribution ($\beta = 0.19$, $p = .014$), while job rotation showed the smallest but still statistically significant effect ($\beta = 0.12$, $p = .032$). These findings suggest that workplace design elements, particularly social interaction and ergonomic conditions, play an important role in enhancing workforce productivity. *Gender was included as a control variable in the regression analysis.* The results indicate that gender was statistically significant ($\beta = 0.34$, $p < .01$). However, the inclusion of the control variable did not materially alter the relationships between the workplace design dimensions and workforce productivity.

Hypothesis Testing

Table 9
Summary of Hypothesis-Testing Results

Hypothesis	Description	Result
<i>General research hypothesis</i>	Workplace design is positively associated with workforce productivity.	Supported
H1a	The physical work environment is positively associated with workforce productivity.	Supported
H1b	Ergonomic working conditions are positively associated with workforce productivity.	Supported
H1c	Employee autonomy is positively associated with workforce productivity.	Supported
H1d	Job rotation is positively associated with workforce productivity.	Supported
H1e	Positive social interaction is positively associated with workforce productivity.	Supported

Discussion

The findings of this study are consistent with the theoretical assumptions of the Job Characteristics Model (Hackman & Oldham, 1976) and the Socio-Technical Systems Theory (Trist & Bamforth, 1951), emphasising that workplace design is a multidimensional construct related to employee productivity.

Based on the results of the study, we found positive and statistically significant relationships between all construct variables that determine workplace design and employee productivity. The positive and significant correlations between all variables indicate that productivity is affected not only by individual efforts but also by factors such as workspaces, work itself, autonomy, and social relations in the workplace.

In terms of statistical significance, social interaction ($\beta = 0.27$, $p < .01$) is the strongest predictor among

the factors analysed. These findings are consistent with studies by Mittal and Rani (2022) and Oktavia and Permana (2025), which found that workplace social interaction significantly increases employee productivity. This may be explained by the fact that effective communication, knowledge sharing, and interpersonal trust create conditions for coordination and collaboration, thus improving employee performance and increasing productivity.

Another important factor is ergonomics, for which, based on the results ($\beta = 0.24, p < .01$), we confirm hypothesis H1b. This finding is consistent with Miska and Azzahra (2025), who concluded that workplace ergonomics, including space organisation, ventilation, ergonomic furniture, and lighting, positively affect employee performance by reducing physical strain and increasing concentration. Based on the study's findings and previous research, organisations should create comfortable workspaces with appropriate lighting, reduced noise levels, an adequate workspace layout, and ergonomic furniture, as these factors are likely to increase employee productivity.

The physical work environment was also found to be a significant factor in workforce productivity ($\beta = 0.21, p < .01$). These findings are consistent with the results of the study by Zhenjing et al. (2022), who demonstrated that a good work environment increases employee performance, as well as Hamed et al. (2023), according to which a well-designed physical workspace increases employee motivation, satisfaction and productivity.

Autonomy, as another dimension of workplace design, was positively associated with workforce productivity ($\beta = 0.19, p < .05$), suggesting that the greater the autonomy provided to employees in carrying out their tasks, the more productive they will be. These findings are also consistent with the study by Johannsen and Zak (2020), which, based on an experiment, found that autonomy plays an important role in both individual and team contexts. The study by Jaafar and Rahim (2022) also supports these findings, indicating that autonomy positively affects employee productivity by giving employees greater responsibility for time management and work tasks.

Job rotation was also found to have a positive and statistically significant relationship with workforce productivity ($\beta = 0.12, p < .05$), although in terms of magnitude of impact it had the smallest effect compared to other dimensions of workplace design. This finding is consistent with the study by Sunday and Gabriel (2024), which found that job rotation contributes positively to employee performance in manufacturing firms in Rivers State, Nigeria. The smaller effect of job rotation on workforce productivity can be explained by the nature of the job and the organisational context. For example, Hsieh and Chao (2004) found that job rotation is less effective in highly specialised positions, where task rotation requires additional training and at the same time longer periods to adapt. Another study on the impact of job rotation on workforce productivity and the mediating effects

of HR strategy and training in the petrochemical industry found that job rotation had a negative effect on productivity (Alizadeh Majd et al., 2024). This study also found that HR strategy and training moderated the positive effect between rotation and workforce productivity. Therefore, organisations should consider task complexity and employee competencies and implement practices to adapt employees before implementing workforce rotation.

Conclusion and Recommendations

This study concludes that workplace design plays a very important role in ensuring employee productivity. From the results of this research, it becomes clear that physical environment, ergonomics, autonomy, job rotation, and social interaction all play a vital role in determining worker performance. Based on the results of the study, social interaction showed the strongest positive association with workforce productivity. These findings suggest practical implications for organisations, which suggest investing in communication and teamwork; the other dimension with the greatest impact was the ergonomic and physical environment dimension, where the findings suggest that organisations should pay attention to ergonomic factors and create good working conditions to improve productivity.

Autonomy should also be evaluated when delegating tasks, as the study's findings suggest that the more autonomy employees are given in performing their tasks, the more productive they will be. While job rotation had a smaller effect, it should therefore be used selectively, and the nature and complexity of the tasks as well as the skills and competencies of the employees should be taken into account.

According to this research, work is no mere economic activity. Rather, work is an organised social process shaped by task design, worker autonomy, the physical environment, and interpersonal relationships.

From these findings, organisations should take into account the following recommendations:

- Ensure that the workplace allows for concentration as well as interactions between employees.
- Purchase ergonomically designed furniture along with appropriate lighting and noise reduction devices, as well as space division to ensure comfort and reduce fatigue.
- Provide employees with an appropriate level of autonomy by allowing greater discretion in task execution and decision-making.
- Use job rotation selectively, where employee skills and competencies allow.
- Employee managers should be trained on how to provide support for autonomy and communication between employees.
- Use valid measures of performance and productivity when evaluating workplace design initiatives.

Limitations and Future Research

While this study offers some empirical evidence, there are a number of limitations that should be considered. Firstly, this study relies on self-reported data collected from surveys, which might be influenced by participants' perceptions rather than their actual productivity levels. Secondly, this study is limited to the organisations operating in the Republic of North Macedonia, which might affect its generalisability to other organisations in different environments. Thirdly, this research was based on a cross-sectional survey design, and the findings should be interpreted as correlations rather than causal relationships. Future research could use longitudinal or experimental designs to investigate the causal relationships between workplace design and workforce productivity.

In the future, the scope of this study could be broadened to include samples of organisations from various industries and countries, include objective measures of productivity, and apply longitudinal designs to investigate whether changes in workplace design have a long-lasting effect on employee productivity. Furthermore, although gender was included as a control variable in the regression analysis, the model did not include other potentially relevant demographic, organisational, and contextual variables (e.g., age, organisational position, leadership quality, compensation, and sector-specific characteristics) that may also influence workforce productivity. Future studies could incorporate these variables to provide a more comprehensive explanation of workforce productivity and could also draw on multiple data sources to further reduce the potential for common method bias.

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Exploring the Impact of Economic Freedom on Entrepreneurial Innovation and Business Growth: The Case of North Macedonia

Abstract

This study examines the relationship between economic freedom, entrepreneurial innovation, and business growth in North Macedonia. Despite the country's notable economic changes, the entrepreneurial landscape remains shaped by institutional-quality challenges and regulatory impediments. Policymakers and business actors can benefit from understanding how perceptions of economic freedom affect business outcomes, thereby supporting sustainable growth. This study explores whether higher perceived economic freedom correlates with greater innovation and business growth among entrepreneurs in North Macedonia. Using a mixed-methods design, this study examines the opportunities and challenges faced by entrepreneurs by combining qualitative thematic analysis with quantitative survey data. An online survey with Likert-scale items and open-ended questions was used to gather data from 150 participants, including analysts, experts, and entrepreneurs from a variety of industries. Descriptive statistics and correlation analysis in SPSS were used to assess the quantitative component, while thematic coding was used to identify recurring themes and insights in the qualitative responses. Limited access to finance and regulatory complexity hinder innovation despite some improvements in property rights. The findings indicate that encouraging entrepreneurial innovation and long-term business growth in North Macedonia requires streamlining regulatory frameworks and increasing access to funding. Increased economic freedom boosts competitiveness and lowers barriers to starting new businesses, allowing start-ups to flourish and supporting overall economic growth. By comparing the results with previous research on the Western Balkans, the study offers insights that can inform a more strategic approach to entrepreneurial policy in North Macedonia.

Keywords: economic freedom, innovation, entrepreneurship, North Macedonia, business growth

Introduction

Over the past thirty years, North Macedonia has moved from the constraints of a centrally planned system towards the institutions of a market economy. This transition has been accompanied by membership in international organisations and a wave of structural reforms, yet many entrepreneurs still describe the business environment as difficult. They most often point to complicated regulations, limited financing channels, and recurring political uncertainty.

In this setting, the idea of economic freedom offers a useful way to understand how rules and institutions shape the chances for new firms to innovate and expand. By economic freedom, we mean the extent to which people and businesses can make their own choices without excessive state involvement, with key dimensions including secure property rights, clear regulations, and open markets. An empirical study by Estrin et al. (2013) provide strong evidence that inadequate property rights protection create institutional barriers, reducing entrepreneurs development.

The study explores how perceptions of economic freedom relate to entrepreneurial outcomes in North Macedonia. We ask whether higher levels of perceived freedom go hand in hand with stronger innovation and business growth. To answer this, we com-

bined a statistical analysis of survey data with insights from entrepreneurs' own written accounts. This mix of quantitative and qualitative evidence allows us not only to identify general patterns but also to highlight the lived experiences behind those numbers. Unlike many previous studies that focus exclusively on entrepreneurs' perceptions, this study integrates both entrepreneurial and institutional perspectives to explain how economic freedom, institutional trust, and governance structures interact to shape innovation and business growth in North Macedonia. The study further contributes by examining the emerging risks of entrepreneurial brain drain within the context of future European integration. In doing so, we aim to contribute to the still-limited discussion of how economic freedom shapes entrepreneurship in transitional economies of the Western Balkans.

Literature Review

The theoretical foundations for linking economic freedom and entrepreneurship trace back to Schumpeter's (1942) idea of creative destruction, which positions the entrepreneur as a disruptive innovator in the marketplace. North (1990) later highlighted that such innovation cannot thrive without supportive institutions – clear property rights, predictable legal frameworks, and enforceable contracts. Building on this tradition, Acemoglu and Robinson (2012) argued that inclusive institutions nurture innovation and long-term growth, while extractive systems suppress entrepreneurial activity. Together, these perspectives underscore that entrepreneurship is as much a product of institutional design as of individual creativity. According to Bowen & De Clercq (2008) entrepreneurs engage improve business growth.

Empirical studies have reinforced this view. Cross-country analyses, such as Berggren's (2003), show that higher levels of economic freedom often align with faster growth and more competitive business environments. An empirical study about economic freedom and economic growth in Southeast European countries over the period 2000-2019 found that economic growth has a positive and statistically significant impact on economic growth (Emini, 2021). More recent evidence using the Heritage Foundation's Index of Economic Freedom and the Fraser Institute's Economic Freedom of the World index finds positive correlations between freedom scores and outcomes such as firm creation, productivity, and innovation capacity (Miller & Kim, 2023). According to Gwartney et al. (2021), higher levels of economic freedom are associated with stronger business performance. Yet, these benefits are uneven. In transitional economies, weak institutions frequently undermine the potential gains from liberalisation. Džafić (2014) documents how SMEs in the Western Balkans struggle with bureaucracy, corruption, and inconsistent regulatory enforcement, while Bitzenis and Nito (2005) observed similar barriers in Albania. These challenges resonate strongly in North Macedonia, where entrepreneurs

continue to report limited access to credit, fragile property rights, and uneven market competition.

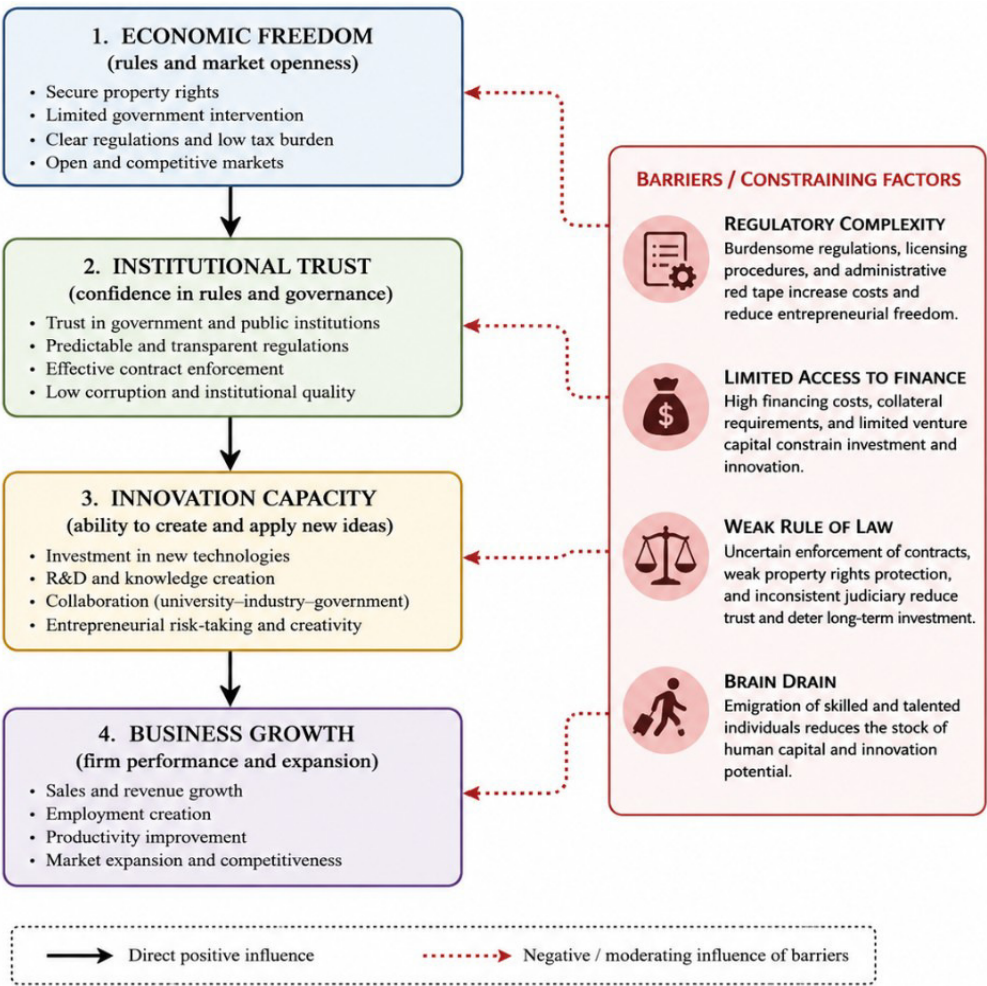
Despite such obstacles, incremental improvements in economic freedom can have tangible effects. Bartlett and Prica (2017), for example, note how closer integration with the European Union has created opportunities for Western Balkan firms. The World Bank's (2020) Doing Business report likewise shows that targeted reforms – such as simplifying registration or streamlining taxation – can lower entry barriers. Still, these reforms are often fragile, especially when political instability erodes predictability.

According to Bowen & De Clercq (2008) entrepreneurs engage improve innovation and business growth. However, as stated by Smallbone & Welter (2008) institutional and political environment that enables development is essential for entrepreneurial growth and economic development. Institutional quality is also central to fostering entrepreneurial innovation. Entrepreneurs in emerging economies typically face a dual challenge: scarce venture financing and burdensome administrative procedures. In North Macedonia, regulatory compliance costs, licensing delays, and restricted funding opportunities remain key barriers. Yet perception matters too. Research suggests that entrepreneurs who feel greater autonomy are more inclined to take risks and adopt new technologies, pointing to a psychological dimension of economic freedom that complements formal reforms. The relationship between entrepreneurship and institutional support can also be understood through the Triple Helix framework proposed by Etzkowitz and Leydesdorff (2000), which emphasises the interaction between universities, industry, and government in fostering innovation ecosystems. In transitional economies, the effectiveness of entrepreneurial development depends not only on market liberalisation but also on the quality of cooperation among these institutional actors. Weak coordination among academia, public institutions, and private industry may significantly limit the capacity for innovation and long-term business growth.

Comparative evidence from neighbouring countries highlights similar dynamics. Serbian entrepreneurs cite finance and regulation as persistent hurdles, while in Albania, reforms have improved economic freedom rankings without fully resolving informality and weak enforcement. These parallels suggest that North Macedonia's constraints are not isolated but reflect broader structural issues in the Western Balkans.

Taken together, the literature reveals a consistent pattern: economic freedom supports entrepreneurship, but the magnitude of this effect depends heavily on institutional quality and access to finance. In North Macedonia, progress in property rights and regulatory reforms has created some momentum, yet innovation and firm growth remain constrained. Closing this gap will require not only stronger legal and financial institutions but also efforts to build entrepreneurs' confidence in their autonomy and opportunities.

Figure 1
Conceptual Framework of the Relationship Between Economic Freedom, Institutional Trust, Innovation Capacity, and Business Growth in North Macedonia



Note. The model proposes that economic freedom enhances institutional trust, which in turn builds innovation capacity and contributes to business growth. However, regulatory complexity, limited access to finance, weak rule of law, and brain drain can weaken this process.

Figure 1 presents the study’s conceptual framework, illustrating the relationships among economic freedom, institutional trust, innovation capacity, and business growth, as well as the main institutional barriers constraining entrepreneurial development in North Macedonia.

Methodology

A mixed-methods design was employed, combining survey data with qualitative insights from entrepreneurs. This approach was chosen to capture both the statistical relationships between perceptions of economic freedom and business outcomes and the personal perspectives of entrepreneurs on institutional challenges in North Macedonia. To deepen the study’s interpretative dimension, an additional qualitative empirical phase was conducted through semi-structured interviews with 10 government rep-

resentatives and institutional stakeholders involved in entrepreneurship and innovation policy in North Macedonia. The integration of institutional perspectives enabled triangulation between entrepreneurs’ perceptions and policy-level interpretations of the entrepreneurial ecosystem.

The study focused on entrepreneurs, business analysts, and sector experts across North Macedonia, with attention to the predominance of small and medium-sized enterprises. Purposive sampling was applied, and 150 questionnaires were distributed online. A subset of responses was used for pilot testing and preliminary feedback. In parallel, semi-structured interviews were conducted with representatives from institutions associated with SME development, innovation support, economic policy, and entrepreneurial governance, including public agencies, innovation funds, chambers of commerce, and university innovation centres.

The sample reflects the structure of the national entrepreneurial landscape. Most respondents were between 25 and 44 years old, an age group often driving new business initiatives. Male participants predominated, reflecting regional gender disparities in entrepreneurship. While IT and technology firms made up a large portion of the sample, respondents also came from trade, services, and other sectors. The majority managed micro and small firms (1–20 employees), underscoring the centrality of SMEs in the national economy.

Data Collection and Analysis

The main hypothesis of the research study is the following: “Perceptions of greater economic freedom (fair competition, secure property rights, and predictable institutions) have a positive impact on firms’ innovation capacity and growth in North Macedonia, while limited access to finance, complex regulations, and weak institutional enforcement constrain these effects.”

Data were collected via an online questionnaire comprising three sections. The first captured demographic details (age, gender, sector, firm size). The second measured perceptions of economic freedom, including taxation, regulation, property rights, competition, and finance. The third section assessed entrepreneurial outcomes such as innovation, R&D investment, expansion, and revenue growth.

Likert-scale (1–5) items provided quantitative data, while open-ended questions encouraged participants to describe their personal experience.

Quantitative analysis was carried out using SPSS. Descriptive statistics were calculated first, followed by Pearson correlations to explore relationships between economic freedom indicators and entrepreneurial outcomes. Ordinary Least Squares (OLS) regression was then applied to test predictive effects on innovation capacity and revenue growth.

Qualitative responses were analysed thematically, with recurring issues identified around regulatory complexity, financing constraints, and institutional trust.

Reliability was ensured through internal consistency checks (Cronbach’s alpha). Validity was supported by aligning survey items with established indices of

economic freedom (Heritage Foundation, Fraser Institute) and tailoring them to the North Macedonian context. Triangulation of quantitative and qualitative evidence strengthened the robustness of findings.

Ethical Considerations

Informed consent was obtained from all participants. Data were collected anonymously, and no identifying information was published. The study followed ethical standards for social science research, ensuring confidentiality and voluntary participation.

Demographic Data

Table 1 summarises the main demographic characteristics of the respondents, covering age, gender, sector of activity, and firm size. The distribution reflects the composition of the entrepreneurial landscape in North Macedonia, where younger cohorts, male ownership, and small enterprises dominate the business environment. This profile provides important context for interpreting subsequent findings, as patterns of perception and performance are often shaped by such structural factors.

Table 1 outlines the demographic profile of the respondents. The majority fall within the 25–44 age range, indicating a strong presence of young and mid-career entrepreneurs in North Macedonia’s business landscape. This pattern is consistent with regional developments in the Western Balkans, where younger cohorts tend to be more engaged in entrepreneurship due to their adaptability and greater exposure to international markets.

The gender distribution shows a predominance of male respondents, reflecting the persistent gender imbalance in entrepreneurial participation. Such disparities are well documented in studies of transition economies, where cultural expectations and structural barriers often limit women’s involvement in business ownership.

In terms of sectoral representation, the IT/Tech industry dominates the sample. This outcome aligns with broader global trends, in which digital enterprises benefit from lower entry barriers and stronger prospects for innovation. By contrast, the weaker presence of traditional sectors such as manufacturing and agriculture suggests that entrepreneurial activity

Table 1
Demographic Landscape of the Research Data

	Age Groups	Gender	Sector	Number of Employees
34–44	2	0	0	0
25–34	2	0	0	0
45–54	1	0	0	0
Male	0	5	0	0
T/Tech	0	0	5	0
6–20	0	0	0	4
1–5	0	0	0	1

in North Macedonia remains concentrated in newer, high-growth industries rather than widely spread across the economy.

Firm size further illustrates this concentration. Most respondents operate small enterprises employing between 1 and 20 workers, underscoring the central role of SMEs in the national economy. These firms are particularly vulnerable to institutional conditions such as regulatory requirements and access to finance – two barriers that feature prominently in the later analysis.

Taken together, the demographic profile depicts a sample representative of North Macedonia’s entrepreneurial core: younger, male-led SMEs concentrated in the technology sector. This context is important when considering the findings on economic freedom and innovation presented in the subsequent sections.

Analysis and Interpretation of Research Data

Quantitative Research

This section reports the findings from the quantitative analysis of the survey data. The presentation begins with descriptive statistics to provide an overview of the sample’s key characteristics, followed by correlations that explore associations between perceptions of economic freedom and entrepreneurial outcomes. Finally, regression models are introduced to examine whether variations in perceived economic freedom help explain differences in innovation and firm growth among entrepreneurs in North Macedonia.

Table 2 summarises the measures of central tendency and dispersion for the main survey items. The results show particularly low ratings for tax policies and access to finance, both averaging below 2 on the Likert scale. These responses indicate widespread dissatisfaction with fiscal and financial frameworks, areas consistently cited as barriers to entrepreneurship in transitional economies.

By contrast, the highest scores were recorded for innovation capacity and investment in research and development. This pattern suggests that, even in the face of regulatory and financial constraints, firms in North Macedonia display notable resilience and a commitment to pursuing innovation. The findings resonate with the broader literature, which identifies institutional barriers as critical obstacles while also emphasising SMEs’ ability to sustain innovative practices despite adverse conditions.

The correlation matrix presented in Table 3 reveals several noteworthy relationships between institutional factors and entrepreneurial performance. Strong negative correlations were observed between regulatory requirements and both innovation ($r = -.63$) and revenue growth ($r = -.63$), suggesting that excessive bureaucracy places a significant burden on firms and constrains their ability to expand or introduce new ideas.

In contrast, property rights and perceptions of government support were positively associated with both growth and innovation. These results underscore the importance of secure ownership frameworks and predictable institutional backing in creating an environment where businesses can thrive.

Taken together, the findings echo regional evidence from the Western Balkans, where institutions often play a dual role – serving either as barriers that stifle entrepreneurship or as enablers that provide the stability and confidence required for innovation.

The regression results presented in Figure 2a indicate that perceptions of fair competition (+1.75) and secure property rights (+0.25) have a positive effect on innovation outcomes. In contrast, unfavourable tax policies (–1.00) and heavy regulatory requirements (–0.75) exert a negative influence. These findings suggest that innovation is more likely to emerge in contexts where entrepreneurs view markets as open and ownership as protected, whereas fiscal pressures and bureaucratic obstacles reduce firms’ willingness or capacity to pursue new initiatives.

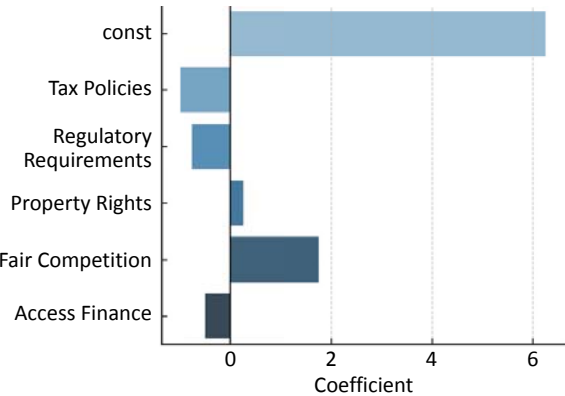
Table 2
Descriptive Statistics of Key Variables

	Mean	SD	Min	Max
Tax Policies	2.00	1.00	1.00	3.00
Regulatory Requirements	2.80	1.79	1.00	5.00
Property Rights	1.60	0.89	1.00	3.00
Fair Competition	1.40	0.89	1.00	3.00
Access Finance	1.60	1.34	1.00	4.00
Innovation Products	4.20	0.84	3.00	5.00
Invest RD	4.60	0.55	4.00	5.00
Support Expansion	2.60	1.82	1.00	5.00
Revenue Growth	3.40	1.67	1.00	5.00
Govimpact innovation	3.40	1.14	2.00	5.00

Table 3
Correlation Matrix of Economic Freedom and Outcomes

Variable	1	2	3	4	5	6	7	8	9	10
1. Tax Policies	1.00									
2. Regulatory Requirements	-.42	1.00								
3. Property Rights	-.28	.25	1.00							
4. Fair Competition	.56	.38	.25	1.00						
5. Access to Finance	.56	.37	.25	1.00	1.00					
6. Innovation Products	.00	-.63	.47	-.13	-.13	1.00				
7. Investment in R&D	-.91	.15	.10	-.61	-.61	.22	1.00			
8. Support for Expansion	.55	-.88	-.58	-.18	-.18	.39	-.20	1.00		
9. Revenue Growth	.00	-.63	.47	-.13	-.13	1.00	.22	.39	1.00	
10. Government Impact on Innovation	.00	-.69	.20	-.20	-.20	.94	.32	.58	.94	1.00

Figure 2a
Regression Coefficients Predicting Innovation

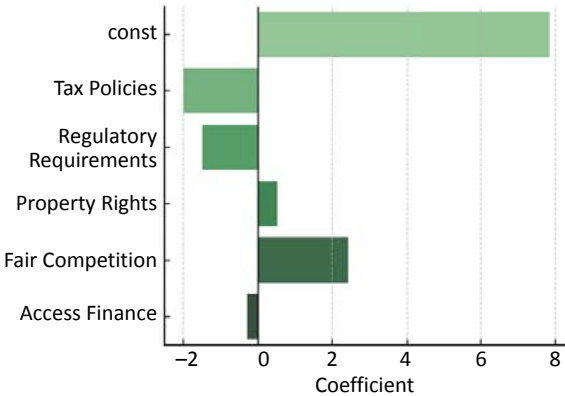


The direction of the coefficients corresponds with theoretical expectations and with previous empirical research on transition economies, where institutional incentives often determine whether entrepreneurs invest in innovation or retreat to less risky activities.

Figure 2b shows a comparable pattern for revenue growth. Fair competition (+2.43) and secure property rights (+0.50) emerge as positive predictors of firm expansion, whereas unfavourable tax policies (-2.00) and burdensome regulatory requirements (-1.50) exert negative effects. These findings indicate that the institutional environment directly shapes entrepreneurial performance: supportive frameworks encourage growth, while restrictive policies constrain potential. Although the sample size is relatively modest, the results align with cross-country evidence underscoring the role of market-friendly institutions in fostering sustainable business development.

Taken together, the analysis highlights two parallel dynamics in North Macedonia. On the one hand, regulatory complexity and limited access to finance continue to pose significant barriers to entrepreneurial growth. On the other hand, secure property rights and perceptions of fair competition provide essential

Figure 2b
Regression Coefficients Predicting Revenue Growth



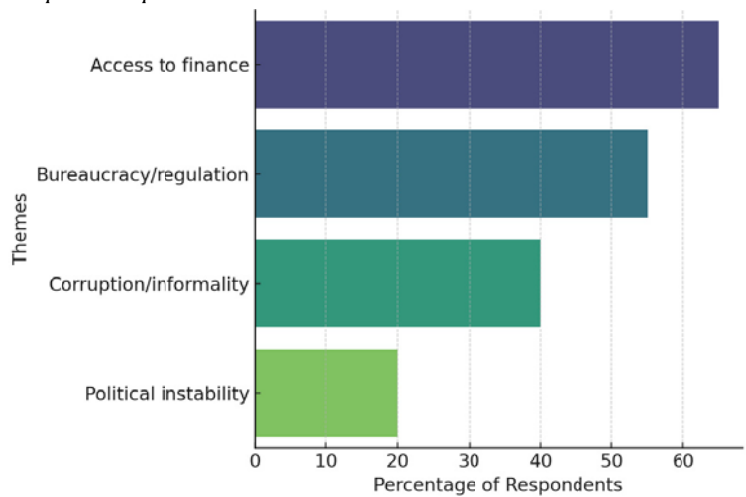
incentives for both innovation and expansion. These findings reinforce the view that institutional reforms should prioritise reducing bureaucratic burdens and improving access to finance, while at the same time safeguarding competitive markets as a foundation for long-term development.

Qualitative Research

Although the survey relied mainly on structured items, space was also provided for open-ended feedback. These qualitative inputs were thematically coded and subsequently quantified to identify recurring patterns across respondents. This section summarises the open-ended responses (Questions 16–20), presenting the main themes together with their percentage frequencies. Visualisations are included to illustrate the relative prevalence of each theme among respondents.

Access to finance (65%) and regulatory burdens (55%) emerged as the most frequently reported barriers to entrepreneurship in North Macedonia. Respondents described difficulties in securing loans or venture capital, as well as frustrations with lengthy procedures and excessive documentation. Corruption

Figure 3
Question 16: Barriers to Entrepreneurship



and informal practices were also highlighted by 40% of participants, often linked to perceptions of favouritism and the absence of fair competition. Political instability was mentioned less frequently (20%) but was seen as a source of uncertainty that discourages long-term investment decisions.

Taken together, these responses confirm that financial constraints and regulatory inefficiency remain the most pressing challenges for entrepreneurs. The qualitative insights therefore reinforce the patterns observed in the quantitative analysis, underlining the systemic nature of institutional barriers in the Macedonian business environment.

Half of the respondents reported that government policies tend to hinder innovation, largely due to excessive complexity. Another 35% emphasised the absence of meaningful incentives for research and development (R&D), citing a lack of tax relief or subsidies to stimulate investment in new technologies. At the same time, a quarter of the sample acknowledged positive reforms, particularly in the areas of digitalisa-

tion and business registration, which were perceived as steps in the right direction.

Overall, the responses suggest that, although certain reforms have been welcomed, many entrepreneurs continue to view regulations as restrictive rather than supportive. This perception is especially pronounced in R&D-intensive sectors, where the absence of policy incentives further discourages innovative activity.

The majority of respondents recommended simplifying tax and regulatory frameworks (60%), arguing that streamlined procedures would remove many of the bottlenecks that currently discourage entrepreneurship. Improved access to credit and venture funding was the second-most-frequent suggestion (50%), reflecting widespread concern about financing constraints. In addition, 30% of participants emphasised the need for stronger enforcement of property rights and contractual obligations, while 25% highlighted the value of education and training programmes aimed at developing entrepreneurial skills.

Figure 4
Question 17: Government Policies and Innovation

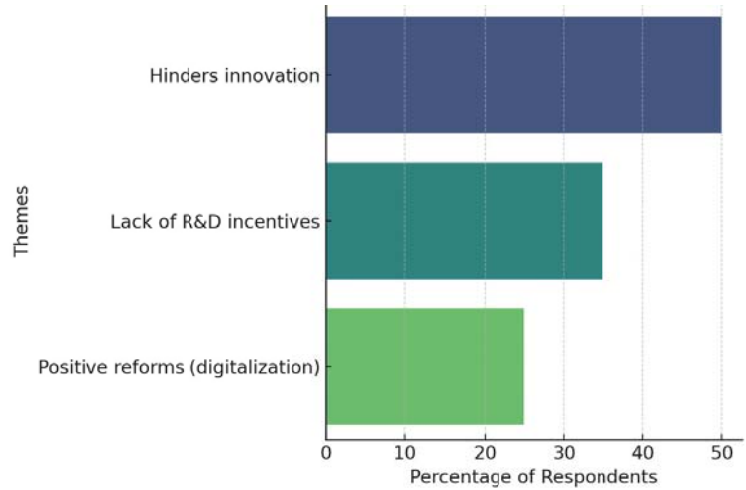


Figure 5
Question 18: Policy Changes to Improve Ecosystem



Together, these responses point to systemic challenges in the entrepreneurial ecosystem. Calls for regulatory simplification and better financing opportunities appear most urgent, while issues of legal protection and capacity building are also recognised as important areas for reform.

Respondents illustrated the impact of economic freedom on business growth and innovation through several concrete examples. The most common reference was to restrictions in obtaining permits (35%), which were seen as a direct obstacle to expansion. Limited access to bank credit was the second most frequently mentioned issue (30%), often linked to difficulties in financing new product development. At the same time, 20% of participants pointed to positive outcomes from European Union integration, particularly in reducing trade barriers and opening new markets. Finally, 15% emphasised the burden of high taxation, which they felt limited reinvestment in innovation.

These examples highlight the dual nature of economic freedom: its absence creates tangible barriers

to growth, while its presence can generate new opportunities. The narratives underscore how institutional conditions shape entrepreneurial strategies, particularly decisions about expansion and innovation.

Entrepreneurs offered several recommendations for improving economic freedom in North Macedonia. More than half (55%) advised policymakers to streamline administrative procedures, arguing that simpler processes would reduce unnecessary delays and costs. Nearly half (45%) stressed the need to increase transparency and curb corruption, identifying these issues as central to building institutional trust. Targeted financial support, including loans, grants, and tax reliefs, was proposed by 40% of respondents, while 25% emphasised the importance of a stable and predictable policy environment to encourage long-term investment.

Taken together, this advice reflects a consistent call for systemic reforms to improve efficiency, transparency, and access to resources. The responses suggest that entrepreneurs place equal value on reducing

Figure 6
Question 19: Examples of Economic Freedom Impact

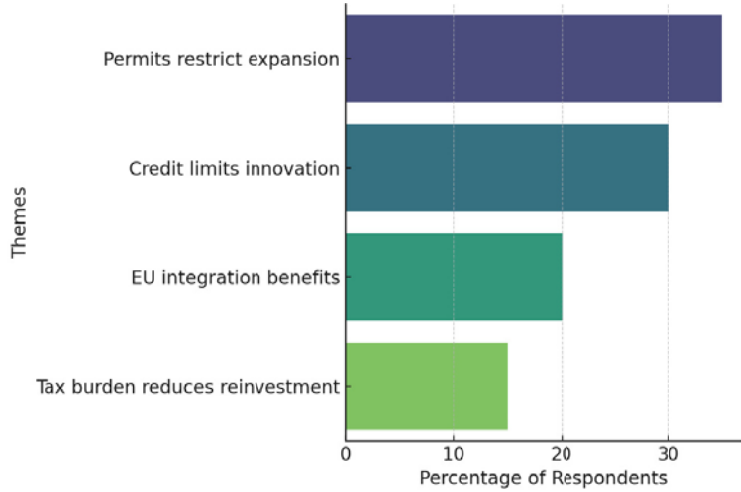
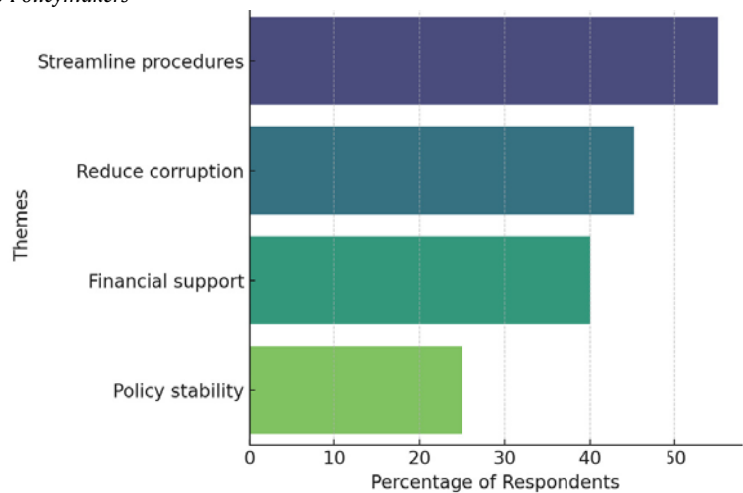


Figure 7
Question 20: Advice to Policymakers



everyday barriers and on creating a trustworthy environment in which business initiatives can grow.

Qualitative research: Government Perspectives on Entrepreneurship and Economic Freedom in North Macedonia

An additional qualitative empirical research phase was conducted involving 10 government representatives and institutional stakeholders responsible for entrepreneurship, innovation policy, SME development, and economic governance in North Macedonia. The purpose of this qualitative component was to compare institutional perspectives with the experiences and perceptions of entrepreneurs and business actors expressed in the study’s survey component.

The qualitative phase was framed through the Triple Helix model developed by Etzkowitz and Leydesdorff (2000), emphasising the interaction between universities, industry, and government as a central mechanism for innovation and entrepreneurial ecosystem development. The integration of institutional perspectives provides deeper interpretative insight into the mechanisms shaping entrepreneurial innovation and business growth in North Macedonia. A qualitative empirical approach based on semi-structured interviews was employed. Ten government representatives were purposively selected from insti-

tutions directly involved in entrepreneurship policy and innovation governance, including the Ministry of Economy, the Fund for Innovation and Technological Development (FITD), municipal economic development offices, chambers of commerce, university innovation centres, and SME support agencies.

Each interview lasted 40–60 minutes and was conducted in March and April 2026. The interview protocol focused on perceptions of the entrepreneurial climate in North Macedonia; government support for innovation and SMEs; institutional barriers affecting entrepreneurship; the rule of law and contract enforcement; financing opportunities for start-ups; the impact of European integration and brain drain; and cooperation among universities, businesses, and government institutions.

All interviews were anonymised to ensure confidentiality and encourage open discussion. Data were analysed through thematic coding, allowing recurring institutional narratives and explanatory mechanisms to emerge systematically from the interview material.

The interviews revealed strong convergence between entrepreneurs and government representatives regarding the major institutional barriers affecting innovation and business growth. Regulatory complexity and administrative inefficiency emerged as the most frequently discussed challenges. More than 80% of interviewees acknowledged that entrepreneurs continue to face excessive bureaucratic procedures,

Table 4
Profile of Government Representatives

Institution	Position	Participants
Ministry of Economy	Policy Advisors	2
FITD	Innovation Officers	2
Municipal Development Offices	Economic Coordinators	2
Chambers of Commerce	SME Representatives	2
University Innovation Centres	Innovation Coordinators	2

licensing delays, fragmented administration, and inconsistent regulatory implementation.

One government representative stated: “Digitalisation has improved some procedures, but institutional fragmentation still creates inefficiencies for entrepreneurs.”

Another respondent emphasised that legal reforms often remain formal rather than operational: “We have modern laws on paper, but implementation capacity remains weak at the administrative level.” The qualitative evidence suggests that bureaucracy reduces entrepreneurial flexibility, increases operational uncertainty, and discourages long-term investment decisions. The issue of the rule of law and contract enforcement also emerged as a dominant theme. Approximately 75% of government representatives acknowledged that weak judicial efficiency and inconsistent enforcement mechanisms reduce entrepreneurial trust in institutions. Several interviewees argued that investors and entrepreneurs are more willing to pursue innovation when property rights and contractual agreements are protected through predictable legal systems.

One participant explained: “Entrepreneurs are willing to take risks only when they believe institutions will protect their investments fairly.”

Weak legal predictability reduces risk-taking capacity and discourages innovation-oriented business strategies.

Brain drain and concerns about EU integration were discussed extensively by the interviewees. Around 70% of respondents expressed concern that North Macedonia may experience significant migration of highly skilled entrepreneurs and innovators following deeper European integration, similar to the experiences of Bulgaria, Romania, and Hungary after EU accession.

One interviewee noted: “The challenge is not only creating entrepreneurs, but creating reasons for them to stay.”

Government representatives repeatedly emphasised that improving economic freedom alone is insufficient without stronger institutional quality, transparent governance, and long-term innovation support systems. Access to finance was identified as another critical challenge. Nearly 90% of respondents acknowledged that start-ups and SMEs continue to face difficulties obtaining venture capital, seed funding, and commercialisation support. Although programmes implemented through FITD and public innovation grants were evaluated positively, participants admitted that traditional financial institutions remain risk-averse towards innovative start-ups.

The interviews also strongly reinforced the relevance of the Triple Helix framework. Approximately 65% of respondents argued that cooperation between universities, industry, and government institutions remains fragmented and underdeveloped. Participants highlighted weak commercialisation of academic research, limited technology transfer infrastructure, and insufficient collaboration between public institutions and private enterprises.

One respondent summarised: “Universities produce knowledge, businesses need innovation, and government creates policy, but coordination between these actors is still underdeveloped.”

The findings demonstrate that entrepreneurial growth depends not only on market liberalisation but also on institutional coordination mechanisms and innovation governance structures.

The qualitative findings reinforce the broader empirical results of the study. Both entrepreneurs and institutional representatives recognise that North Macedonia possesses considerable entrepreneurial potential, particularly among younger and innovation-oriented firms. However, this potential remains constrained by institutional weaknesses, financing limitations, regulatory burdens, and insufficient coordination among innovation actors.

The findings suggest that economic freedom influences entrepreneurship not only directly through deregulation and market openness, but also indirectly through institutional trust, legal predictability, innovation governance, and Triple Helix cooperation mechanisms. Consequently, future reforms should prioritise stronger contract enforcement, improved access to finance, transparent governance, and stronger cooperation between universities, industry, and government institutions.

By integrating the perspectives of both entrepreneurs and government representatives, the study provides a more process-oriented explanation of how institutional environments shape entrepreneurial innovation and business growth in transitional economies such as North Macedonia.

The qualitative evidence reinforces and substantially deepens the patterns identified in the quantitative analysis. Limited access to finance, burdensome regulation, weak institutional enforcement, and low institutional trust emerge as the most persistent obstacles to entrepreneurship and innovation in North Macedonia. Across responses, entrepreneurs repeatedly called for reforms to simplify administrative procedures, strengthen property rights protection, improve contract enforcement, and expand financial support mechanisms for start-ups and SMEs.

The additional interviews with government representatives further confirmed these findings, revealing a strong convergence between institutional actors and entrepreneurs regarding the structural weaknesses of the entrepreneurial ecosystem. Government representatives acknowledged that bureaucratic fragmentation, inconsistent regulatory implementation, and insufficient coordination among public institutions continue to undermine entrepreneurial confidence and limit long-term investment decisions. At the same time, concerns about brain drain and the potential migration of highly skilled entrepreneurs following deeper European integration were identified as emerging strategic challenges to the country's long-term innovation capacity.

The findings also highlight the importance of institutional cooperation within the Triple Helix framework. Weak coordination between universities, industry, and government institutions was identified as a significant limitation for the commercialisation of innovation and the development of sustainable entrepreneurial ecosystems. This suggests that entrepreneurial growth depends not only on market liberalisation and economic freedom, but also on the quality of institutional governance, legal predictability, and innovation-oriented public support structures.

Taken together, the quantitative and qualitative findings confirm the general hypothesis: “Perceptions of greater economic freedom (fair competition, secure property rights, and predictable institutions) have a positive impact on firms’ innovation capacity and growth in North Macedonia, while limited access to finance, complex regulations, and weak institutional enforcement constrain these effects”, demonstrating that higher perceptions of economic freedom are indeed associated with stronger innovation and business growth in North Macedonia.

Importantly, the integrated findings move the analysis beyond descriptive observation by identifying the institutional mechanisms through which economic freedom influences entrepreneurial behaviour. The results suggest that entrepreneurs are more willing to innovate, invest, and expand when institutions are perceived as transparent, predictable, and supportive of fair competition. These insights therefore add significant interpretative depth to the statistical results by grounding them in the lived experiences of both entrepreneurs and institutional representatives. As such, they provide policymakers with concrete, experience-based recommendations to improve the entrepreneurial environment, strengthen institutional trust, and foster sustainable, innovation-driven growth in North Macedonia.

Conclusion and Recommendations

The findings of this study point to several targeted reforms that could strengthen the entrepreneurial ecosystem in North Macedonia. Simplifying regulatory frameworks remains a top priority. Streamlined procedures for registration, licensing, and taxation, supported by one-stop digital platforms, would reduce compliance burdens and allow entrepreneurs to devote more energy to innovation and growth. The qualitative findings further suggest that reducing administrative fragmentation and improving institutional coordination would significantly enhance entrepreneurial trust in public institutions and create a more predictable business environment.

Improving access to finance is equally critical. Expanded credit guarantee schemes, along with alternative funding channels such as venture capital and crowdfunding, could provide new opportunities for small firms. Tailored financial instruments for innovative start-ups, particularly in high-growth sectors such as information technology and renewable energy,

would further stimulate investment. Government representatives also emphasised the need for stronger public–private investment partnerships capable of supporting commercialisation and scaling of innovative business models.

A more predictable and efficient system of property rights and contract enforcement would help to build trust among entrepreneurs and investors. Transparent judicial processes are essential for resolving disputes fairly, while clear enforcement of ownership rights can attract both domestic and foreign capital. The interviews demonstrated that institutional trust and legal predictability directly influence entrepreneurial willingness to invest, innovate, and expand operations.

Promoting fair competition and tackling corruption are also necessary steps. Stronger oversight of public procurement, open data initiatives, and greater transparency in government–business interactions would reduce favouritism and increase accountability. In parallel, policies that directly support innovation and research – such as R&D tax credits, innovation vouchers, and partnerships between universities, research institutes, and the private sector – would encourage firms to invest in new ideas. These findings strongly reinforce the importance of the Triple Helix framework, in which sustainable entrepreneurial development depends on effective cooperation among government, academia, and industry.

Finally, entrepreneurial education and skills development should not be overlooked. Training programmes, business incubators, accelerators, and mentoring initiatives can enhance managerial capacity and expand networking opportunities, especially for younger entrepreneurs who represent the most dynamic segment of the business community. Additional attention should also be given to retaining highly skilled entrepreneurial talent and reducing the long-term risks associated with brain drain and outward migration following future EU integration processes.

Taken together, these recommendations address the main barriers identified through both quantitative and qualitative analysis: limited access to finance, regulatory complexity, weak institutional enforcement, and insufficient institutional coordination. At the same time, they build on the strengths revealed in the study – the resilience of small firms, a strong culture of innovation, and the positive effects of fair competition and secure property rights.

Overall, the evidence suggests that enhancing economic freedom in North Macedonia requires more than institutional reform alone. Sustainable entrepreneurial growth also depends on strengthening institutional trust, improving governance quality, and creating an innovation ecosystem in which entrepreneurs perceive opportunities as accessible, transparent, and supported by stable institutions. The findings demonstrate that economic freedom yields stronger entrepreneurial outcomes when accompanied by an effective rule-of-law framework, coordinated innovation governance, and stronger cooperation among universi-

ties, businesses, and public institutions. By addressing financial and regulatory bottlenecks while reinforcing transparency, institutional stability, and innovation support structures, North Macedonia can unlock its entrepreneurial potential, stimulate sustainable business growth, reduce the risks of entrepreneurial migration, and contribute more effectively to long-term economic development across the Western Balkans.

Limitations and Future Improvements

While this study offers important insights into the relationship among economic freedom, entrepreneurial innovation, and business growth in North Macedonia, several limitations warrant acknowledgement. The sample, although based on 150 distributed questionnaires, represents a relatively small subset and is skewed towards male respondents in the IT/Tech sector. This imbalance limits the generalisability of the findings across industries and reduces the visibility of female entrepreneurship and rural business initiatives, which may face different institutional and financial barriers compared to urban technology-oriented firms.

The cross-sectional design presents another limitation, as it captures perceptions at a single point in time. Institutional reforms, political developments, and entrepreneurial behaviour are dynamic processes that evolve continuously in transitional economies. Consequently, a longitudinal approach would provide stronger evidence regarding how changes in economic freedom, governance quality, and regulatory reforms shape entrepreneurial outcomes over time.

A further constraint concerns reliance on self-reported perceptions. While perceptions are valuable indicators of the entrepreneurial climate and institutional trust, they are also subject to bias influenced by optimism, pessimism, media narratives, or short-term political developments. The absence of objective indicators such as profit margins, export performance, firm survival rates, investment intensity, or employment growth limits the robustness of the findings and reduces the ability to establish stronger causal relationships between economic freedom and business performance.

Although the study was strengthened through the inclusion of semi-structured interviews with government representatives, the qualitative component still remains limited in scope. A larger number of interviews with entrepreneurs, investors, policymakers, and innovation stakeholders could provide deeper insight into the institutional mechanisms that shape entrepreneurial behaviour. In addition, focus groups and longitudinal case studies would enable future researchers to capture more nuanced experiences of innovation processes, institutional trust, and business adaptation strategies.

Another limitation concerns the institutional context itself. North Macedonia represents a transitional economy with unique political, historical, and socio-economic characteristics. While this provides valuable country-specific insights, it also restricts

the ability to distinguish localised challenges from broader regional patterns. The Western Balkans share many structural similarities, including post-socialist institutional transformation, EU integration pressures, and persistent governance challenges. However, differences in reform trajectories, political stability, and market development may significantly influence entrepreneurial ecosystems across countries.

Furthermore, the study did not directly examine informal institutions such as political networks, cultural norms, social trust, and informal business practices, despite their significant influence within transitional economies. Future research could benefit from integrating institutional sociology and political economy perspectives to better understand how formal and informal institutional dynamics interact in shaping entrepreneurship.

Future research can address these limitations in several ways. Expanding the sample to include more diverse sectors, greater regional representation, and greater inclusion of female-led enterprises would improve generalisability and inclusiveness. Longitudinal research designs could capture the evolving impact of institutional reforms and EU integration processes on entrepreneurship over time. A mixed-methods approach combining perceptual data with objective financial, legal, and institutional indicators would further strengthen analytical validity and explanatory depth.

Future studies could also explore the role of brain drain, diaspora entrepreneurship, and return migration in shaping entrepreneurial ecosystems in the Western Balkans. Comparative studies involving neighbouring countries such as Serbia, Albania, Kosovo, Bulgaria, and Romania would help situate North Macedonia's experience within a broader regional and European framework. In addition, further research grounded in the Triple Helix framework could examine how cooperation between universities, government institutions, and private industry influences innovation capacity, technology transfer, and long-term entrepreneurial sustainability in transitional economies.

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CONFERENCE REPORT



25th Anniversary of the MIC (Management International Conference), June 3–6, 2026, Koper (Slovenia)

The Faculty of Management of the University of Primorska hosted the 25th anniversary edition of its annual Management International Conference (MIC), held under the theme *Bridging Gaps, Building Futures: Business and Policy in a Complex World*. Co-organised with the Department of Economics, Business, Mathematics and Statistics of the University of Trieste, the conference brought together 130 participants from over 25 countries, with 100 papers presented across sessions covering management, economics, digitalisation, innovation, the green transition, entrepreneurship, finance, and sustainability.

Twenty-five years of MIC represent more than an academic milestone – the conference has grown into a genuine community of scholars who return year after year, making it as much a gathering of long-standing colleagues and friends as a forum for presenting new research. This sense of continuity was evident throughout the programme, which opened on 3 June with a doctoral pre-conference day and a methodological workshop on qualitative research and AI-assisted data analysis. The main conference featured keynote addresses by Dr Ondřej Dvoutělý on SME supporting policies (Prague University of Economics and Business, Czechia) and Dr Damjan Kukovec (Judge at the General Court of the European Union, Luxembourg) on the geopolitics of the international economic order, alongside a roundtable on implementing the European Green Deal in ports and a Meet the Editors session featuring editors of MIC-affiliated journals.

The Book of Abstracts is available in open access at: <https://www.hippocampus.si/ISBN/978-961-293-577-1.pdf>.

‘E-mentor’ is one of the Conference supporting journals.

Marta
Krajewska-
Beentjes

Exploring Organisational Approaches to Measuring Knowledge Sharing: Evidence from Business Analysts

Abstract

Knowledge sharing is broadly recognised as a critical factor in organisational learning, innovation, and competitiveness. However, measuring knowledge sharing proves challenging due to the nature of knowledge, especially tacit knowledge that is hard to formalise and pass on. This study investigates how organisations measure knowledge sharing from the perspective of experienced Business Analysts. A qualitative research method was adopted, based on 16 semi-structured interviews with experienced Business Analysts who had between 4 and 16 years of professional experience in business analysis. The findings reveal five themes: no formal system to measure knowledge sharing, informal or indirect mechanisms, quantitative proxy metrics, scepticism towards existing measures, and the role of organisational culture in knowledge sharing. Interview participants noted that organisations often rely on numerical indicators such as onboarding or training completion. However, many questioned the validity of these metrics. The study concludes that organisations recognise the importance of knowledge sharing but still struggle with measuring it and therefore rely on a combination of indirect indicators and reinforcement through organisational culture.

Keywords: knowledge management, knowledge sharing, knowledge sharing measurement, business analyst, qualitative research

Introduction

Knowledge is inherently difficult to quantify and measure because it is intangible, fluid and embedded in people's minds (Nakash & Bouhnik, 2024). In addition, knowledge does not conform to formal organisational structures or predefined boundaries (Edwards & Kidd, 2003). However, according to Zeleny (2013), knowledge is a tangible asset whose value can be evaluated, whereas the value of information is more difficult to determine. Information acquires value only when it is applied in action and contributes to the creation or use of knowledge. In such cases, its value is assessed indirectly through the value of the knowledge it helps create.

Knowledge sharing is recognised as a building block for organisational success and competitiveness, serving as a crucial mechanism for survival in the knowledge-based economy (Yeşil & Dereli, 2013). Moreover, within the knowledge management (KM) cycle, it is regarded as one of the most critical processes and forms the foundation of effective knowledge management. Therefore, knowledge sharing has become one of the most extensively researched topics in management (Serenko & Bontis, 2016).

Whether knowledge sharing occurs through formal or informal mechanisms, it follows a process. This knowledge-sharing process is viewed as a structured activity (Chatterjee et al., 2022) that is aligned with organisational strategy, employee skills and competencies, and established guidelines designed to support its implementation (Yeboah, 2023).

As Sveiby (2007) notes, while knowledge sharing is widely recognised as valuable in theory, organisations often face obstacles in translating it into practice, partly because employees perceive it as an activity outside their formally defined job responsibilities. Furthermore, the phenomenon's complexity stems from the intricate network of

interactions and relationships among individuals and within organisations (Yang & Wu, 2008). Moreover, motivating employees to engage in knowledge-sharing activities remains a major challenge for both researchers and practitioners (Martinez, 2015). Lastly, knowledge-sharing goals are often not explicitly integrated into business strategies, partly because the impact of knowledge-sharing practices is challenging to measure (Riege, 2005).

Literature Review

Performance measurement is a critical component of knowledge management, as without measurement, organisations cannot judge what to continue, what to improve, and what to eliminate (Andone, 2009). Knowledge by its nature is a challenging resource to measure (Nakash & Bouhnik, 2024). As a result, measuring knowledge management is often regarded as an attempt to 'measure the immeasurable' (Capezzuoli & Jolly, 2019, p. 4). Therefore, it is not surprising that many authors claim that measuring organisational knowledge is a challenging concept to define and measure (Argote, 2011; Hargadon & Fanelli, 2002). According to Sveiby (2010), measuring social phenomena with scientific precision is not feasible. Therefore, all measurement systems, including conventional accounting, rely on proxy measures, such as monetary values (e.g., dollars or euros) and indicators that only indirectly reflect the underlying events or actions responsible for the phenomenon. Moreover, traditionally, knowledge workers have placed greater emphasis on the quality of their outputs than on the process factors involved in their creation. While process variables, including time and cost, can be measured relatively easily, measuring knowledge work outputs remains difficult (Davenport et al., 1996; Pyöriä, 2005).

According to Matáškova (2016), methods of measuring knowledge sharing can be divided into three groups: (1) hard data measurement (e.g., contributions to knowledge bases), (2) opinion-based surveys (e.g., which examine knowledge-sharing factors), and (3) a combination of hard and soft indicators. An example of the second approach is provided by Usoro et al. (2007), who measured knowledge sharing in virtual communities of practice using a questionnaire. In their research, they examined three aspects linked to knowledge sharing: how often an employee takes part in a knowledge-sharing process (quantity of sharing), the usefulness of shared knowledge (quality), and the degree to which an individual feels they engage in knowledge sharing (focus). For example, Wang et al. (2014) propose measuring tacit knowledge sharing by assessing whether employees share and seek knowledge derived from their experiences and expertise. In contrast, explicit knowledge sharing can be measured by assessing whether employees share externalised knowledge, such as reports, manuals, and other official documents.

If managers believe knowledge sharing benefits both individuals and the organisation and want to reward knowledge-sharing behaviours, they must measure those behaviours first. A challenge in setting up knowledge-sharing rewards is the difficulty of identifying and evaluating knowledge sharing (especially tacit knowledge) at the individual level (Ipe, 2003). For example, tracking contributions to an online knowledge-sharing system, an example of hard data measurement (Matošková, 2016), is relatively easy; however, monitoring whether knowledge sharing occurs through face-to-face interactions is much more difficult (Yi, 2009).

Despite the recognised importance of knowledge sharing, understanding remains limited of how organisations measure this process in practice, particularly tacit knowledge. Moreover, even when knowledge sharing is measured as one of the knowledge management processes, its assessment remains inconsistent (Fan & Beh, 2024), as no universally accepted framework for measuring knowledge management has been established (Nakash, 2024). This study explores how organisations approach measuring knowledge sharing from the perspective of experienced Business Analysts (BAs). Business Analysts were considered a particularly relevant group because their role typically requires interaction with multiple stakeholders and involves connecting business (e.g., users) with technical staff (e.g. IT staff) (Vashist et al., 2011). This cross-functional role provides BAs with a broad perspective on how knowledge is shared and applied across organisational functions, making them a valuable source of information. The objective of the study is to identify the measurement practices currently used by organisations and to examine how practitioners perceive their effectiveness.

Methodology

A qualitative research approach was adopted to understand the phenomenon under investigation. In simplified terms, qualitative research methods generate non-numerical, non-quantifiable data, such as interview transcripts, observations, expert insights, and other descriptive information (Trutkowski, 2008). The present study adopted a micro-level perspective, with the objective of gaining an in-depth understanding of questions such as 'what,' 'where,' 'how,' and 'why,' focusing on the nature and underlying mechanisms of the phenomenon under investigation, rather than quantitative questions concerning 'how many' or 'how much' (Trocki & Juchniewicz, 2013).

Semi-structured interviews were selected over structured interviews as they provide greater flexibility and allow for deviation from a pre-defined set of questions. Moreover, semi-structured interviews are particularly suitable for exploratory research, as they facilitate the collection of rich, detailed, and in-depth data from participants (Ruslin et al., 2022).

All interviews were conducted online. With the participants' consent, all interviews were recorded and automatically transcribed using MS Teams. In total, 16 semi-structured interviews were held. While each interview followed a predefined interview script, they varied due to differences in participants' personalities, communication styles, and other factors. The estimated duration of each interview was 60 minutes.

For the qualitative analysis, data were collected directly from 16 interviewed experts in business analysis and business process analysis. This data-collection method was appropriate because it enabled the collection of in-depth accounts of participants' experiences and perspectives. The present study draws on a subset of the collected interview material that is related to the research question addressed in this article. The analysis focused on responses to one main open-ended question and two follow-up questions concerning the measurement of knowledge sharing: 'Does your organisation measure knowledge sharing?' and 'If yes, what indicators are used to measure the success of knowledge sharing?', 'If not, what indicators would you suggest implementing?' These questions generated a wide spectrum of responses and provided sufficient empirical material for the analysis.

The interview data were analysed using an inductive thematic analysis, as themes emerged from the data. Interview transcripts were manually coded by a single researcher. Initial codes were generated from the experts' responses. These codes were then compared in terms of recurring patterns and subsequently grouped into broader clusters based on similarities identified across the interviews. Through this iterative process of familiarisation with the interview transcripts, generating initial codes, identifying recurring patterns and comparing and grouping conceptually related codes, the codes were consolidated into five thematic clusters derived from the empirical material.

Although coding was conducted by one researcher, the coding process followed a consistent analytical procedure throughout the study. To enhance the credibility of the findings, the coding process was conducted iteratively by the researcher. After initial coding, the interview transcripts and assigned codes were reviewed multiple times, with ongoing comparison between the original interview data and emerging categories to ensure the identified categories accurately reflected participants' responses. This iterative process helped improve the consistency and trustworthiness of the analysis.

Data saturation was achieved at the 16th interview, when no new substantive information emerged, indicating that the collected data were sufficient to address the research objectives and that additional data collection was unnecessary.

A Business Analyst was defined as an individual who performs business analysis activities, regardless

of their formal title or position within an organisation. This definition aligns with that of the International Institute of Business Analysis (IIBA), which defines business analysis as 'the practice of enabling change in an organisational context by defining needs and recommending solutions that deliver value to stakeholders', and a Business Analyst could be any person who performs business analysis activities, regardless of job title (Institute of Business Analysis, 2021). Most experts carried out their professional responsibilities in English and collaborated within diverse, international teams. Several interviewees occupied senior positions, such as Senior Business Analyst, while others combined their primary role with additional responsibilities, including Product Owner duties.

As mentioned earlier, the research sample consisted of 16 participants: 5 female and 11 male. The privacy of interview participants was protected, as all personally identifiable information, including names, organisational affiliations, and contact details, was removed or anonymised in accordance with the requirements of the General Data Protection Regulation (GDPR). To further prevent identification, each Business Analyst was assigned a unique identifier and was referenced exclusively by that identifier (Table 1).

The experts were recruited through multiple channels, including the International Master of Business Administration (IMBA) Program Network, the Cracow School of Business (CSB) Alumni MBA Club, LinkedIn, professional Business Analyst networks, other professional networks, and professional and private recommendations. The recruitment process was conducted exclusively by the author. Participant selection followed explicitly defined inclusion criteria (Galletta, 2013): (a) participation in cross-functional initiatives, (b) involvement in business process analysis, and (c) at least four years of professional experience in business analysis to ensure informed and conceptually rich data. The four-year experience threshold is consistent with prior research (Ammann et al., 2025) and aligns with the eligibility requirements for the CBPP™ (Kirchmer et al., 2019) and CBAP™ (International Institute of Business Analysis, 2021) professional certifications.

Moreover, the overall professional experience of the experts interviewed ranges from 8 to 35 years, while the majority have over 15 years of professional experience. Experience in business analysis ranges from 4 to 16 years, and most of the experts have over 7 years of experience in business analysis.

The interview process generated three primary data sources. First, all interviews were video-recorded, providing a complete record of the discussions. Second, automatic transcripts were generated, and thirdly, observational notes were documented during the interviews to capture contextual information, non-verbal cues, and additional insights that were not readily captured in the recordings or transcripts.

Table 1
Demographic and Professional Profile of Interviewed Experts

No	Identifier	Overall professional experience (in years)	Professional experience in business analysis (in years)	Gender (M = male, F = female)
1	BA1	35	15	M
2	BA2	10	7	M
3	BA3	35	15	M
4	BA4	25	12	M
5	BA5	17	7	M
6	BA6	8	4	F
7	BA7	10	4	M
8	BA8	24	14	M
9	BA9	16	5	F
10	BA10	22	12	M
11	BA11	18	8	F
12	BA12	18	11	M
13	BA13	30	10	M
14	BA14	20	10	M
15	BA15	20	15	F
16	BA16	20	16	F

Results

Based on the data collected through the semi-structured interviews, several thematic clusters emerged regarding the measurement of knowledge sharing in organisations.

- Cluster 1: No formal system to measure knowledge sharing
- Cluster 2: Informal or indirect knowledge-sharing mechanisms
- Cluster 3: Quantitative proxy knowledge-sharing metrics
- Cluster 4: Scepticism towards existing knowledge-sharing metrics
- Cluster 5: Knowledge sharing embedded in organisational culture

The clusters reflect varying approaches to measuring knowledge sharing, including indirect approaches, scepticism towards existing metrics, and scepticism towards the measurement of knowledge sharing more generally.

The first cluster, *No formal system to measure knowledge sharing*, shows that most interviewed Business Analysts explicitly stated that their organisations did not measure knowledge sharing formally and that they were unaware of any organisational-level indicators, metrics, or key performance indicators (KPIs) designed to evaluate knowledge-sharing practices.

Some BAs made strong statements such as BA12: 'There are no formal indicators like leading or lagging indicators'. Other typical answers in this cluster were related to the lack of awareness of whether such

indicators exist, BA9, 'I have never heard about it. No idea'. Another interviewed expert with the identifier BA2 noted 'Honestly, nothing comes to mind'. These statements suggest not only the absence of visible measurement systems but also rather low awareness among employees regarding existing mechanisms for monitoring knowledge-sharing activities. The lack of formal indicators identified by participants might potentially reflect a wider organisational challenge. Although knowledge sharing is frequently acknowledged as a critical factor in organisational learning, innovation, and competitive advantage, organisations seem to struggle to translate it into measurable indicators. The findings could suggest that the Business Analysts were not aware of any formal measurement of knowledge sharing; as a result, it remains underdeveloped in many organisations.

The second cluster, *Informal or indirect knowledge-sharing mechanisms*, shows that although formal systems for measuring knowledge sharing are not in place in most cases, the interviewed Business Analysts shared that the organisations use a range of indirect indicators, such as onboarding, handovers, or performance observations. Several Business Analysts described onboarding as one mechanism for assessing knowledge sharing. BA12 said, 'We have the onboarding... once someone is fully onboarded... there is an official document that this person has been through like that.'

This could suggest that successful onboarding is perceived as evidence that knowledge has been transferred from an experienced employee to a new

one. Although onboarding completion is not explicitly designed as a knowledge-sharing metric, it functions as an informal indicator. Other participants emphasised recognition and observation rather than formal measurement. As BA11 noted, 'It's more in the form of a recognition. It's not really like measured with certain...'

This could suggest that knowledge-sharing behaviours may be acknowledged informally without being incorporated into structured performance measurement systems. Delegation was identified as another indirect indicator of successful knowledge sharing. According to BA16, 'Indirectly more the check in how far we are delegating.' The ability to delegate tasks effectively may indicate that knowledge has been shared and that dependence on specific individuals has been reduced. Similarly, participants highlighted handover processes as critical moments during which knowledge-sharing behaviours become visible. BA12 said, 'I think handover helps a lot and handover is also a moment that you know if the person knows, if the person is willing to share.'

The findings from the second cluster can suggest that organisations assess knowledge sharing through process outcomes rather than through measurement frameworks. Successful onboarding, effective delegation, smooth handovers, cross-functional collaboration, and supportive employee behaviours are all interpreted as signs that knowledge sharing is taking place. Consequently, knowledge-sharing performance is evaluated indirectly through organisational practices and employee interactions.

The third cluster, *Quantitative proxy knowledge sharing metrics* (trainings, certifications, platform statistics), shows that, according to the interviewed experts, organisations attempt to assess knowledge sharing through measurable indicators such as training completion rates, professional certifications, employee skills profiles, repository contributions, and usage statistics generated by knowledge management platforms. Unlike the second cluster, in which knowledge sharing was assessed informally or indirectly, this cluster reflects the use of quantitative measures that can be easily collected and monitored.

Several interviewed Business Analysts indicated that organisations create key performance indicators, such as those related to learning and upskilling. For example, BA4 stated: 'There is definitely a possibility to collect KPIs, for example, how many trainings were delivered over the year, quarter, how many users attended etc.' This response could suggest that organisations rely on training-related metrics as evidence. Such indicators are relatively easy to collect and compare across dimensions, for example, the number of trainings per year and the average number of trainings received per team member. However, participation in various trainings does not necessarily indicate whether knowledge has been understood or applied.

The use of digital collaboration platforms also emerged as a measurable indicator; some platforms

have built-in statistics, and some indicators could be taken directly from them, for example, the number of visited websites. One of the experts, namely, BA6, explained: 'For example, some stats about contributors in Confluence.' Similarly, BA3 noted, 'You can collect stats on how many people access the page, how many people contribute, how many people might download something.'

These observations show that organisations can use platform analytics to monitor user engagement. Metrics such as page views, document downloads, content contributions, and active users provide a quantifiable record of employee interactions with various platforms. From a managerial perspective, such indicators offer some insight into how and how often systems are used. However, these indicators do not present the full picture, as a visit to a page doesn't directly translate into reading and understanding, let alone knowledge sharing. Participants also identified employee skills profiles and certifications. BA14 shared that employees maintain records of acquired competencies: 'Every employee has a profile, and when you complete a training or gain a new skill, you have to update it there.' Similarly, BA15 stated, 'The only measure...is, for example, which skills, competencies do you have? ... or the number of certificates.' Certifications, completed training programmes, and competency records provide tangible indicators that can be incorporated into various monitoring and evaluation systems.

Building on the third cluster concerning *proxy knowledge-sharing metrics*, a fourth cluster emerged: *scepticism towards existing knowledge-sharing metrics*. This cluster was defined independently, as many interview participants showed scepticism towards simplified quantitative metrics and questioned the validity of knowledge-sharing measures.

Many interviewees questioned whether commonly used quantitative indicators, such as the number of completed training courses, were valid measures of knowledge sharing. As BA1 noted, metrics such as 'how many workshops were done or how many publications were prepared' are 'not a real measure,' while BA15 said that completing a training does not necessarily indicate learning, as participants may not have actively engaged with the content. BA15 said, 'What kind of measure is that you acquired new competencies like you completed a training? You could have slept during the training.' Moreover, such measures could create a false impression about knowledge sharing.

Several respondents also emphasised the difficulty of developing meaningful quantitative measures, with BA1 stating that 'it's very difficult to propose any quantitative way of assessing effectiveness,' and BA10 admitting 'No, actually I couldn't imagine how we measure it'. BA15 said, 'I cannot recall an organisation that I would say that they measured knowledge sharing successfully.' This cluster suggests that Business Analysts perceive knowledge sharing as a complex, qualitative, and context-dependent process that

cannot be adequately captured through simplified numerical metrics alone.

The fifth cluster, *Knowledge sharing embedded in organisational culture*, highlights organisations where knowledge sharing is primarily encouraged through cultural values, leadership, and a focus on collaboration rather than competition. The interview participants described knowledge sharing as established and expected. BA2 said 'there is this culture of knowledge sharing' and emphasised that 'this is something that is being mentioned on a regular basis from the management level.' Similarly, BA10 explained that knowledge sharing is actively promoted within the organisation, stating 'We encourage it.' BA8 pointed to the positive career implications of collaborative behaviour in his organisation, observing that 'for us knowledge sharing is better for your career than not sharing.'

The emphasis on organisational culture reinforcement indicates that it may play a significant role in motivating knowledge-sharing behaviours; however, it is not recognised as a measure. In such an environment, employees are encouraged to share knowledge as it is perceived as beneficial for both organisational success and individual professional development.

Discussion

The findings of this study demonstrate that knowledge sharing is valued but difficult to measure in the organisational context. Across 16 interviews, a major theme was a lack of formal, organisation-wide systems to measure knowledge sharing. Most participants were either unaware of any organisational indicators related to knowledge sharing or stated that such measures didn't exist in their organisations. Consequently, organisations rely on organisational practices and employee interactions rather than direct measures of knowledge sharing. Although knowledge sharing is acknowledged as a critical factor in organisational learning, organisations struggle to translate it into measurable indicators.

The findings provide several explanations for why organisations choose particular approaches to measuring knowledge sharing. First, organisations struggle to manage knowledge as a resource because knowledge, particularly expertise-based knowledge, is inherently intangible (Geiger & Schreyögg, 2012). This intangible nature complicates measuring knowledge-sharing activities, making it challenging to track complete knowledge flows and evaluate their outcomes (Danko & Crhová, 2025). This finding also supports the related work of Pérez López-Portillo et al. (2016), who found that knowledge management is not analysed from a market value perspective, but from knowledge quality and quantity, KM processes, KM initiatives, KM outcomes and potential benefits.

Second, the findings suggest that organisations evaluate the outcomes of knowledge sharing rather than the sharing process itself. The emphasis on onboarding, delegation, and handover shows that knowledge sharing is assessed indirectly through

operational continuity. Frögéli et al. (2023) claim that formal onboarding facilitates organisational socialisation, with key indicators including role clarity, task mastery, and social acceptance. These include sufficient information about expectations and sufficient knowledge of the behaviours needed to achieve goals. This observation may be explained by the fact that the effectiveness of knowledge-sharing mechanisms may depend on broader organisational factors, including communication quality, trust, teamwork, and managerial support (Balcerzyk, 2021).

The third finding relates to the use of quantitative proxy indicators such as completed training, certifications, skills profiles, and knowledge platform analytics, as these measures offer organisations tangible data. However, the interviewed Business Analysts expressed scepticism regarding their validity. While such indicators prove participation in certain activities, they do not indicate whether knowledge has been understood or shared with others.

The findings raise important questions regarding the validity of these measures as proxy indicators of knowledge sharing. Although training attendance, professional certifications, and platform activity are quantifiable, they do not reflect whether meaningful knowledge sharing has actually taken place.

This scepticism is consistent with Wong et al. (2015), who state that knowledge management is difficult to measure and is therefore evaluated indirectly using non-monetary or 'intermediate' measures, such as the number of collaborative projects. Similarly, Dzenopoljac et al. (2023) emphasise that previous studies focused primarily on the level of acquired knowledge, not on the role of knowledge quality in the context of knowledge sharing. In practice, it is important to understand whether specific knowledge adds value or has a positive impact. Therefore, the present study questions the validity of proxy indicators as they do not reflect actual outcomes and quality of knowledge sharing.

Finally, the study highlights the importance of organisational culture in facilitating knowledge sharing. Several interview participants described knowledge sharing as an expected and valued behaviour within the organisation, rather than as something enforced through formal measurement systems. Management support, collaboration, and recognition emerged as important mechanisms for encouraging knowledge-sharing behaviour. This finding supports previous research suggesting that organisational factors can act as both enablers and barriers to knowledge sharing (Świgoń, 2015). Sveiby and Simons (2002) propose that the organisational context for knowledge sharing, called collaborative climate, could be perceived as the shared mental space where knowledge sharing takes place.

The findings also reinforce the argument that knowledge sharing is related to 'soft factors' such as motivation, communication climate and organisational culture that encourage such behaviours (Ardichvili et al., 2006; Cabrera et al., 2006; Moffett et al., 2003).

Moreover, in organisations with a strong knowledge-sharing culture, cultural reinforcement through norms, expectations, and managerial practices seemed to be in place rather than explicit indicators. Therefore, the choice of measurement approach reflects both the difficulty of measuring knowledge and organisations' preference for observable indicators.

Conclusions

This study explored how organisations measure knowledge sharing from the perspective of experienced Business Analysts. The findings reveal that formal, organisational measurement systems for knowledge sharing are largely absent or not visible to employees, and organisations instead tend to rely on indirect or proxy indicators.

The study identified five thematic clusters: the absence of formal measurement systems, the use of informal and indirect mechanisms, the application of quantitative proxy metrics, scepticism towards existing measures, and the role of organisational culture in knowledge sharing. These findings suggest that organisations acknowledge the importance of knowledge sharing but struggle to define measures.

A managerial implication is to incorporate knowledge sharing into employees' job descriptions and performance reviews. Clearly defined knowledge-sharing objectives make it easier to assess performance against them at the end of a performance review cycle. Managers should also use a mix of 'hard' and 'soft' measures. For example, quantitative measures of knowledge asset usage should be complemented by qualitative measures to explain why employees use these assets and the value they bring to the organisation (Janus, 2016).

Finally, recent studies conceptualise knowledge sharing as distinct tacit and explicit dimensions that contribute differently to organisational capabilities (Dzenopoljac et al., 2023). Therefore, tacit indicators should capture the transfer of practical know-how, professional judgement, and contextual understanding (e.g., client workstyle preferences) (Capestro et al., 2024; Nonaka & von Krogh, 2009; Polanyi, 1967). In contrast, indicators of explicit knowledge sharing may include contributions to organisational knowledge repositories, participation in communities of practice, and the preparation of project-closing documentation, including lessons learned (Zamiri & Esmaeili, 2024).

The main limitation of the study is that the findings are based on a relatively small sample of Business Analysts. However, the sample is sufficient from the perspective of a qualitative methodology and the exploratory nature of the approach, with the main objective of gaining in-depth insight. Different perspectives might have emerged if other Business Analysts or additional stakeholder groups had been included. Although the respondents represented different industries and organisational contexts, the data collected were not considered sufficient to support a reliable analysis of how these differences might influence knowledge-sharing practices. Moreover, the

transcripts and codes were reviewed iteratively by a single researcher to ensure consistency; the absence of independent verification may have increased the potential for researcher subjectivity in categorising and interpreting the data.

Future research could therefore expand the sample to encompass a broader range of stakeholders, compare practices across industries, and investigate how knowledge-sharing measurement approaches evolve over time. Despite these limitations, the study contributes to the growing body of knowledge management literature by providing empirical evidence that organisations do not have organisation-wide knowledge-sharing measures.

In conclusion, the findings indicate that organisations continue to face challenges in measuring knowledge sharing. While knowledge sharing is recognised as critical, there is still no defined way to measure it. As a result, organisations try to combine various metrics to assess whether knowledge sharing is occurring.

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CONFERENCE REPORT



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**7th Polish BPM Symposium,
April 23–24, 2026, Wrocław
(Poland)**

The 7th Polish BPM Symposium was held at Wrocław University of Economics and Business (WrUEB) on 23–24 April 2026, providing a forum for dialogue on Business Process Management (BPM) between academia and business [1,2]. The Symposium gathered representatives of 21 Polish higher education institutions, 5 foreign universities participating remotely, and 8 companies. Its program included 22 paper presentations, a panel discussion, 3 doctoral dissertation project presentations, a keynote lecture in an interactive hybrid format, and a visit to the EU Business Process Simulation Center in Wrocław. After the ceremonial opening by the Rector of WrUEB, Prof. C. Zając, the event began with the panel discussion "Science for Practice, Practice for Science". Representatives from academia, business, and BPM software providers discussed the foundations and practical implementation of BPM, the future challenges for the field posed by hyperautomation, Industry 5.0, and Artificial Intelligence (AI). In the keynote lecture, Prof. E. Mercier-Laurent from the University of Reims Champagne-Ardenne, focused on the importance of human–AI collaboration and discussed both the opportunities AI offers, such as increased efficiency and faster data processing, and the risks of excessive reliance on technology and algorithmic limitations. The paper sessions addressed key BPM-related topics, including processification, digital transformation, industrial process modeling, organizational process maturity, BPM education, knowledge sources, the changing roles of people in organizations affected by digital transformation, the importance of transparent communication, and clear instructions for effective process automation. A special session for doctoral students enabled young researchers to present their dissertation projects, share achievements, and discuss challenges, and receive constructive feedback in a supportive atmosphere. On 23 April 2026, the Founding General Meeting of the association Polish BPM Community was held, and its Steering Committee was elected. The Community aims to network BPM-related scientists and practitioners in Poland and to support research, knowledge exchange, and the continuous improvement of BPM education [3]. The 7th Polish BPM Symposium was partially funded by the state budget, granted by the Polish Minister of Science and Higher Education under the "Wektory Nauki" (Science Vectors) program [4].

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'E-mentor' is one of the Symposium supporting journals.

Ashna
Sonik

Jagwinder
Singh

Retaining Generation Z Employees in the Knowledge-Intensive Service Organisations: The Influence of Organisational Virtuousness and Work-Life Balance through Psychological Capital

Abstract

The prominence of Generation Z in the workplace has heightened organisational concerns related to retention and employee loyalty. Despite growing interest in factors that encourage long-term commitment among young employees, limited research has examined how workplace resources influence employee loyalty. This study examines the impact of organisational virtuousness and work-life balance on employee loyalty, with psychological capital as a mediator. A quantitative cross-sectional approach was used, collecting data from 493 Gen Z respondents and analysing them using PLS-SEM. The findings indicate that virtuousness positively affects employee loyalty, whereas work-life balance does not. Furthermore, psychological capital partially mediates the relationship between virtuousness and loyalty, and fully mediates the relationship between work-life balance and loyalty. Drawing on conservation of resources theory, these results highlight the importance of personal resources in translating job resources into effective retention strategies for Gen Z employees.

Keywords: organisational virtuousness, work-life balance, psychological capital, employee loyalty, generation Z

Introduction

Failures are more likely to occur in the service sector because this sector relies on human interaction, the behaviour of the employees, as well as real-time customer experiences, which makes it challenging to make it consistent and controllable (Ma et al., 2022). Stereotyped as disengaged and disloyal, and famous for its job hopping, Generation Z can disrupt service, increasing recruitment and training expenses, eroding customer trust, and decreasing organisational performance. To gain a competitive edge, employee loyalty is crucial for retention and performance (Dutta & Dhir, 2025). Consequently, the biggest challenge for companies is to motivate and retain them and bridge the gap between industry demands and the needs of the workforce (Cherkaoui et al., 2025; Deloitte, 2025; Dolot, 2018).

Generation Z, a cohort born between 1997 and 2012, is currently 377 million in India and is the largest workforce in the world (Jain et al., 2024). 65% of the population in India is under 35, crowning India as a global talent ecosystem (India Brand Equity Foundation, 2025). Gen Z is tech-savvy, switches jobs at will, appreciates ethics, purpose, and work-life balance and is responsible for changing the workplace norms (Das & Malik, 2025). Research on Gen Z requires prudent attention, especially in transition and emerging economies (Nguyen et al., 2022). Gen Z places greater emphasis on learning, skill upgradation, psychological well-being and interpersonal relationships (Deloitte, 2025). Gen Z expectations from the workplace are different, which poses a challenge for the organisation to attract and retain the digital natives.

Although previous studies have explored employee loyalty through tangible (rewards, career opportunities, leadership) and selected intangible (organisational culture, commitment, satisfaction) job resources, the integrated association of organisational virtuousness, work-life balance, and psychological capital remains underexplored (Aboobaker et al., 2022; Cherkaoui et al., 2025; Silva et al., 2024). Financial rewards and compensation were considered primary retention drivers for earlier generations, but Generation Z demonstrates different workplace priorities (Krishna & Agrawal, 2025; Twenge et al., 2010; Wongprasurt & Lee, 2024). Generation Z varies from previous generations, values work-life balance and job security, and remains worried about staying in the same job for a long period of time, without growth in their career (Bieleń & Kubiczek, 2020; Deloitte, 2025; Silva et al., 2024). The changing expectations indicate that the central compelling factor for employee loyalty among Generation Z is driven less by material rewards and more by intangible organisational and psychological resources that enable employees to flourish, rather than by mere employee retention. Intangible resources are unique in nature and become inimitable, leading to a gained competitive advantage (Barney, 1991).

By understanding the factors that affect employees' willingness to stay with the current organisation, employers can better assess workforce needs and foster a work environment that values individual qualities while ensuring job security (Schroth, 2019). Limited research has explored employee loyalty from the perspective of virtuousness (Chand et al., 2026). No doubt, most scholarly work focuses on employee engagement; there is a gap in the academic literature examining the combined effect of virtuousness and work-life balance on employee loyalty among Generation Z, particularly in the knowledge-intensive service industries. Based on this, the proposed research question is:

RQ1: *How do intangible job resources make an impact on loyalty of Generation Z employees in the knowledge-intensive service industries?*

To answer RQ1, this study explores the direct effects of organisational virtuousness and work-life balance on employee loyalty and psychological capital. Prior research has already demonstrated that organisations promoting virtuousness exhibit positive employee outcomes such as engagement, extra-role behaviour, increased job satisfaction and improved psychological state (David et al., 2024; Gogia et al., 2024; Ho et al., 2023). Similarly, work-life balance has shown its positive linkages with employee attitudes such as satisfaction, commitment, improved performance and mental health (Rahman et al., 2025; Wongprasurt & Lee, 2024; Zhang et al., 2024).

Although previous research has found that job resources can boost engagement and loyalty, this work suggests that the importance of internal psychological resources can facilitate a resource gain spiral that increases employee resiliency, optimism and

engagement (Glavanits et al., 2025; Hobfoll, 1989). The mediating mechanism is particularly relevant for Generation Z as they view their experiences at work as the process of developing their intrinsic personal resources, and the internalisation of organisational resources is a significant factor in loyalty. The purpose of this research is to determine other mediators between job resources and employee loyalty. The second research question is:

RQ2: *Do intangible psychological resources, such as psychological capital, act as a bridge between intangible job resources and employee loyalty among Gen Z?*

To address this, RQ2 asks whether psychological capital mediates the relationship between workplace resources and employee loyalty. Supportive organisations that provide an environment of transparency, open communication, trustworthy leadership, work-life balance, and flexibility foster employees' internal psychological state, which is necessary to deal with the stress that job demands create. Psychological capital, therefore, becomes essential in translating the effect of organisational resources to employee loyalty. The following literature review presents the theoretical arguments that underlie these relations and the hypotheses of the study.

Literature Review and Hypothesis Development

Organisational Virtuousness (OV), Employee Loyalty (EL), and Psychological Capital (PC)

OV, a component of positive organisational scholarship (positive psychology), is defined as the shared endorsement of moral values such as optimism, compassion, trust, forgiveness, and integrity (Cameron et al., 2004; Kalinowska-Andrian, 2006). OV can be disseminated through the virtuous behaviour of the leader, positively influencing employee commitment and loyalty (Singh et al., 2024). A virtuous organisation makes employees feel connected towards work, increasing their tendency to exhibit loyalty (Aboobaker et al., 2022; Gogia et al., 2024). Based on the above studies, the following hypothesis can be proposed:

H1a: *OV has a positive impact on EL.*

A study has shown that perceptions of OV boost employees' psychological capital (Aubouin-Bonnaventure et al., 2023). One such study reported that a 1-unit increase in OV is associated with a 0.249-unit increase in psychological capital (Dubey et al., 2020). Psychological capital, a construct of positive organisational behaviour, is a positive developmental state characterised by hope, efficacy, resilience, and optimism. Organisational optimism fosters a positive work environment and culture, encouraging the development of individual optimism, a core construct of PC. Similarly, integrity in organisations fosters employee trust by demonstrating consistency between organisational values and actions, nurturing employees' hope of fulfilling personal and professional goals. Therefore,

OV instils resilience and agility among employees, which are necessary for survival in today's environment (Panda & Singh, 2026). Based on these studies, the following hypothesis can be developed:

H1b: *OV has a positive impact on PC.*

Work-Life Balance (WLB), Employee Loyalty (EL), and Psychological Capital (PC)

Managing work with personal responsibilities to reduce conflict and satisfy one's own needs is termed work-life balance (Hayman, 2005). Generation Z pays significant attention to maintaining a balance between their professional and private life (Wójcik & Łukasiński, 2024). This generation uses flexible working hours to manage this balance (Łukasiński & Romański, 2025). One such study conducted among start-up employees in India found that promoting flexible work policies increases employee commitment (Rahman et al., 2025). Despite work on WLB, few studies have examined its psychological mechanisms and long-term outcomes. Therefore, the proposed hypothesis is:

H2a: *WLB has a positive impact on EL.*

A study demonstrated that WLB acts as a mediator, showing a positive relationship between PC and job attitudes (Parray et al., 2022). Studies also mention the role of WLB in enhancing PC and job satisfaction, by allowing employees to fulfil both professional and personal responsibilities, thereby improving their mental health by reducing stress and emotional exhaustion (Samroodh et al., 2023; Zhang et al., 2024). Employees with higher PC perform better at work and enjoy a healthy work-life balance. Therefore, it is hypothesised that:

H2b: *WLB has a positive impact on PC.*

Psychological Capital (PC) and Employee Loyalty (EL)

Employees with strong PC skills are positively associated with career commitment and employee engagement (Singh et al., 2023). Enhancement of PC fosters employees to engage in extra-role behaviour,

which can further impact their loyalty (Dai et al., 2022). Facilitating job resources helps build positive emotions among employees, leading to increased trust and reduced negative effects of undesirable outcomes. Hence, it is assumed that enhancing psychological capital can increase employee loyalty. So, the following hypothesis is proposed:

H3: *PC is positively related to EL.*

Psychological Capital as a Mediator (PC)

A mediation is said to exist if the relationships between the input variable and the mediator, and between the mediator and the endogenous variable, are significant (Miles & Shevlin, 2001). Conservation of Resources theory posits that while employees strive to maintain their personal resources, the work environment can enhance or hinder them, creating a spiral (Arshad et al., 2025; Aubouin-Bonnaventure et al., 2023). A study found that PC served as a mediator in the relationship between OV and job satisfaction (Zaheer et al., 2022). Another study mentioned its mediating role between authentic leadership and thriving (Shahid & Muchiri, 2019). Organisational support and job autonomy show a positive association with employees' intention to stay (Samroodh et al., 2023).

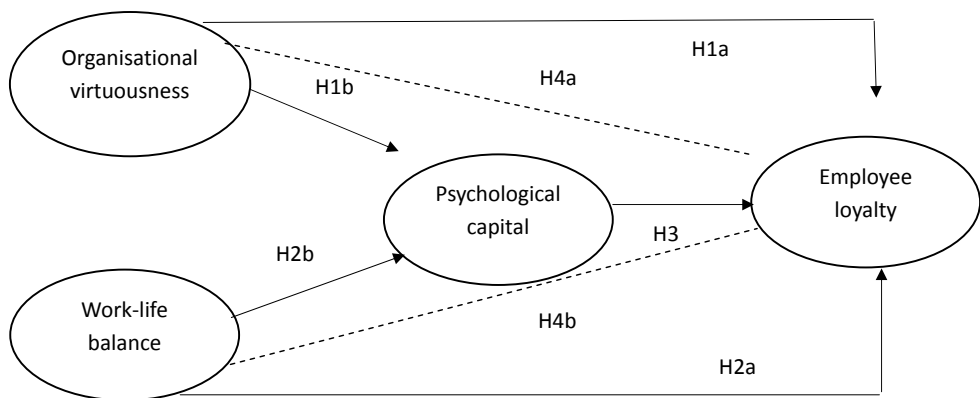
Organisations that provide employees with policies for maintaining WLB help build psychological resources, which, in turn, encourages improved mental health (Zhang et al., 2024). A study revealed that WLB and job satisfaction positively impact EL among Gen Z in Jakarta (Olii et al., 2024). Future research could investigate whether PC is predictive of employee behaviours when physical, emotional and job insecurities are high (Chen et al., 2018). Based on the above studies, it is hypothesised:

H4a: *PC mediates the relationship between OV and EL.*

H4b: *PC mediates the relationship between WLB and EL.*

The model's theoretical framework is presented in Figure 1.

Figure 1
Conceptual Model



Methodology

Data Collection Phase

Data were collected through a structured questionnaire distributed to 1,020 Gen Z employees working in the knowledge-intensive service industries. Informed consent was obtained from the respondents prior to data collection. Ethical considerations, including confidentiality, informed consent, anonymity, and voluntary participation, were strictly maintained in this study, in accordance with the Institutional Ethical Clearance Certificate (NITJ/DRC/1924). A 5-point Likert scale with 29 indicators was used to measure the four study variables. Following a pilot test with 60 respondents, minor wording revisions were made for clarity and reliability. Data collection was conducted between November 2025 and March 2026. After removing outliers and unengaged responses, 493 valid responses were retained (response rate: 48.33%). Non-response bias was assessed using an independent-samples t-test comparing the first and last 50 responses, which revealed no significant differences. Ethical standards of

confidentiality, anonymity, and institutional approval were maintained throughout the study.

Measurement Scale

The scales were adapted from the previous literature. The original scales consisted of a large number of items; a reduced set was adopted while retaining the original meaning of the construct. Negatively worded items were reverse-coded prior to analysis to ensure consistent interpretation. Principal component analysis with varimax rotation was employed to refine the indicators. The KMO (Kaiser-Meyer-Olkin) value of 0.958 exhibited excellent sample adequacy. Bartlett’s test of sphericity was significant, indicating the suitability for factor analysis. Table 1 provides an overview of the variables included in the model, along with their items adapted from sources.

The demographic profile of the respondents, including their gender, years of experience, and mode of working, is mentioned in Table 2. The sample was taken from private-sector organisations (84.58%), with the largest percentage of participants employed in

Table 1
Overview of Variables

Variable code	Variable name	Adapted from
OV	Organisational virtuousness	Cameron et al. (2004)
WLB	Work-life balance	Hayman (2005)
PC	Psychological capital	Luthans et al. (2007)
EL	Employee loyalty	Dutta and Dhir (2025)

Table 2
Respondents' Demographic Profile (N = 493)

Categorical constructs	Categories	Frequency	(%)
Gender	Male	282	57.21
	Female	211	42.80
Sector	Public	76	15.41
	Private	417	84.58
Type of Service Industry	Infrastructure Engineering	45	9.13
	IT	181	36.71
	Education	97	19.67
	Banking and Financial Services	125	25.35
	Consulting	45	9.13
Years of Experience	Less than 1 year	72	14.60
	1–3 years	286	58.01
	More than 3 years	135	27.38
Organisation Nationality	Indian	412	83.57
	MNC	81	16.43
Mode of Working	Offline	286	58.01
	Hybrid	125	25.35
	Remote	82	16.63

the IT (36.71%), and Banking and Financial Services (25.35%), followed by education, consulting and infrastructure engineering. Infrastructure engineering sector participants were considered because of their employment in project management, engineering consultancy work and technical service provision that specifically provided knowledge-intensive professional services rather than merely dealing in construction or manufacturing activities. Most participants were in their early-career stage and had work experience of between one and three years (58.01%). The findings should be interpreted specifically, in the context of early-career Generation Z employees working in knowledge-intensive and professional service industries. While responses from multiple industries were collected, differences across service industries may correspond to varied perceptions of workplace resources.

Common Method Bias (CMB)

Harman’s single-factor test was used to assess CMB. The results suggested that, among all factors, the largest single factor accounted for 41.56% of the difference, which was below the threshold of 50% (Podsakoff et al., 2003). Additionally, the marker variable approach was applied, confirming that CMB did not pose a significant concern for this study.

Data Analysis

PLS-SEM was employed due to its robustness, flexibility, predictive accuracy, and suitability for

exploratory research without strict assumptions about data distribution (Hair et al., 2019). As this study is among the first to examine the relationships between OV, PC, WLB, and EL among Gen Z, PLS-SEM was considered appropriate. The analysis was conducted in two stages: assessment of the measurement model for reliability and validity, followed by evaluation of the structural model to test relationships among variables.

Results

Measurement Model

Preliminary analysis assessed reliability, validity, multicollinearity, and common-method bias (Table 3). Cronbach’s alpha and composite reliability values exceeded 0.70, confirming internal consistency (Hair et al., 2019). Skewness, kurtosis, and VIF values were within acceptable limits, indicating normality and absence of multicollinearity. All outer loadings exceeded 0.708, supporting construct validity (Hair et al., 2017). Convergent validity was established by AVEs exceeding 0.50 and CRs exceeding 0.70. Discriminant validity, as shown in Table 4, was confirmed through HTMT values below 0.85 (Henseler et al., 2015). Also, the square roots of the AVEs for each construct were greater than their correlations with any other construct, providing support for discriminant validity (Fornell & Larcker, 1981).

Table 3
Convergent Validity and Reliability

Construct	Items and code	Outer loadings	AVE	Cronbach Alpha	CR
Organisational Virtuousness	A sense of purpose in work is important for individuals and the organisation (OV1)	.786	.669	.929	.942
	Optimism in organisational communication is important for overall welfare (OV2)	.832			
	Courtesy and consideration need to be an essential part of the work ecosystem (OV3)	.836			
	The organisation must emphasise care and mutual support for new or struggling employees (OV4)	.826			
	I work in an organisation that promotes social harmony through inclusiveness and mutual respect (OV5)	.815			
	The well-being of individuals in an organisation is maintained through trustworthy leadership and mutual trust among followers (OV6)	.819			
	Integrity needs to be present at all levels from top to bottom (OV7)	.802			
	It is important to embrace failures and acknowledge mistakes (OV8)	.825			
Work-life balance	I feel psychologically detached from work (WLB1)	.827	.653	.911	.929
	I can focus on my personal needs despite work schedules (WLB2)	.790			
	I am able to balance between work and non-work activities (WLB3)	.809			
	My energy at work does not get drained due to personal life responsibilities (WLB4)	.814			
	I feel energetic at work (WLB5)	.816			
	This job gives me energy to pursue personal activities (WLB6)	.788			
	I’m in a better mood at work because of my personal life (WLB7)	.811			

Construct	Items and code	Outer loadings	AVE	Cronbach Alpha	CR
Psychological capital	I hope that my efforts will lead to the achievement of my goals and aspirations (PC1)	.765	.629	.916	.931
	I hope that the organisation's management will continue to trust and support me in taking new initiatives (PC2)	.791			
	I am confident that I can achieve more and strive for high benchmarks with respect to my work (PC3)	.850			
	I am confident that I will be able to turn emerging challenges into value-added opportunities (PC4)	.764			
	I understand that I possess enough dynamism that I can quickly recover from setbacks (PC5)	.784			
	I dare to embrace failures (PC6)	.848			
	I am optimistic about my bright future at the workplace (PC7)	.773			
	I am optimistic about turning my dreams into reality at my workplace (PC8)	.765			
Employee loyalty	This firm is my first choice (EL1)	.756	.598	.866	.899
	I will continue to stay in this firm, even if I get better package offers from other competitors (EL2)	.797			
	I voluntarily recommend this firm to others (EL3)	.791			
	I look forward to another day at work (EL4)	.778			
	I do not feel the need to remain in touch with consultants for better work opportunities (EL5)	.762			
	If I could choose again, I could choose to work for the current organisation (EL6)	.755			

Note. CR – composite reliability, AVE – average variance extracted.

Table 4
Discriminant Validity

Fornell-Larcker Criterion	EL	OV	PC	WLB
EL	.773			
OV	.441	.818		
PC	.541	.653	.793	
WLB	.428	.569	.665	.808
HTMT Ratio Criterion				
EL				
OV	.490			
PC	.604	.706		
WLB	.478	.618	.725	

Note. EL – employee loyalty, OV – organisational virtuousness, PC – psychological capital, WLB – work-life balance.

Structural Model Analysis

After assessing the measurement model, bias-corrected bootstrapping (10,000 subsamples, two-tailed) was performed to evaluate the structural model (Hair et al., 2019). The results for path coefficients, f^2 , SRMR, and NFI are presented in Table 5. SRMR (Standardised root mean square values) values below 0.08 and an NFI (Normed Fit Index) of 0.910 indicated good model fit. Effect sizes ranged from small to medium, with WLB showing the strongest effect on PC ($f^2 = 0.285$), followed by OV on PC ($f^2 = 0.249$), highlighting PC as a key mechanism linking OV and WLB to EL.

Direct Effects

The results support H1a, indicating a positive relationship between OV and EL ($\beta = 0.132$, $p < .05$), and H1b, showing a significant positive effect of OV on PC ($\beta = 0.406$, $p < .001$). WLB also demonstrated a significant positive effect on PC, supporting H2b ($\beta = 0.434$, $p < .001$). However, the relationship between WLB and EL was positive but non-significant ($\beta = 0.090$, $p > .05$); therefore, H2a was not supported, suggesting that WLB alone may not directly improve employee loyalty. Furthermore, PC had a significant positive effect on EL ($\beta = 0.395$, $p < .001$), supporting H3a.

Table 5
Structural Model Evaluation

Relationships	Std. beta	SE	T-value	p-values	BC 95% CI	f ²	Decision
H1a: OV-EL	0.132	0.045	2.918	.004	[0.044, 0.223]	0.014	Yes
H1b: OV-PC	0.406	0.040	10.159	.000	[0.325, 0.481]	0.249	Yes
H2a: WLB-EL	0.090	0.049	1.840 ^{ns}	.066	[-0.003, 0.188]	0.006	No
H2b: WLB-PC	0.434	0.037	11.725	.000	[0.361, 0.506]	0.285	Yes
H3a: PC-EL	0.395	0.054	7.254	.000	[0.288, 0.501]	0.101	Yes
Model fit indices		Saturated model	Estimated model				
SRMR		0.040	0.040				
NFI		0.910	0.910				

Note. SE – standard error, f² – effect size, ns – non-significant, OV – organisational virtuousness, WLB – work-life balance, EL – employee loyalty, PC – psychological capital, BC 95% CI – bias-corrected confidence intervals at 95% significance level, SRMR BC 95% CI – bias-corrected confidence intervals at 95% significance level standardized root mean square values, NFI – normed fit index.

The model demonstrated satisfactory explanatory power (R²), with organisational virtuousness and work-life balance explaining 55.3% of the variance in psychological capital and predictor variables explaining 31% of the variance in employee loyalty, as shown in Table 6. Positive Q² values further con-

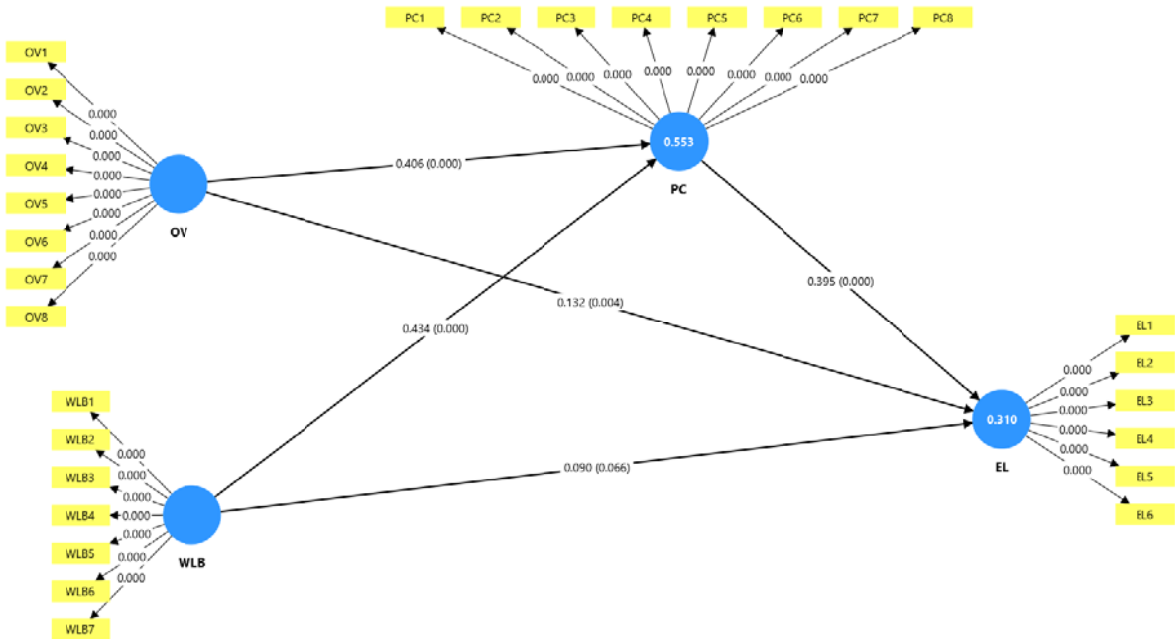
firmed predictive relevance, with high predictive relevance for psychological capital (Q² = 0.546) and moderate predictive relevance for employee loyalty (Q² = 0.233). The findings of the structural model are presented in Figure 2.

Table 6
Computing the Explained Variance

Construct	R ²	R ² adjusted	Q ²
PC	.553	.551	0.546
EL	.310	.306	0.233

Note. R square – explained variance, Q square – predictive relevance, EL– employee loyalty, PC – psychological capital.

Figure 2
Structural Model Results



Note. OV – organisational virtuousness, WLB – work-life balance, PC – psychological capital, EL– employee loyalty.

Mediation Analysis

Table 7 presents the direct, specific, indirect and total effects of OV and WLB on EL through the mediating role of PC. The results reveal that OV strongly impacts EL through PC (H4a: $\beta = 0.160$; $t = 5.816$; CI [0.109;0.216]; $p < .001$), highlighting the important role of psychological capital in translating virtuous organisational practices into employee loyalty, supporting H4a. This is evidenced by their variance accounted for (VAF) values ranging from 40% to 57%, indicating the crucial role of PC as a mediator.

Table 7
Reporting Mediation Analysis

Type of effect	Relation	Path coefficient	T stats	BC 95% CI	Remark
Total effect	OV-EL	0.292	6.761***	[0.205, 0.375]	Significant total effect
	WLB-EL	0.261	5.652***	[0.169, 0.350]	
Indirect effect	H4a: OV-PC-EL	0.160	5.816***	[0.109, 0.216]	Significant indirect effect
	H4b: WLB-PC-EL	0.171	5.937***	[0.119, 0.232]	
Direct effect	OV-EL	0.132	2.918**	[0.044, 0.223]	Significant DE Insignificant DE
	WLB-EL	0.090	1.840 ^{ns}	[-0.003, 0.188]	
VAF	IE/TE H4a: OV-PC-EL H4b: WLB-PC-EL	54.79% 65.51%			
Conclusion	PC partially mediates the relationship between OV and EL, but fully mediates the relationship between WLB and EL.				

Note. OV – organisational virtuousness, WLB – work-life balance, EL – employee loyalty, PC – psychological capital, *** $p < .001$, ** $p < .01$, * $p < .05$, ns – non-significant, DE – direct effect.

In contrast, PC fully mediates the relationship between WLB and EL (H4b: $\beta = 0.171$; $t = 5.937$; CI [0.119;0.232]; $p < .001$). Although the VAF value falls within the conventional range of 66% associated with partial mediation, the direct effect was non-significant while the indirect effect was significant. This pattern indicates a full (indirect-only) mediation, following the guidelines of Zhao et al. (2010).

Discussion

The study aims to examine the roles of intangible organisational and psychological job resources (organisational virtuousness, work-life balance, psychological capital) in enhancing employee loyalty. The study shows that organisational virtuousness and psychological capital have a significant, positive effect, whereas work-life balance has a positive but moderate association with EL among Gen Z employees in the knowledge-intensive service industries in India. Organisations that promote virtuousness can retain a more loyal workforce during crises (Gogia et al., 2024). Likewise, certain OV indicators such as care, support and inclusiveness could be conceptually similar to organisational support. However, organisational virtuousness is a more encompassing, values- and ethics-based organisational climate, rather than just perceived support (Cameron et al., 2004). Although moderate correlations among these

constructs are theoretically plausible, they represent different individual and organisation-based constructs. Also, leaders who exhibit virtuous behaviours inspire employees to exhibit loyalty and spread positive word of mouth (Shahid & Muchiri, 2019; Singh et al., 2024). For Gen Z, WLB moderately affects employee loyalty ($p = .066$), but millennials experience greater job satisfaction and loyalty than this cohort (Krishna & Agrawal, 2025).

However, when mediated by PC, the link between WLB and EL becomes significant ($p = .000$),

demonstrating that WLB contributes to employee loyalty through PC. These results corroborate a study that demonstrated that work-life balance might not be the sole factor driving employee loyalty (Rahman et al., 2025). In contrast, the association of psychological capital is the highest, implying that personal resources yield positive outcomes and reduce employees' intent to quit (Deloitte, 2025; Francis & Hoefel, 2018). The indirect effects of both OV and WLB via PC are strong and significant, suggesting that PC is a strong augmenting factor. The findings confirm that a better work-life balance boosts job satisfaction and PC among employees, thereby improving the mental health of employees (Zhang et al., 2024). The present study also demonstrates that the mediation and intervention of personal resources facilitate the outcomes of job resources.

Although the HTMT value between PC and WLB (0.725) was the highest, it was still below the proposed threshold of 0.85, indicating a good degree of discriminant validity (Henseler et al., 2015). Theoretically, there is some overlap, as better psychological resources are likely to be associated with better work-life balance. However, the constructs are still separated conceptually. Work-life balance indicates perceptions of balance between work and personal life, while psychological capital is a state of positive psychology that is defined by hope, efficacy, resilience and optimism.

In addition to statistical significance, the effect size analysis provides a deeper understanding of the proposed relationships. The direct impact of OV and WLB on employee loyalty was small, but both constructs demonstrated a comparatively strong impact on PC. This pattern indicates that employees' psychological capital helps in translating the effects of organisational resources, serving as a mediator.

The model has a moderate level of explanatory power in behavioural research, accounting for about 31% of the variance in employee loyalty, but almost two-thirds of the variance remains unexplained. This indicates that employee loyalty, being a complex behavioural construct, is influenced by other factors such as leadership style, organisational commitment, compensation, career development opportunities, organisational justice, and employee experience; therefore, these should be explored in further studies. While tangible workplace resources, such as salary and rewards, provide a baseline for employees to survive, intangible workplace resources enable them to thrive by fostering the development of internal personal resources, such as psychological capital. Owing to their unique and inimitable nature, these resources play a significant role in strengthening employee loyalty.

Implications

Theoretical Implications

The study extends the positive psychology literature by combining the elements of positive organisational behaviour (PC) and positive organisational scholarship (OV) and empirically demonstrating that PC serves as a key catalyst through which OV and WLB correspond to employee loyalty among Gen Z. The study refines Conservation of Resources theory by showing that not all organisational resources work in the same manner. Organisational virtuousness had a direct impact on employee loyalty ($\beta = 0.132$) and an indirect impact on psychological capital ($\beta = 0.160$), suggesting that organisations promoting virtuous climates act as a catalyst for developing employee's psychological personal resources.

While WLB did not show a direct association with employee loyalty ($\beta = 0.090$; $p > .05$), it demonstrated an indirect relationship through PC ($\beta = 0.171$). This asymmetry indicates different organisational resources elicit different resource gain processes. This indirect-only mediation indicates that WLB contributes to employee loyalty primarily through PC. The results refine the Conservation of Resources theory by demonstrating that some resources facilitate employee loyalty through direct/indirect pathways, whereas some translate their effect through internal resources.

Furthermore, the path coefficients from OV ($\beta = 0.406$) and WLB ($\beta = 0.434$) to PC, as compared with their direct relationships with employee loyalty, highlight PC as a key resource in the Conservation of Resources theory. The results mention the impor-

tance of personal resources through which supportive organisational practices correspond to positive attitudes among Gen Z employees.

The effect size estimates add to the theoretical interpretation of findings. OV had a moderate direct influence on employee loyalty, but exerted a higher direct impact on PC, indicating that the main impact of OV is the development of employees' PC. Similarly, WLB demonstrated a strong impact on employee loyalty via PC, supporting the proposition that personal resources are important bridges connecting organisational resources to employee outcomes.

Managerial Implications

The study findings suggest that not all workplace resources influence employee loyalty in the same manner. OV shows a direct and an indirect relationship with employee loyalty, indicating that organisations fostering virtuousness through moral correctness, human welfare, supportive leadership, and inclusiveness can strengthen employee loyalty even beyond psychological capital. Consequently, it is the duty of managers and leaders to create a workplace environment where employees feel respected, safe and supported.

In contrast, WLB did not demonstrate a significant direct relationship with employee loyalty but had an indirect association through psychological capital. The findings reveal that flexible arrangements and work-life balance programmes alone may be insufficient to sustain Gen Z employees unless they are supported by fostering employees' psychological capital. Organisations, therefore, must enhance flexible working and employ the right interventions to develop optimism, resilience, confidence and hope through coaching, mentoring, strengths-based leadership and developmental feedback. Such an integrated method is likely to yield more effective results than providing WLB in isolation.

Limitations and Conclusion

Workplace resources result in engagement among Gen Z, but they only work when designed to address Gen Z's personal needs for meaning, mental health, and work-life balance. They require a relational connection to stay truly engaged, where they feel their individual growth is supported and personal contributions are valued. This study is limited to the Generation Z workforce, but it acknowledges the broader discussion on generational cohort research. Variations between generations have been suggested to be partly due to age, career stage or larger socio-economic factors, instead of generational features. The findings, therefore, should be interpreted as specific to this sample of Generation Z employees, rather than implying homogeneous characteristics across the entire generation. Future research could involve an intergenerational comparison to better understand these differences. The involvement of HR managers can further facilitate this process. Demographic data on gender, mode of working, industry

type and public/private sector were gathered, but not included in inferential analysis. The sample was concentrated mainly in the IT and banking and financial services sectors, thereby limiting its applicability to knowledge-intensive service organisations rather than other service sectors like healthcare, tourism, hospitality, etc. Further research may explore their direct, moderating or comparative effects to provide a richer understanding of the proposed relationships in a variety of organisational and workforce settings. Future researchers can use qualitative methods to complement quantitative results.

Conflict of Interest: The authors declare that they have no known competing financial interests or personal relationships that could influence the work reported in this paper.

Ethical Approval: This study has been conducted in accordance with the guidelines and ethical research principles laid down by the Institutional Ethical Research Advisory Committee, ensuring confidentiality, anonymity, and voluntary participation (NITJ/DRC/1924).

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AI Transformation in Polish Organisations: The Gap Between Individual Adoption and Organisational Maturity

Abstract

This article diagnoses the state of AI transformation in Polish organisations and explores whether leader education is associated with organisational readiness. The study employs an exploratory, mixed-methods design based on data source triangulation: a survey of 179 leaders, a qualitative analysis of 539 AI projects, and a descriptive contrast between graduates of an AI leadership programme ($n = 102$) and a market comparison group ($n = 66$); the remaining 11 respondents, programme graduates, are included only in aggregate analyses. The results indicate a pronounced gap between individual AI adoption (83% of leaders use AI daily) and organisational maturity (roughly 70% of organisations have not progressed beyond pilots). The study offers three contributions: (1) the Awareness Paradox, whereby leaders with higher competencies evaluate their organisations more critically despite reporting stronger, albeit self-reported, implementation indicators; (2) exploratory evidence of patterns consistent with a cascading effect of leader education; and (3) an inverted build-versus-buy pattern, in which internal builds achieve markedly higher PoC effectiveness than purchased SaaS. Barriers prove primarily organisational rather than technological; change management, the only dimension in which the two groups do not differ, emerges as a systemic barrier requiring whole-organisation intervention.

Keywords: artificial intelligence, AI transformation, organisational maturity, AI readiness, leader education, Shadow AI, change management, Polish enterprises

Introduction

Artificial intelligence (AI) has become one of the defining catalysts of digital transformation. Enterprise spending on generative AI surged from \$1.7 billion in 2023 to \$37 billion in 2025 (Tully et al., 2025), yet only about 5% of companies globally generate substantial value from AI at scale, while 60% fail to achieve measurable returns (Apotheker et al., 2025). This split between escalating expenditure and modest outcomes raises fundamental questions about the systemic causes of AI transformation failures.

In Poland, AI transformation is entering a decisive phase. KPMG (2025a) data indicate that the share of Polish enterprises declaring some degree of AI implementation surged from 28% to 82% within a single year. Concurrently, EY (2025) reports that over 70% of Polish companies are taking steps to comply with the EU AI Act, though only 31% have actually begun implementation. Poland is among the most mature AI markets in Central and Eastern Europe (KPMG, 2025c), yet, as our data show, roughly 70% of organisations have not progressed beyond pilots and experiments.

The literature increasingly identifies a ‘widening AI value gap’ (Apotheker et al., 2025) and a ‘valley of death’ between the proof-of-concept (PoC) stage and production deployment (Deloitte, 2026): McKinsey (2025) reports that 88% of global respondents use AI, but only 6% qualify as ‘high-performing AI organisations.’ In parallel, Shadow AI – the unauthorised use of AI tools by employees – has emerged as a critical governance challenge (Cisco, 2025; KPMG, 2025b), reflecting deeper deficits in governance frameworks, change management capabilities, and leadership competencies.

Research Problem

Although individual adoption of AI tools among Polish leaders is near-universal, most Polish organisations cannot convert this momentum into systemic, production-scale deployments – and it is unclear which organisational mechanisms (strategy, ownership, competencies, change management) account for this gap, or whether educating leaders can help close it. Theoretically, maturity and readiness models developed for mature Western markets (Holmström, 2022; Jöhnk et al., 2021) have rarely been examined in a market combining very low SME-level adoption (OECD, 2025b) with very high individual-level adoption. Empirically, Polish studies linking leader education to organisational readiness remain scarce. Practically, organisations entering the EU AI Act enforcement period need evidence on where transformation stalls and which interventions are worth investing in.

The aim of the study is therefore to diagnose the state of AI transformation in Polish organisations and to explore the relationship between leader education and organisational readiness. Three research questions are addressed: (1) What is the current level of AI maturity in Polish organisations, and what are the primary barriers to transformation? (2) Is leader education associated with organisational readiness for AI transformation, and if so, through what mechanisms? (3) What patterns of success and failure can be identified in the transition from PoC to production deployment?

The article makes three original contributions: it presents one of the broadest empirical studies of AI transformation in Poland, integrating organisational, market, and project-level perspectives; it introduces the concept of the ‘Awareness Paradox,’ whereby leaders with higher competencies evaluate their organisations more critically despite reporting stronger, albeit self-reported, implementation outcomes; and it provides exploratory evidence of patterns consistent with a cascading effect of leader education.

Theoretical Background and Related Work

This section distinguishes the constructs of AI maturity and AI readiness, then reviews related work on maturity models, adoption barriers, Shadow AI, and leadership. Because peer-reviewed evidence lags practice in this fast-moving field, the conceptual framework is anchored in the academic literature, while industry reports are used strictly as sources of current market evidence.

AI Maturity and AI Readiness

Although often used interchangeably, the two constructs differ in temporal orientation. Maturity derives from the capability maturity tradition (Becker et al., 2009): it describes the current, evolutionarily achieved state of capabilities – retrospective and descriptive. Readiness is prospective: an organisation’s capacity to undertake a specific change (Weiner, 2009)

– the degree to which resources, structures, data, and attitudes enable effective adoption (Holmström, 2022; Jöhnk et al., 2021; Uren & Edwards, 2023). An organisation may thus be ready but immature, or display pockets of maturity without the readiness to progress – running advanced pilots while lacking the strategy, ownership, and change capacity needed for production deployment.

In this study, maturity is operationalised as an organisation’s position on a five-stage model and on an implementation-quality ladder (see Methodology), whereas readiness is operationalised through the presence of organisational preconditions: a formal AI strategy, a designated transformation owner, employee access to AI training, and governance policies. This distinction structures the entire analysis: the study’s central finding is precisely a readiness deficit underlying a maturity plateau.

Organisational AI Maturity

Organisational AI maturity models have evolved from stage-gate models to multidimensional frameworks encompassing strategy, data, talent, technology, and culture (Becker et al., 2009; Mikalef & Gupta, 2021). Enholm et al. (2022) show that value realisation depends on a chain of organisational enablers rather than the technology itself; Mikalef and Gupta (2021) link AI capability – tangible, human, and intangible resources – to creativity and performance. Sawang and Sornlertlamvanich (2026) propose an SME-grounded framework of eight dimensions and five levels, underscoring that AI maturity is nonlinear.

Market evidence confirms the discriminating power of maturity: 45% of high-maturity organisations keep AI projects operational for at least three years, versus 20% of low-maturity ones (Gartner, 2025); Apotheker et al. (2025) identified 5% ‘future-built’ firms, 35% scaling, and 60% failing to achieve measurable returns; Deloitte (2026) reports that only one-third of organisations use AI for deep transformation; and KPMG (2026) finds that technology ROI rises with maturity (200% on average, 450% among the most mature).

Individual Versus Organisational Adoption

The gap between individual and organisational adoption has clear theoretical anchors. At the individual level, technology acceptance research (Venkatesh et al., 2003) explains adoption through performance expectancy, effort expectancy, and social influence – dimensions on which generative AI assistants score exceptionally well. At the organisational level, the technology-organisation-environment framework (Tornatzky & Fleischer, 1990) makes adoption dependent on readiness factors such as top management support, resources, and absorptive capacity. When individual drivers race ahead of organisational enablers, theory predicts precisely the configuration documented here: mass bottom-up usage, organisational stagnation, and unsanctioned use (Shadow AI) as a coping mechanism (Dwivedi et al., 2021; Raisch & Krakowski, 2021).

Barriers to AI Transformation

Research on adoption barriers highlights the dominance of organisational factors. Jöhnk et al. (2021) identify strategic alignment, resources, knowledge, culture, and data as the five categories of readiness factors – none primarily technological. Uren and Edwards (2023) show that AI journeys stall at predictable points related to people and process readiness, and Davenport and Ronanki (2018) argue that successful adopters take an incremental, capability-building approach rather than a technology-first ‘moon shot’ approach.

Market evidence is consistent: McKinsey (2025) reports that 46% of leaders cite skill gaps as a major barrier and only about one-third of organisations have scaled AI; Deloitte (2026) identifies the skills gap as the single largest barrier. The OECD (2025a) argues that training supply is insufficient and that management, business-process, and social skills are the most in-demand competencies for high-AI-exposure occupations. In Poland, only 4.9% of SMEs utilised AI in 2024, against an EU-27 average of 12.6% (OECD, 2025b); yet over 70% of employees state that their organisations use AI tools, while only 30% report formal governance policies (KPMG, 2025c). This suggests a dual-track pattern – mass individual adoption, fragmented organisational adoption – precisely the gap this study investigates.

Shadow AI as a Governance Challenge

Shadow AI – employees’ use of AI tools without official authorisation – has become one of the most pressing governance challenges of 2025–2026: 60% of IT teams lack confidence in their ability to identify unapproved AI tools (Cisco, 2025), and 45% of leaders confirmed or suspected sensitive data leaks tied to unauthorised third-party AI tools (KPMG, 2025b). The issue is urgent under the EU AI Act, whose key provisions on high-risk systems came into force in 2026. Yet prohibitive approaches appear counterproductive: Deloitte (2026) reports that enterprise-approved AI access expanded from under 40% to nearly 60% of workers, indicating that organisations increasingly formalise access rather than restrict it. Shadow AI thus appears to be a symptom of inadequate official solutions, not of employee ill will – a hypothesis this study’s findings support.

The Role of Leader Competencies in AI Transformation

Academic and market literature converge on the critical role of leadership. Fountaine et al. (2019) argue that building an AI-powered organisation is primarily a matter of culture, structure, and ways of working, with leadership commitment as the decisive enabler; Kotter (2012) places leadership coalition-building at the centre of successful change; Weiner (2009) emphasises that readiness for change is a collective property irreducible to individual attitudes. Bedard and Beauchene (2026) estimate that only 10% of AI value derives from algorithms and 20% from technology

– 70% depends on people, organisation, and culture. Leader education may therefore produce a multiplier effect, with a single trained decision-maker initiating changes across multiple organisational levels; Polish empirical studies examining this hypothesis remain scarce – a gap this article addresses.

Methodology

Research Design

The study adopts an exploratory, descriptive, mixed-methods design based on data source triangulation, combining three sources: (1) a structured survey of graduates of an AI leadership programme, (2) a structured survey of a market comparison group, and (3) a qualitative analysis of 539 AI projects. Triangulation mitigates the limitations inherent in any single data source.

Given the non-probability character of the sample, the design is explicitly not quasi-experimental. The graduate-Market contrast is treated as an exploratory, descriptive comparison of two structurally different populations and interpreted as a source of hypotheses, not evidence of causal effects. No inferential tests are applied, no statistical significance is claimed, and all reported percentages and means are descriptive.

Sampling Procedure and Recruitment

The study employed non-probability sampling: a convenience sample with purposive elements, targeting leaders involved in, or responsible for, AI-related decisions in Polish organisations. Respondents were recruited through two channels. The first group comprised graduates of the AI Managers programme (Editions 1 and 2), an intensive programme for senior management covering AI strategy, maturity frameworks, project canvases, and case studies; 102 completed the survey. The second group comprised participants of the AI Managers Conference 2026; 77 completed the survey, of whom 66 had not participated in the programme and constitute the market comparison group (‘Market’). In total, the survey covered 179 respondents ($N = 179$); the remaining 11 conference respondents had completed the programme and are included in the combined sample but not in the two-group contrast (102 vs. 66). The unit of analysis is the individual leader reporting on his or her organisation; because responses were anonymous, it cannot be ruled out that more than one respondent described the same organisation. The third source – 539 AI projects developed by participants during the programme – comprised practical implementation concepts for participants’ own organisations; one participant could submit more than one project, so the number of distinct participants and organisations is lower than the number of projects.

Participation was voluntary, unpaid, and anonymous (online questionnaire). Because membership in both groups results from self-selection (enrolment in a paid programme; conference attendance), the sample over-represents organisations already engaged with

AI; the implications are discussed in the Limitations section.

The sample reflected a decision-maker population: 78% held managerial positions or above (82% of graduates, 72% of the Market group), and 62% had real influence over AI decisions. The largest industries were IT/technology (31%), e-commerce/retail (15%), finance/banking (13%), and manufacturing (12%). The groups differed structurally: 45% of graduates represented international corporations and 42% organisations with 1,000+ employees, whereas the Market group featured predominantly Polish-owned firms (70%) and smaller organisations – a further reason the contrast is treated as exploratory. A detailed respondent profile is provided in Appendix A.

Data Quality Assessment

Several procedures safeguarded data quality: records were screened for completeness and duplicates, and incomplete questionnaires excluded; ‘don’t know’ options were provided throughout to reduce forced guessing; technically demanding sections (e.g., cloud and data platforms) were optional and could be delegated to a technical colleague. The share of ‘don’t know’ responses was retained as an indicator of organisational awareness. Open-ended responses and project descriptions were reviewed for substantive content before coding.

Research Instrument

The study employed a structured online questionnaire of 53 questions in eight thematic parts, combining single- and multiple-choice questions, five-point anchored rating scales, and optional open-ended questions; typical completion time was 15–20 minutes, and the instrument was administered in Polish and fielded across 2025 and 2026, spanning both recruitment channels. Its full structure, response formats, measurement dimensions, and key measurement items are presented in Appendix A.

Assessing AI Maturity

AI maturity was assessed through a triangulated self-placement procedure combining three components: (1) self-placement on a five-stage maturity model (Exploring, Experimenting, Scaling, Transforming, AI-Native), each stage defined by an operational criterion; (2) ratings of five capability areas on a five-point anchored scale (1 = no activity; 5 = scaled and optimised); and (3) placement of the most advanced deployments on the Value Ladder (Assist, Augment, Automate, Agentic).

Table 1
AI Maturity Stages of Surveyed Organisations (N = 179)

Maturity stage	Poland (N = 179)	Graduates (n = 102)	Market (n = 66)
Exploring	21%	19%	25%
Experimenting	49%	49%	48%
Scaling	26%	26%	27%
Transforming + AI-Native	4%	7%	0%

Responses were combined into a composite maturity score: each component was mapped onto a common 0–100 scale and combined with equal weights, with score bands defined as equal 20-point intervals (Exploring 0–20 through AI-Native 81–100); ‘don’t know’ and omitted optional responses were not scored, and classification then relied on the completed components. Full operational definitions are provided in Appendix A. The procedure allowed cross-checking of stage self-placement against dimensional ratings and implementation quality, and underpins the Awareness Paradox analysis, which contrasts these (self-reported but verifiable) implementation indicators with purely evaluative declarations of benefit.

Analytical Methods

Data analysis was conducted across three layers: (1) combined data (N = 179), describing the overall state of AI transformation; (2) a descriptive contrast between the graduate and Market groups, interpreted as hypothesis-generating, not causal; and (3) analysis of discrepancies between subjective benefit declarations and implementation indicators (the Awareness Paradox). The 539 projects were analysed through qualitative thematic coding: operational problems were coded inductively, recurring patterns identified iteratively, and use cases categorised by business function. Design limitations are discussed in the Limitations and Future Research section.

Findings

AI Maturity of Polish Organisations

The vast majority of surveyed organisations remain at early stages: Exploring (no production deployments) accounts for 21%, Experimenting (pilots and PoCs) for 49%, Scaling for 26%, and Transforming or AI-Native for only 4%. The distribution between graduates and the Market was similar in the middle range (Experimenting: 49% vs. 48%), but diverges at the upper end: 7% of graduate organisations reached Transforming or AI-Native, compared to 0% in the Market group (Table 1).

These results are broadly consistent with global data – Apotheker et al. (2025) identified 5% ‘future-built’ firms, 35% scaling, and 60% failing to achieve measurable returns – despite Poland’s lower starting point (4.9% of SMEs with AI in 2024; OECD, 2025b). The sample over-represents AI-engaged organisations, however, so the population-wide distribution is likely less favourable.

Implementation quality (Value Ladder) deepens this picture: 48% of organisations are at Assist, 28% at Augment, 21% at Automate, and only 3% at Agentic. The association with maturity stage is pronounced: among Transforming and AI-Native organisations (n = 7) most deployments sit at Automate or Agentic, whereas among Exploring organisations 78% remain at Assist – consistent with the automation-augmentation tension (Raisch & Krakowski, 2021): genuine transformation requires qualitatively different deployments, not merely more pilots.

The Adoption Gap: Individual vs. Organisational

The study’s central finding is the scale of the gap between individual adoption and organisational maturity. All respondents use at least one AI assistant, and 83% use AI daily; simultaneously, roughly 70% of their organisations (Exploring and Experimenting combined) lack sustained, systemic deployments. The most popular personal applications are research (63%), document analysis and summarisation (58%), writing and editing (55%), and brainstorming (48%); applications requiring integration with internal data remain marginal: decision support (32%), customer service (14%). Organisations deploy AI where it is easy, not where the potential is greatest.

Transformation Barriers

The analysis of barriers points to the dominance of human and organisational factors. Asked to rank their three most important barriers, respondents named the lack of an AI strategy most often (36%), followed by the absence of a transformation owner (32%) and insufficient competencies (32%). On the anchored 1–5 scale, change management received the lowest mean score (M = 2.43), marginally below strategy and governance (M = 2.44); data infrastructure was rated at 2.55, talent and competencies at 2.75, and technology stack at 2.77 (Table 2).

Graduates rate their organisations somewhat higher on strategy (+0.25), competencies (+0.27), and technology (+0.21), but the two groups converge exactly on change management (2.42 in both). Given the descriptive character of the comparison, we do not interpret these differences as programme effects; notable, however, is that the one dimension on which the groups do not differ at all is the organisation’s capacity for change – suggesting a systemic barrier at the level of organisational culture (see Discussion).

Shadow AI, Governance, and the Regulatory Context

60% of surveyed organisations confirm the presence of Shadow AI: in 26% of cases ‘widespread,’ in 34% ‘controlled but existing’; only 28% claim clear rules that eliminate the problem. The primary frustrations with official tools are lack of corporate context (‘the tool doesn’t know our company’ – 25%) and poor output quality relative to free alternatives (24%). This produces what we term the ‘Copilot Paradox’: Microsoft 365 Copilot is the most frequently deployed enterprise AI tool (58%), but implemented without prior data clean-up, it amplifies chaos, and employees revert to free tools.

In the regulatory context, only 12% of respondents identify the EU AI Act as a significant risk, though 25% of the 539 projects fall within regulated domains (finance, HR, healthcare). Against EY (2025) data showing 71% of Polish firms working on AI Act compliance, transformation leaders paradoxically under-prioritise governance: it ranked second-to-last among planned 2026 initiatives (15%), trailing process automation (47%), training (44%), and chatbots (32%) – a significant risk in the year key AI Act provisions take effect.

The Valley of Death: From PoC to Production

Only 7% of organisations achieve high PoC-to-production effectiveness (>50% of projects deployed), 27% selective (10–50%), 20% experimental (<10%), 18% remain preparatory, and 28% cannot assess. Analysis of the 539 projects, read together with the survey data, identified five causes: lack of clear ownership for production deployment (35% of organisations have dispersed responsibility), data silos (70% of projects), no scaling budget (21% without a dedicated AI budget), expert resistance (45% of projects), and missing MLOps competencies (39% rely on individual specialists rather than teams).

The build-versus-buy analysis revealed a surprising pattern: organisations building internally report PoC effectiveness 3.7 times higher than those purchasing off-the-shelf SaaS (55% vs. 15%). This contrasts with the global dominance of purchased solutions (76% worldwide; Tully et al., 2025) – though that figure concerns prevalence, not effectiveness, and thus provides context rather than a direct benchmark. Explanations are elaborated in the Discussion. Notably, organisations using partners and integrators achieve the highest share of 4+ active deployments (44%), suggesting the optimal path may be ‘building with a

Table 2
Self-Assessment of Organisational AI Capability Areas (Anchored 1–5 Scale, N = 179)

Capability area	Poland	Graduates	Market
Technology stack	2.77	2.83	2.62
Talent and competencies	2.75	2.85	2.58
Data infrastructure	2.55	2.60	2.40
Strategy and governance	2.44	2.51	2.26
Change management	2.43	2.42	2.42

domain-knowledgeable partner’ rather than a binary build-or-buy choice.

The Awareness Paradox

The Awareness Paradox emerges from contrasting two classes of indicators. The first is subjective-evaluative: declarations of benefits achieved and of AI’s impact. The second is factual-implementational: reports of verifiable organisational facts – whether a documented AI strategy exists, what share of PoCs reached production, whether employees have training access, how many solutions are in active use. Both are self-reported, but the second refers to observable states of affairs rather than evaluations; ‘paradox’ is used as a descriptive label for the reversal of orderings documented below, not as a claim about an established cognitive mechanism.

On the subjective-evaluative indicators, the Market group consistently declares higher benefits: productivity (62% vs. 38%), faster decisions (48% vs. 26%), faster product deployment (30% vs. 17%), new revenue (13% vs. 3%). On the factual-implementational indicators, the ordering reverses: graduates report more formal strategies (33% vs. 21%), higher selective PoC effectiveness (30% vs. 20%), broader training access (67% vs. 51%), and more active deployments (32% vs. 23% with 4+). Higher declared benefits thus do not necessarily signal higher maturity; leaders with greater competencies may simply possess more precise evaluation frameworks and judge their organisations more strictly (see Discussion).

Education-Related Differences

The descriptive contrast between the graduate and Market groups reveals systematic differences across readiness indicators (Table 3).

Graduates show consistently higher readiness indicators and lower ‘don’t know’ rates across all infrastructure and strategy questions – a pattern consistent with a cascading-effect hypothesis: a trained decision-maker formalises strategy, initiates team training, raises infrastructural awareness, and selects projects more effectively. Two alternative explana-

tions must be stated: self-selection (participants may come from organisations already more advanced) and structural composition (more corporations and large organisations among graduates). The present design cannot adjudicate between them; a longitudinal design could. The consistency of the pattern across seven indicators – and its complete absence in exactly one dimension, change management (2.42 = 2.42) – nonetheless makes the hypothesis a productive candidate for further testing.

The Impact of AI on Team Structures

Projections of AI’s impact on team structures over 12 months reveal moderate optimism: stability is the most common expectation (42%), 17% of leaders see AI as a growth driver, 8% forecast competency structure changes, 7% plan workforce reductions, and 26% are unable to forecast. Sectoral variation is notable: in telecommunications/media no respondents expect team structures to remain stable (60% are uncertain), healthcare has the highest share of optimists (30%), while finance and e-commerce report the highest planned reductions (8–9%).

Discussion

The findings align with and extend existing research; in line with the exploratory design, the interpretations below are evidence-based hypotheses rather than demonstrated causal claims.

The Adoption Gap Is Bottom-Up in Shape

The adoption gap (83% daily individual adoption vs. roughly 70% of organisations at early stages) is consistent with global observations of divergence between technology availability and organisational readiness (Deloitte, 2026; McKinsey, 2025), and with the prediction that individual acceptance drivers (Venkatesh et al., 2003) can outpace organisational enablers (Tornatzky & Fleischer, 1990). Poland has among the lowest SME-level AI adoption in the EU (OECD, 2025b), yet leaders’ individual adoption approaches global averages: Polish AI transformation

Table 3
Education-Related Differences in Organisational Readiness Indicators (Descriptive Contrast)

Dimension	Graduates	Market	Difference
Formal AI strategy	33%	21%	+ 12 pp.
AI training available	67%	51%	+ 16 pp.
Selective PoC effectiveness	30%	20%	+ 10 pp.
4+ active deployments	32%	23%	+ 9 pp.
‘Don’t know’: cloud provider	11%	26%	-15 pp.
‘Don’t know’: build vs. buy	20%	33%	-13 pp.
‘Don’t know’: data/ML team	4%	11%	-7 pp.
Change management (1–5)	2.42	2.42	0

Note. Differences are descriptive; given the non-probability sample and structural differences between groups, they should not be interpreted as causal effects of the programme.

is fundamentally ‘bottom-up’, generating distinctive governance challenges, including Shadow AI.

Organisational Barriers Dominate

The dominance of organisational barriers is consistent with the readiness literature (Jöhnk et al., 2021; Uren & Edwards, 2023) and McKinsey’s (2025) skill-gap findings. The three most frequently named barriers – lack of strategy (36%), owner (32%), and competencies (32%) – reinforce the pattern of readiness lagging behind technology. Linking barriers to outcomes, change management as the lowest-rated dimension ($M = 2.43$) coincides with 93% of organisations not reporting high PoC-to-production effectiveness – consistent with Bedard and Beauchene’s (2026) thesis that 70% of AI value depends on people and organisations, not technology.

The Awareness Paradox Challenges Self-Report Methodology

The Awareness Paradox contributes to the discourse on AI maturity measurement. The point is not that two groups disagree, but that the group scoring higher on subjective-evaluative indicators scores lower on factual-implementation ones – and vice versa: the Market group, which declares markedly higher productivity gains (62% vs. 38%), does not outperform the more critical graduates on any implementation indicator. The phenomenon bears a cautious analogy to the miscalibration described by Kruger and Dunning (1999); the analogy remains tentative, as respondents’ actual knowledge and self-assessment accuracy were not directly measured. The implication is that maturity studies relying solely on evaluative self-assessment may overstate the maturity of less advanced organisations and understate that of more advanced ones; future research should pair evaluative declarations with factual implementation metrics.

Leader Education and the Cascading-Effect Hypothesis

The education-related differences in Table 3 align with the consensus that executive commitment is among the strongest predictors of implementation success (Bedard & Beauchene, 2026; Fountaine et al., 2019; McKinsey, 2025), and with Deloitte’s (2026) finding that transformation-stage organisations are 3–4 times more likely to have dedicated governance and upskilling programmes. The observed differences may, however, be partially or wholly explained by selection and group composition. The appropriate conclusion is conditional: the pattern is consistent with a cascading effect of leader education and justifies longitudinal verification, but does not prove such an effect.

The Build-Versus-Buy Inversion

The inverted build-versus-buy pattern contrasts with a global market in which purchased solutions dominate in prevalence (Tully et al., 2025). Four complementary mechanisms may make the inversion market-specific. First, data-infrastructure immaturity:

Polish organisations carry substantial ‘data debt’ (70% of analysed projects reported data silos); off-the-shelf SaaS presupposes integration-ready data, whereas internal builds engage with integration from day one. Second, a localisation gap: many global SaaS products offer limited support for Polish-language content, local document standards, and regulatory specifics. Third, relative factor costs: competitively priced Polish engineering talent versus SaaS priced in dollars or euros shifts the calculus towards building. Fourth – a caveat rather than a mechanism – sample composition: IT/technology firms (31%) are over-represented, which may inflate the observed effectiveness of building. The inversion is therefore framed as a plausible, multi-causal, market-specific pattern requiring verification on a representative sample; its practical reading is the sequence articulated by respondents themselves: data → processes → AI, whether an organisation builds or buys.

Change Management as a Systemic Barrier

Perhaps the most consequential – and most easily misread – finding is the exact convergence of the two groups on change management ($2.42 = 2.42$), against graduate advantages on every other indicator. This must not be read as evidence that education does not work: the data cannot show what education causes. The pattern indicates something narrower: whatever is associated with leader education across strategy, training, and infrastructure awareness does not extend to the organisation’s capacity for change. This is theoretically coherent – readiness for change is a collective property (Weiner, 2009), and successful change requires structural mechanisms no single trained individual can supply (Kotter, 2012). Training decision-makers moves many levers, but change management requires whole-organisation intervention – culture, incentives, structures – alongside individual competency development.

Conclusions

The survey of 179 leaders and the analysis of 539 AI projects yield a coherent picture of AI transformation in the studied sample of Polish organisations: strong individual foundations (83% daily AI adoption among leaders) coexist with weak organisational foundations (roughly 70% at the pilot stage, 32% naming the absence of a transformation owner as a main barrier, only 28% reporting clear AI-use policies). Closing this gap is the central challenge of 2026–2027. Five conclusions follow.

First, the barriers are human and organisational, not technological: effective transformation requires change management competencies, decision structures, and an innovation-friendly culture (cf. Bedard & Beauchene, 2026; McKinsey, 2025).

Second, the data reveal a pattern consistent with a cascading effect of leader education (+12 pp. strategy formalisation, +16 pp. training access, +10 pp. PoC effectiveness among graduates); subject to the

selection caveats above, AI competency programmes should target senior management, not only technical teams.

Third, the Awareness Paradox challenges the reliability of maturity studies based solely on evaluative self-assessment; maturity measurement should combine declarative data with factual implementation metrics (deployments, PoC effectiveness, strategy formality).

Fourth, the inverted build-versus-buy pattern shows that global recommendations cannot be transposed uncritically to markets with lower data maturity; data and process clean-up precedes AI deployment regardless of the build or buy model.

Fifth, change management emerges as a systemic barrier – the only dimension where the groups do not differ – so building change capacity requires whole-organisation intervention (culture, incentives, communication structures), not individual development alone.

Limitations and Future Research

The findings must be read against the design's limitations. First, the sample is a non-probability convenience sample of AI-engaged leaders: it is not representative of Polish organisations, and reported maturity levels likely overestimate market-wide reality. Second, the graduate-Market contrast is affected by self-selection and structural differences between the groups; it was therefore reported as descriptive and hypothesis-generating, with no inferential statistics applied. Third, all data are self-reported; verifiable facts were not independently audited. Fourth, the cross-sectional design precludes tracing causal pathways over time.

Future research should pursue longitudinal designs following organisations before and after leader education, representative samples of Polish enterprises, in-depth case studies of the change management barrier, and comparisons with other Central and Eastern European countries to test the proposed market-specific explanation of the build-versus-buy inversion.

The appendices are available in the online version of the journal.

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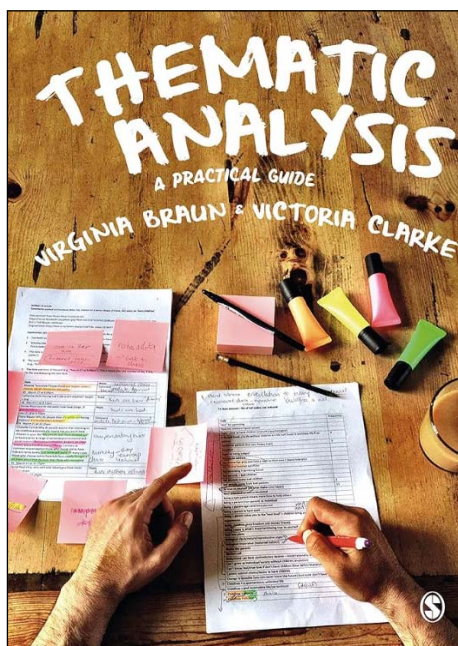


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Thematic Analysis. A Practical Guide

Virginia Braun & Victoria Clarke

The purpose of this article is to review the book *Thematic analysis. A practical guide* by Virginia Braun and Victoria Clarke is one of the most important modern studies of thematic analysis (TA). Thematic analysis is a method for analysing empirical data within a qualitative approach. This approach is one of the most popular in psychology, social sciences and health. It is a practical guide for those engaged in qualitative research. The book under review is a specialist publication, aimed both at those just beginning their journey with TA and learning this method, as well as at those teaching and supervising TA.

Keywords: qualitative research, reflective thematic analysis, coding, data analysis, reflexivity

The reviewed book, *Thematic analysis. A practical guide* is 315 pages long and was published by Wydawnictwo Naukowe PWN SA in Warsaw in 2024. The book was translated by Dorota Przygucka. Virginia Braun is a professor in the School of Psychology at the University of Auckland in Aotearoa, New Zealand and a health psychologist. She lectures on the psychology of gender and health. Victoria Clarke is a professor in the Faculty of Social Sciences at the University of the West of England (UWE) in Bristol. She lectures on qualitative methods. The book also includes excerpts from other scholars, including Suzy Anderson, Melanie Beres, Elicia Boulton, Gina Cowie, Louise Davey, Pantea Farvid, Ally Gibson, Rachel Graham, Jade Le Grice, Nikki Hayfield, Michelle G. Ong, Matt Sillars, Gareth Terry, Lisa Trainor, and Matthew Wood.

Thematic analysis. A practical guide is a publication focusing on thematic analysis (TA). Reflective TA is a qualitative research method that involves in-depth, subjective analysis of data sets that coalesce into themes (Braun & Clarke, 2024a). TA is a popular qualitative method that can analyse large datasets and is applied within larger research groups (Nowell et al., 2017). Given the popularity of qualitative research, the transparency of the procedures used is important. Reflective TA differs from other methods in its approach to thematic development and philosophy. The authors analyse various approaches to technical analysis in TA: inductive and deductive, semantic and implicit, critical realist and constructivist. Importantly, these are not necessarily mutually exclusive. Analysis can incorporate elements of several orientations (Braun & Clarke, 2024a; 2024c). The authors repeatedly emphasise the flexibility of reflective TA and its applicability to various research paradigms.

This book is a comprehensive and reliable guide covering a six-step approach to conducting reflective TA. It describes in detail the process of coding and analysing empirical data, as well as the detailed development of themes and report writing. The book emphasises the reflexivity and contextualisation of this method. According to the authors, the researcher is aware that they are in some way influencing the analysis results and are part of the research process. The authors also emphasise that data should not be analysed out of context. During analysis, it is important to be aware of the cultural and environmental context. It is also crucial to pay attention to when and how a specific data set was created (Braun & Clarke, 2024a).

The book is written in a language that is understandable to everyone, in a very engaging and accessible style. Even those with no prior knowledge of TA will have the necessary skills to successfully conduct reflective TA after reading it. The book's structure is clear. It includes numerous practical examples that help understand the issues discussed, as well as tables and figures, which significantly facilitate understanding of the information presented. At the end of each section, a summary is provided,

along with suggested further reading (for readers who want to learn more) and useful exercises. It combines both practical and theoretical knowledge, making it a very interesting and solid resource on this topic. The book's language is clear and easy to understand. It is recommended for anyone interested in this qualitative research method, from professionals to students. Its most important strength is demonstrating that TA is not just a mechanical process but a complex, intricate interpretive activity that requires reflection.

The book consists of two parts and nine thematic chapters. A very useful glossary of terms is included at the end. Subsequent chapters provide information on preparing and coding empirical material and a detailed process for interpreting data. The authors (Braun & Clarke, 2024a) propose a six-phase approach to conducting reflective TA (presented below), which is described in detail in each chapter:

1. **Familiarising yourself with the dataset.** The authors recommend multiple readings of the data. In the context of familiarising yourself with the data, they discuss proximity (immersion) and distance (critical engagement). During reading, they emphasise the importance of creating logical notes, either in a classical format or by capturing potential patterns of meaning and possible questions.
2. **Coding.** The authors describe this as identifying interesting fragments and emphasise assigning code labels. Braun and Clarke (2024a) distinguish between superficial and latent multilevel coding. They describe semantic coding and latent coding. Semantic coding involves examining the meaning of the data's surface, and such codes remain close to participants' language, although they are not intended to reflect their words. Latent codes, on the other hand, focus on deeper, hidden meanings, which are sometimes completely thematically detached from the content of the empirical data. It is also important to complete at least two rounds of coding.
3. **Generating initial themes.** In this phase, the authors emphasise the importance of identifying and grouping potential or preliminary themes. The researcher should identify relevant themes and then create coding categories. This is where the concept of a *candidate theme* emerges.
4. **Developing and verifying themes.** Braun and Clarke (2024a) provide a detailed description of the process of assessing the initial relevance of themes and emphasise the importance of verifying their relevance. Themes can be combined, separated, or removed entirely.
5. **Refining, defining, and naming themes.** This section describes the process of consolidating one's analysis and selecting themes, and the importance of writing a short summary for each theme.

6. **Writing.** The final phase described by the authors is the formal refinement of the writing process, which informally begins in Phase 1.

The reviewed publication aims to demonstrate that TA is a fully fledged research method. The authors (Braun & Clarke, 2024a) emphasise how reflexivity compels us to examine how we make sense of data. They emphasise that the data analysis process is not mechanical, but organic. The authors also point out the importance of maintaining analytical sensitivity.

Although TA has been criticised (Saldana, 2013) for its explicit procedures, it remains a frequently used method due to its flexibility. TA has never been as appreciated as other qualitative research methods, such as grounded theory or phenomenology (Braun & Clarke, 2006; Nowell et al., 2017). Some researchers believe that because TA is often used alongside other qualitative methods, it is not a separate method but merely a subset of others (Boyatzis, 1998). However, Braun & Clarke (2006) argue that this is a flawed approach and TA should be considered a separate method. Other authors also support this position (Nowell et al., 2017).

TA offers considerable flexibility regarding research questions and data volume (Braun & Clarke, 2013). However, this flexibility can also lead to inconsistencies in data processing (Holloway & Todres, 2003). Other researchers also note drawbacks of this method, such as the relatively small body of scientific literature devoted to it, especially compared to other qualitative research methods, which can pose difficulties for inexperienced researchers (Nowell et al., 2017).

TA is widely used but rarely recognised, so the authors (Braun & Clarke, 2024a) present an accessible, understandable approach to using TA in research. TA is often misused, its superficial practices are common, and researchers have the misconception that the method lacks theoretical foundations (Braun & Clarke, 2023; 2024c). Many research errors stem from imposing universal criteria on this method (Braun & Clarke, 2020). It is important to understand that TA is not a single method, but a collection of qualitative data analysis approaches that focus on developing emerging themes (Braun & Clarke, 2024b).

This book can definitely be recommended to a wide audience. It is a book that will be understandable for both professionals and those just beginning their adventure with TA. It is a valuable source of knowledge on qualitative data analysis methods.

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VIRTUAL EXCHANGE PROJECTS REPORT

Virtual Exchange Projects 2025/2026 at the Foundation for the Promotion and Accreditation of Economic Education

The Virtual Exchange initiative is a project coordinated by the Foundation for the Promotion and Accreditation of Economic Education and offered to students of the five economic universities affiliated with the Foundation. It provides students with an opportunity to collaborate with partners from different cultural and geographical backgrounds on tasks related to their academic and professional interests. At the same time, Virtual Exchange offers a simple and low-cost way of internationalising the teaching and learning process, making international experience accessible to a broader group of students than traditional mobility programmes.

In the 2025/2026 academic year, the Foundation organised five Virtual Exchange projects in cooperation with international partner universities: two editions of 'Career Booster' with Grand Valley State University (USA), 'HRM in Action' with the University of Tasmania (Australia), 'Business Consultants for Sustainability and Technology' with Fatec São Paulo (Brazil), and 'Social Entrepreneurship' with ESAN University (Peru).

A total of 62 students successfully completed the projects. Participation gave them an opportunity to develop their business interests, improve their language skills and, above all, gain experience of working in multicultural teams. The projects focused on foreign-language communication, the use of digital communication tools, international teamwork and building confidence in a cross-cultural environment.

Participant feedback showed that students particularly valued the opportunities for cultural exchange and personal development, while language barriers and time-zone differences were among the main challenges. The Foundation plans to continue the Virtual Exchange initiative in the next academic year and to involve students from all five member universities.

All academic teachers and institutions interested in cooperation are welcome to contact the editorial team of 'e-mentor' at biuro@e-mentor.edu.pl



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