



**Entrepreneurship and innovation
in the age of digital transformation**

Edited by

Anna Ujwary-Gil

Anna Florek-Paszowska

Bianka Godlewska-Dzioboń

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Business innovation and critical success factors in the era of digital transformation and turbulent times

Anna Florek-Paszowska¹ , Anna Ujwary-GiĹ 
Bianka Godlewska-Dzioboń³ 

Abstract

PURPOSE: Explore what entrepreneurship and success factors can help drive business to resilience and stability and achieve competitive advantage through innovation in different countries and business realities in the era of digital transformation and turbulent times. **METHODOLOGY:** Based on the narrative literature review, we present research findings concerning new strategies and outlooks for business innovation in times of many unknowns. Each organization wants to find its way to gain success and create its unique business model, which can capture value creation and innovativeness and be more adaptive, resilient, and stable in critical moments and sustainable over time. **FINDINGS:** The articles presented in this issue explore the essential factors of business innovation and success in different organizations and the environments in which these businesses function. **IMPLICATIONS FOR THEORY AND PRACTICE:** This article synthesizes the presented research field's importance and relevance, connecting its theoretical background with practical research. Recommendations and implications for future trends of this research stream might also be helpful for professionals and academicians. **ORIGINALITY AND VALUE:** The novel studies presented in this issue were done in five different (developing and developed) countries and business sectors that present human-based and non-human-based factors as crucial factors needed to empower business transformation in a complex world. Each group of elements is essential in business success, and their components are interdependent. We need to look at the interactions and interdependencies of

1 Anna Florek-Paszowska, Ph.D., CENTRUM Católica Graduate Business School and Pontificia Universidad Católica del Perú, Urbanización Los Álamos de Monterrico, Jirón Daniel Alomía Robles 125, Santiago de Surco 15023, Lima, Peru, e-mail: aflorekpaszkowska@pucc.edu.pe (ORCID: <https://orcid.org/0000-0002-1249-5069>).

2 Anna Ujwary-GiĹ, Ph.D., Hab. Professor of Institute of Economics, Polish Academy of Sciences, Laboratory of Process and Network Analysis, Nowy Swiat 72, 00-330 Warsaw, Poland, e-mail: ujwary@inepan.waw.pl (ORCID: <https://orcid.org/0000-0002-5114-7366>).

3 Bianka Godlewska-Dzioboń, Ph.D., Assistant Professor, Cracow University of Economics, Rakowicka 27, 31-510 Kraków, Poland, e-mail: godlewsb@uek.krakow.pl (ORCID: <https://orcid.org/0000-0001-9668-458X>).

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their components in a dynamic and network form and cannot simplify the reality, focusing only on one group of business components and ignoring the other. These unique studies provide a valuable outlook to establish dynamic, adaptive business pathways towards a sustainable and resilient organizational future and propose future research paths needed to execute structural changes in businesses.

Keywords: *business model, innovation, critical success factors, digital transformation, knowledge management, talent management, competitiveness, leadership, transformation, change management, VUCA*

INTRODUCTION

Donald Rumsfeld (a former US Defense Secretary) said in 2001 “we are now living in a world which combines known knowns, known unknowns, and unknown unknowns” (Syrett & Devine, 2012, p. 1). As a continuation, Syrett and Devine (2012, p. 2) point out that “the growth of the last category presents business leaders with a new and little charted management challenge.” These words are still relevant nowadays after a lot of intensity we all faced from that time. The authors continued that when the environment is so uncertain, it is challenging to apply the traditional analytical tools to predict the future of businesses and choose a clear strategic direction. Tassabehij and Isherwood (2014), after research conducted in 47 countries, found there are similarities in each country and business sector in that, although managers use a variety of tools, they continue to use those that are well established and are focused on the management of internal and external resources. In contrast, novel strategies, tools, and disruptive technologies needed to foster innovative “blue oceans” and dynamic organizations to gain new markets are not widely applied in practice. Syrett and Devin (2012) asked several questions that are still valid today, like 1) What makes for a good strategy in highly uncertain business environments and modern economies? 2) How can organizations prepare themselves for the challenge of anticipating and responding to unanticipated events? and 3) What are the individual and organizational capabilities needed in uncertain and intense times?

Agility, resilience, digitalization, and sustainability are terms that are gaining more popularity in business and leadership during turbulent times. Miceli et al. (2021) present how these dimensions interact to help business to become strategically resilient. They offer a new view of resilience that includes a strategic attribute that could help companies capture change-related opportunities to design new ways of doing business under stress. An essential set of strategically agile processes, enabled by digitalization, creates strategic resilience that includes a proactive, opportunity-focused attitude in the face of change. Strategic resilience that leads to organizational sustainability is

presented as a multi-domain concept similar to the holistic view of sustainability and its three components: environment, economy, and society.

The abovementioned dimensions are even more understandable and essential during the global crisis of the COVID-19 pandemic and will be in a “new normal” post-pandemic. Agility and resilience are among the most important and needed features for future challenges, business continuity, and their leaders post-pandemic (Nasser, 2021). Agility is an attribute that helped organizations survive and pass through the obstacles, especially those during COVID-19. Those who can adapt to those challenges, apply their lessons learned, and add new practices to react to the crisis might be called resilient. Chong et al. (2020) present five common characteristics that can help build agility in the “new normal”: 1) Establish a common purpose and clear communication, 2) Set up structures to allow rapid decision making; 3) Create networks of local teams with transparent, accountable roles; 4) Develop a culture that empowers people; and 5) Provide people with the technology they need.

The pandemic has become a global catalyst for the information society’s development that began many years ago, regardless of residence, age group, and educational level. People and organizations worldwide faced a considerable challenge and drastic change when almost every aspect of their professional and personal life was transformed into a virtual space. We were forced into international isolation, and digital technology has become a tool to continue all business functions and survive personally on many levels. As Kohnke (2016) presented, digitization changes the way of working and accelerates the speed of change that companies face. Some companies and people could accept the rapid and drastic change of reality and its ubiquitous virtualization faster. Their productivity and economic efficiency quickly returned to the pre-pandemic track. What makes them survive, adapt rapidly, and be resilient and prosperous during critical times? This question was and will be valid in the “new normal”. The negative impact on many businesses during the pandemic was not only because of the lack of technological and systemic preparation to conduct business remotely but also the rigid organizational culture and lack of the proper mindset of the managerial staff to manage change in the VUCA (volatile, uncertain, complex, and ambiguous) world. Only those organizations with a leadership culture based on trust, effective communication, and empathy (competent leaders with well-developed “soft skills” to manage human resources) could succeed in these challenging times of digitalization and continuous change. From the beginning of the last decade, much has been written about the growing importance of non-technical/non-cognitive skills, also called the “soft skills” of the leaders and employees, to benefit business organizations

due to the fourth industrial revolution, its technological advancement, and turbulent times (e.g., Bunker & Wakefield, 2004; Dirani et al., 2020; Josten & Lordan, 2021; Lepeley et al., 2021). Many organizations and managers undervalue that information. As underlined by Cukier et al. (2021), while a focus on technology skills dominates the discourse, particularly among large corporations, management, and leadership skills present a gap overall among manufacturing SMEs. Despite the preoccupation with technology skills, more SMEs fail because of a lack of other founders or founding team skills. In other words, the skills needed to manage ongoing innovation and growth are often disregarded because of an outsized focus on technology and technology skills.

The pandemic has fueled a surge in innovation, as necessity forced businesses, governments, and individuals to find ways to adapt. Not only has it driven the creation of new technologies, but it has also driven the development of new products and services, changes in processes, the development of new business models, and even shifts in the approach to work itself (Cukier et al., 2021).

As an immediate response to the global crisis observed worldwide, it is more critical than ever to present novel and interdisciplinary research, which will help leaders and businesses in developing and developed countries to be more prepared in challenging times. The research question (RQ) that guides this issue is:

RQ: What kind of entrepreneurship and success factors can help drive business to resilience and stability, and achieve competitive advantage through innovation in different countries and business realities in the era of digital transformation and turbulent times?

LITERATURE BACKGROUND

Business challenges and its adaptability to change management in VUCA times

Many challenging events happened during the last two decades. Some of them are turbulent ones, like the financial crisis in 2008 or the last one caused by the COVID-19 pandemic (Pena-Boquete & Dios-Murcia, 2021; Rueda Cantuche, 2021). As Heraclitus said, “the only constant in life is change,” and not only each of us should embrace the change to foster the development; businesses should also be prepared for unexpected future disruptive situations.

Giones et al. (2019) use the turbulent context to immerse managers' decision-making processes and depict how the VUCA framework description by Bennett and Lemoine (2014) helps identify, map, and prepare an organization to respond to volatility, uncertainty, complexity, and ambiguity in the short and long term. Managing change and crisis in an organization during turbulent times requires the organization and its leaders to be flexible, react quickly, adapt, and reorganize its talents, competencies, and resources. The authors proposed a two-step approach to put the VUCA framework to work and thus support managers in the position of making strategic choices regarding how to respond to the VUCA challenges in their industries: 1) Breaking down the perception of uncertainty using the VUCA framework; 2) Preparing the organization to take action: choices and timing. Concerning the first stage, Giones et al. (2019) point out that this is not because we aim to convert reality into a dashboard of indicators, but rather to decipher what is uncertain, volatile or complex, and ambiguous. The objective of this first step is to break down the sources of what we commonly call uncertainty. The second recommended step involves preparing the organization to take action. These represent a portfolio of responses that managers in VUCA contexts can activate, e.g., the actions to respond to volatility are substantially different from those to respond to ambiguity. Concerning volatility, the focus is on isolating and creating mechanisms that can buffer or compensate for the effects (e.g., additional unexpected costs). In the long term, actions related to changing the degree of vertical integration of the business should also be considered. The authors indicated that ambiguity requires actions that introduce internal changes to the organization's culture. Making short-term changes opens further options for organizational change in the long term. The suggestions of ways to respond to complexity are linked to the necessity of understanding and controlling the outcomes of the company actions such that valuable knowledge of the situation to help the organization broaden its mindset regarding the problem and alternative future scenarios.

Change management requires a new look at many aspects of the company's functioning. Organizations that want to survive and thrive during challenging times also focus on innovation inside their business model. Business model innovation (BMI) is a growing field of discussion in business model (BM) research that mainly focuses on three aspects: value proposition, value creation, and value capture (Dyduch, 2019). BMI is a crucial issue in innovation research where these three elements or their relationships to each other are innovated (Filser et al., 2021). Filser et al. (2021) created a holistic framework for BMI based on the existing core in the literature and emerging trends. The authors of the study identified four core literature streams: value creation through BMI, strategic BM concepts, design of the BM and its

connection to entrepreneurship, and the interrelation of BM and strategy. Filser et al. (2021) highlight that, besides BMI's dynamic capabilities and small- and medium-sized enterprises, sustainability is the most crucial trend. The study also integrates into the research the intersection of sustainability and innovation, which is also recently investigated by Bocken et al. (2021), Gurzawska (2021), and Veldhuizen (2021), and adjusted to a business model to create business model innovation for sustainability (Preghenella & Battistella, 2021; Pichlak & Szromek, 2021; Pieroni et al., 2021).

Development of a business model innovation starts from typology to support strategic decision-makers in identifying and analyzing various options, evaluating their consequences, including performance effects and determining the business model innovation(s) most suitable for the company, as presented by Taran et al. (2015). The authors started by introducing and then offering a response to five fundamental questions that management needs to answer when considering innovating their business model: 1) What should we innovate? 2) How far do we go? 3) How will the innovation support our business strategy? 4) Do we adopt a closed or open approach to innovation? 5) When do we consider the business model innovation a success? The results of the study made by Taran et al. (2015) suggest that the success of the innovation depends on, among others, the company's appreciation of the new business model's innovativeness. Apart from the balance that needs to be found between the innovativeness (radicality, reach, complexity), strategic context (proactiveness), and organizational setting (openness) of the innovation.

Innovation creation in organizations during challenging times depends on the climate inside the organization that focuses on human abilities, creative ideas, and employees' motivation to add value to the organization. As Masumba (2019) points out, the climate for innovation inside organizations is generated mainly by human abilities. The author presents two groups of innovation skills: 1) Innovation management skills; 2) Innovation engagement skills. The first group involves creating and implementing organization-wide innovation support systems (innovation-support strategies, policies, procedures, plans, innovation-development processes, and workforce innovation skill-development programs). The second group involves applying skills and abilities by organizational leaders to create and implement organization-wide, innovation-support initiatives aimed at specifically engaging and installing innovation in the hearts and minds of workforces. Apart from human skills, non-human abilities make a climate for innovation in an organization: research and development (R&D) and innovation-support technologies. Many authors linked change management to the effect of technological disruptions and

a digitalization wave across industries that spawned new digital opportunities and challenges for established firms (Giones et al., 2018).

Digital transformation vs. business transformation and virtual leadership

Digital transformation is a type of business transformation driven by emerging technologies (Tang, 2021). As mentioned by the author, the applicability of technology is mainly dependent on the industry and organization. It might include social media, mobility, the Internet of Things (IoT), cybersecurity, big data and analytics, cloud computing, robotic process automation (RPA), artificial intelligence (namely machine learning), blockchain, and others. With these technology trends, businesses are armed with the capability to digitize, transform, and grow their organizations fully. But these digitally sophisticated technologies are usually integrated by digitally mature organizations. In contrast, as underlined by Kane et al. (2015), less digitally mature businesses focus on solving strategic problems using individual digital technologies like e-commerce sites, social media analytics, and mobile applications. Kane et al. (2015) found out in their study that employees across all age groups want to work for businesses deeply committed to digital progress. This result is relevant for leaders to attract and retain the best talent.

As Philip (2021) emphasizes, digital transformation is mainly studied through information technology and strategic management. There are a deficient number of studies discussing digital transformation from an organizational behavior (OB) perspective. The author pointed out that the presentations of the organizational changes made by digital transformation focused on internal processes, mainly ignoring the consequences of such changes on people. For that reason, future research should also be more focused on the transformational leadership concept, significantly differentiating the role of leaders and their behaviors in planned or forced business digital transformation. Besides, there is a lack of studies presenting the pathways for sustainable talent management during digital transformation, especially those from traditional professions, less digitally mature businesses, and developing countries. The leadership concept should be integrated into the digital transformation theme, as corporate leaders are heavily involved in creating a new vision and implementing plans for the business transformation. Recent advancements in emerging technologies are redefining the managerial roles of managers. The deployment of artificial intelligence (AI) and remote intelligence (RI) technologies makes outsourcing easier for organizations. As a result, managers at all levels have to learn how to plan, organize, lead, and control virtual, cross-cultural teams and

tackle “globotic upheavals” regarding inequality, job displacement, and unemployment in organizations (Song Ng, 2021).

Nowadays, much research is related to the business transition to organizations 4.0 and the adoption of smart technology (STs) gains in productivity, better control over operations and supply chain processes, and improved competitiveness (Gastaldi et al., 2022; Rymarczyk, 2020). Frank et al. (2019, p. 3) conceptualized Industry 4.0 as “a new industrial maturity stage of product firms, based on the connectivity provided by the industrial Internet of Things, where the companies’ products and processes are interconnected and integrated to achieve higher value for both customers and the companies’ internal processes.” Lyke-Ho-Gland et al. (2019), in the APQC report, show where organizations are along the path of digital transformation and how they evaluate these initiatives’ progress and success. The data obtained from the survey done in more than 25 industries and 304 valid participants show that organizations are proceeding rapidly through their digital transformation journeys – 43% are already in their first or second wave of digital projects – while 39% of the organizations have a centrally managed portfolio of digital projects with an overarching strategy. The authors present the top drivers (goals) behind digital transformations: (a) optimize core business processes – 38.8%; (b) build efficiencies through automation – 37%; (c) improve customer experience – 29.1%; (d) move systems to a cloud or mobile environment – 20.8%; establish real-time data capabilities – 18%. An overwhelming majority (95.4%) of organizations use explicit measures to track the effectiveness and success of their digital transformations. 63.3% use operational measures to track their digital transformations. Within this category, most companies respond that they measure productivity (66.9%) and quality (59.6%) to monitor the efficiency and efficacy of core business processes. In third place are innovation and collaboration measures. Both gain 40.4% of responses. More than half (55.8%) of organizations use financial measures to track the success of their digital transformations to make sure they get a return from investment. The popular measures are cost reductions (63.6%) and ROI (56.1%). Concerning implementation measures, 40% of respondents, including this one, are the most important project milestones (77.2%). Customer measures are used less often (39.2%) than the other three to track digital transformations. However, the customer satisfaction index is by far the most common customer measure (71.4%).

The pandemic impacted the transition to digital transformation in a massive form and increased the interest in virtual team leadership as an emerging research theme. A virtual team might be presented as the one that “has members who potentially span different organizations, time zones, geographic locations, and cultures with technology enabling communication

and coordination between members” (Huang et al., 2010, p. 1098). For many companies and leaders, remote management of people and business, where survival is important, but health and human life is a priority, is a new, so far unknown challenge. COVID-19 introduced a sense of threat to life, health, material security, and social isolation (e.g., Loan et al., 2021; Marona & Tomal 2020). Good virtual leaders can be seen as a lifebuoy for struggling businesses. The argument for virtual leadership to keep organizations operational is especially timely in helping leaders deal with the challenges of running organizations remotely (Thambusamy, 2020).

Many research studies show the harmful effects of a pandemic and physical distancing on people’s mental health (Rohde et al., 2016; Galea et al., 2020; Banerjee & Rai, 2020). Hence, human-based factors, especially soft skills, have become crucial in an organization’s digital transformation and successful implementation (Gulati & Raiche, 2020; Ziadlou, 2021). The leaders’ empathy towards their co-workers and the ability to manage their own and others’ emotions and resistance to change increases the sense of psychological security in the organization and impacts employee engagement. Empathetic management, a complete understanding of employees and customer needs minimizes the stress level of employees. It allows for the development of products and services to meet recipients’ needs better. Employees are characterized by more outstanding commitment and motivation to share knowledge and ideas to find the optimal solution in turbulent change and digital technology. As Hoque et al. (2017) argued, employee engagement can interact in the relationship between corporate entrepreneurship and innovation performance.

Sariwulan et al. (2021) present in their study that transformational leadership has the most significant influence on employee talent management rather than organizational culture and work division. The impact of leadership is related to the visionary view of achieving better results in the future, acting as agents of change, acting transparently and democratically, giving trust to employees, and developing togetherness to achieve company progress. On the other hand, employee talent management impacts job satisfaction, performance, and commitment to work sustainability (Pauli & Poczowski, 2019). The application of employee talent management will not positively impact if, as underlined by the authors, workers do not feel the benefits, increase income, provide career certainty, fulfillment of guaranteed rights, work quality, timeliness, loyalty, work passion, and others. Lack of knowledge or familiarity with these technologies’ features and potential benefits generates resistance to change. Fear and aversion amongst people raise against that business technological transformation (Palomares et al., 2021). There is a significant need to research digital transformation,

transformational leadership, and employees' behavioral changes towards business sustainability transformations.

THE CONTRIBUTIONS

The articles in this issue provide several themes based on quantitative and qualitative research, critical literature reviews made in different countries (the USA, Finland, Poland, Ukraine, and Nigeria), and business realities in the era of digital transformation and turbulent times. The research was related to various aspects of a business functioning to be more resilient and stable and achieve competitive advantage through innovation: (a) interactive effects of the factors affecting the success of a startup enterprise, (b) value chain benchmarking to identify innovative digital technologies and the benefits of their application, (c) entrepreneurial self-efficacy and entrepreneurial intention's impact to start a business venture among young graduates, (d) analysis of knowledge management initiatives, policies and tools application in small, medium, and large enterprises, (e) analyze the importance of internal capabilities (resources) and external information sources in implementing the product, process, marketing, and organizational innovations to maximize the firm's competitive advantage and create value for stakeholders.

The unique part of **Keogh** and **Johnson**'s research is to test the interactive effects of factors affecting the success of a startup enterprise. In the existing literature on the subject, the emphasis is on investigating those factors in an individual form and not presenting interactive effects. The authors model and test potential complementarities between financing strategies and the personal attributes of the entrepreneurs, using survival rates as a measure of success. A Cox proportional-hazard model was used to estimate longevity in startups, and two metrics of success and their interactions were calculated: employment and revenue. The research results show that angel investors and venture capital investors benefit differently from founders with industry experience; founders with higher educational achievement generate more revenue than their peers, specifically when their startups collaborate in university partnerships. This presented article is the first to explicitly and empirically test for the presence of those complementarities.

In the article of **Potoczek**, different types and models of benchmarking in the water supply industry are presented. The approach to benchmarking is an original concept based on analyzing the value chain and digital maturity of business processes. The attempt made in the article to develop benchmarking research with an analysis of the value chain, allows for identifying innovations undertaken by enterprises from the perspective of implemented processes

that create a dynamic, multi-instance structure of tasks, resources, and technological competencies. The concept of using value chain benchmarking is to identify innovative digital technologies and the benefits of their application in achieving higher effectiveness in obtaining goals and taking up new civilization challenges. The concept of researching technological changes in the value chain requires a reference to research on the digital maturity of enterprises, the nature of benchmarking research in the selected water supply industry, and the possible use of value chain analysis. Analysis of the decomposition of the water supply company's value chain, criteria, and levels of process maturity assessment, as well as the types and advancement of digital technologies, makes it possible to prepare two scenarios of digital technology benchmarking stages depending on the level of process maturity and the propensity to invest in business process management.

The process-benchmarking concept presented in this article is used for the first time by water supply companies. Nevertheless, the results of benchmarking research should be an essential source of information both for entities with water resources and for users themselves, for whom access to clean water is vital and who must accept the price of water is dictated by suppliers. Potoczek developed the benchmarking research concept through literature studies and identifying research problems and ideas on internet platforms operated by enterprises, associations, and foundations. Research methods presented in the article have grown in popularity in the literature, but their relationship to the context of the water industry is an innovative approach by the author.

Osadolor, Agbaeze, Isichei, and Olabosinde, through the lens of behavioral reasoning theory, present an entrepreneur's intent to start a business venture among young graduates in Nigeria. The authors focus on assessing the direct effect of entrepreneurial self-efficacy (ESE) and entrepreneurial intention (EI) and the indirect impact of the need for independence on the relationship between the constructs. The authors indicated that the business climate in Nigeria offers little to young adults in terms of support towards venture creation. It thus implies that developing the need for independence as an entrepreneur could account for the process through which their self-belief is triggered towards steering the need to start, own and manage a venture. In the presented research, a quantitative approach was applied. Data was collected using a questionnaire form from 235 Nigerian graduates participating in the National Youth Service Corp in twelve states in Nigeria. Analysis was made using a partial least square structural equation model. The results from the study show that self-efficacy does not significantly affect intention, and the need for independence affects entrepreneurial

intention. The need for autonomy fully mediates the relationship between entrepreneurial self-efficacy and entrepreneurial intention.

The purpose of the original study, done for the first time in the transition economies of post-Soviet states by **Sytnik** and **Kravchenko**, was to conduct a comparative analysis of knowledge management (KM) initiatives in small, medium, and large enterprises operating in Ukraine, and highlight the specific characteristics of knowledge management policies, as well as the scope and intensity of knowledge management tools application in these categories. Knowledge management is an intensely researched topic in the literature, but there are limited studies on the KM differences in small, medium, and large enterprises. The empirical data were obtained through a questionnaire survey among 90 managers and analyzed statistically. Regardless of the size, all enterprises showed a high awareness of knowledge/KM importance for their business. In contrast to the standard view on SMEs as a homogeneous sector in knowledge management, the study shows its heterogeneity in knowledge management initiatives. The differences were observed, especially between small and large enterprises. In the case of large enterprises, high awareness of KM importance was highly consistent with implementing KM policies at organizational procedures. On the contrary, small enterprises demonstrated apparent inconsistency between declared attitude to KM and actual implementation of KM policies at an executive level. Medium enterprises were more similar to large enterprises in their actions.

The theoretical contribution of this study was the provision of SMEs sector heterogeneity evidence based on several knowledge management characteristics presented in the article. This finding allows us to deepen our knowledge of conceptual differences in knowledge management approaches applied by different enterprise categories. While designing specific knowledge management policies, programs, and tools, the size of the enterprise is essential in considering how to meet its needs. The larger the enterprise is, the more structured, deliberate, and conscious the knowledge management approach that should be applied.

The article by **Littunen**, **Tohmo**, and **Storhammar** aims to analyze the importance of internal capabilities (resources) and external information sources in implementing the product, process, marketing, and organizational innovations to maximize the firm's competitive advantage and create value for stakeholders. Furthermore, it examines the role of public organizations, business networks, firm size, and the industry sector in the emergence of different product types, processes, marketing, and organizational innovations. The research is based on the typology of innovation (product, process, marketing, and corporate) adopted by the OECD. The data from 389 SMEs in Finland were used for further calculations. Data were collected through

telephone interviews with industrial SMEs and KIBS-based companies in autumn 2017 and spring 2018. Samples from SMEs of different sizes and regions were purchased from Statistics Finland. The logistic regression analysis was applied to determine the stakeholders (various information sources) and firm-level characteristics that distinguish noninnovative and innovative companies based on the sample. The study analyzes to what extent different types of innovation rely on specific information sources.

Contrary to expectations, public support organizations were not statistically significant in any innovation model. Therefore, public support organizations should develop better mechanisms to find SMEs with solid motivations to create new products and market opportunities. The results show that creating novel products, processes, and marketing innovation is related to various external sources of information, such as fairs, the media, and the Internet. Moreover, the relationship between internal capabilities such as the firm's know-how increases SMEs' marketing and organizational innovativeness. Furthermore, the design of novel processes and corporate innovation is related to firm size. Those with less than 20 employees (smallest firms) concentrated among non-innovators, and companies with more than 20 employees focused on innovators.

The study provides comprehensive information on how different stakeholders contribute to the emergence of SME innovation. The article's authors offer a new viewpoint on the literature by examining the possible factors explaining the increase in SMEs' likelihood of implementing the product, process, marketing, and organizational innovations.

FUTURE RESEARCH

The articles in this issue suggest implications for further theoretical and practical research. In the article of **Keogh** and **Johnson**, we can find specific ways of entrepreneurs' financing options as complements to their founder attributes. We can find inspiration for future research related to the indicators of success and give advice to policymakers, financiers, and entrepreneurs because of the nuanced nonlinearities and interactions demonstrated. This research and its continuation are needed to help investors make proper decisions. As presented in the article, industry experience was most effective when combined with angel investing (to achieve revenues and employment), whereas industry experience combined with venture capital worked against success. This new finding is consistent with the existing literature on the subject and explains differences between the outcomes of the previous studies presented in the author's article. It may be interpreted by the startup's

control and strategic direction (hearkening back to Cooper et al., 1994), but it needs further research on this question.

Potoczek creates a conceptual benchmarking model that needs validation in pilot studies to verify the value chain's levels of detail. The author also formulates a need to develop research methods to build knowledge about technological and organizational innovations and their use, which significantly improve the efficiency of water utilities and the availability of their products and services.

Osadolor, Agbaeze, Isichei, and Olabosinde gave us an outlook on future studies needs as a continuation of their research related to the factors that could support young graduate interest in venture creation. The presented study's objective was to broaden understanding of how the need for independence indirectly accounts for the process between Nigerian graduates' self-efficacy and entrepreneurial intention. The results of the study help conclude that graduates' self-belief could not drive the choice to start a venture, but the impact might come from an external factor(s). The authors underlined that the decision not to open a business might be related to the evident inability to access capital or support funds required to establish a business of their own and the hostile business climate in Nigeria that is relatively harsh to new entrants. Further research is needed to understand the motivations and future needs of potential young entrepreneurs to develop a business in Nigeria, which helps to fight the high unemployment rate in the country that is forecasted to grow in 2022 from 32.5% (2021) to 33%. Also, what kind of governmental help is needed to convince a young graduate to choose the entrepreneurship route?

Sytnik and Kravchenko suggested the directions for further research related to knowledge management studies. Comparing the characteristics of knowledge management between small, medium, and large enterprises allow one to understand better the features of KM policies, procedures, tools, and practices among various sizes. The question is: does a less structured, less consistent, and less conscious knowledge management approach demonstrated by small enterprises satisfy their knowledge needs in the same way that a structured, consistent and deliberate knowledge management approach could fulfill the knowledge needs of larger enterprises? Further research is needed to determine how the different knowledge management approaches applied by small, medium, and large enterprises affect the efficiency of decision-making processes, organizational productivity and, ultimately, organizational competitiveness.

In the article of **Littunen, Tohmo, and Storhammar**, further research was suggested concerning different types of innovations in SMEs. There is a need to examine the companies in more detail and carefully decide the choice of

a sample (single industry, various industries) and country(ies) to do the research. Also, comparative studies are needed to understand better the differences and standard features of innovation activities in different organizations.

CONCLUSION

This article synthesizes the interdisciplinary research presented in this issue with the narrative literature review to explore what entrepreneurship and success factors can help drive business to resilience and stability and achieve competitive advantage in the fourth industrial revolution, technological advancement, and turbulent times. In conclusion, these factors can be grouped as (1) *human-based factors* and (2) *non-human-based factors*. In the first group, we have (a) competent, responsible, and open-minded *leaders* with well-developed soft skills to manage human resources. They can bring and maintain talent in an organization. Their attitude shows that they are open to embracing change, try to be flexible and adapt rapidly, and distribute that mindset within their staff; (b) talented *employees*, who want to share their experience and knowledge, are motivated, committed to supporting the organization in challenging moments, and want to learn to adapt rapidly in the future. The second group of factors is a compound of (a) *business culture* that empowers people (based on trust, effective communication, and empathy); (b) *business model* and its transformation to create business model innovation for sustainability; (c) *novel strategies* in a highly uncertain business environment (also financing one, related to personal attributes of the entrepreneurs); (d) *support (disruptive) technologies* that depend on the digital maturity of the business to foster its innovation and sustainability transitions.

The world is complex, and we cannot try to simplify it. Still, we should embrace the complexity by identifying and applying a new way of thinking and solving the problems in an organization (Rzevski & Brebbia, 2016). Each group of the above-presented factors is essential for business success, and their components are interdependent. We need to look at the interactions and interdependencies of their components in a dynamic and network form, e.g., as presented by Ujwary and Potoczek (2020), Lombardi Netto et al. (2020), or Greda (2009). Each company is different and is dependent on many factors that differentiate them: talented people (leaders and employees), its organizational, financial, technical and technological, environmental, social, political, and other components. That is why it cannot be simplified, focusing only on one group of factors and ignoring the other.

To balance the business necessities vs. opportunities that appear in a complex (VUCA) world, open-minded leaders are needed who are not

afraid to apply novel tools and strategies to solve the problems in their organizations by looking at them holistically. As underlined by Philip (2021), leaders should be paying attention to changing employee attitudes during a digital transformation. The business transformation will be successful only when employees are wholeheartedly committed to the company's vision and not merely when the company successfully installs some of the new and emerging technologies and implements changes. That is why human-based factors, especially the soft skills of leaders, have become crucial in an organization's digital transformation and its success in turbulent times. There is a significant need to study digital transformation, transformational leadership, and employees' behavioral changes towards business sustainability transformations. Especially, there is a necessity to present pathways for sustainable talent management during digital transformation, taking into account traditional professions, less digitally mature businesses, and developing countries.

These unique studies presented in this issue provide a valuable outlook to establish dynamic, adaptive business pathways towards a resilient and sustainable organizational future, and propose future research paths needed to execute structural business changes in different countries and business areas. Recommendations and implications for the future trends of this research stream might also be helpful for professionals and academicians.

References

- Banerjee, D., & Rai, M. (2020). Social isolation in Covid-19: The impact of loneliness. *International Journal of Social Psychiatry*, 66(6). <https://doi.org/10.1177/0020764020922269>
- Bennett, N., & Lemoine, G. J. (2014). What a difference a word makes: Understanding threats to performance in a VUCA world. *Business Horizons*, 57(3), 311-317. <https://doi.org/10.1016/j.bushor.2014.01.001>
- Bocken, N., Weissbrod, I., & Antikainen, M. (2021). Business experimentation for sustainability: Emerging perspectives. *Journal of Cleaner Production*, 281(4). <https://doi.org/10.1016/j.jclepro.2020.124904>
- Bunker, K., & Wakefield, M. (2004). In search of authenticity: Now more than ever, soft skills are needed. *Leadership in Action*, 24(1), 17-21. <https://doi.org/10.1002/lia.1055>
- Chong, E., Handscomb, C., Williams, O., & Hall, R. (2020). Agile resilience in the UK: Lessons from COVID-19 for the "next normal." McKinsey & Company. Retrieved from <https://www.mckinsey.com/business-functions/organization/our-insights/agile-resilience-in-the-uk-lessons-from-covid-19-for-the-next-normal>
- Cukier, W., Mccallum, K.E., Egbunonu, P., & Bates, K. (2021). The mother of invention: Skills for innovation in the post-pandemic world. *The Future*

- Skills Centre Report*. Canada. Retrieved from https://www.ryerson.ca/diversity/reports/MotherOfInvention_EN.pdf
- Dirani, K.M., Abadi, M., Alizadeh, A., Barhate, B., Garza, R. C., Gunasekara, N., Ibrahim, G., & Majzun, Z. (2020) Leadership competencies and the essential role of human resource development in times of crisis: A response to Covid-19 pandemic. *Human Resource Development International*, 23(4), 380-394. <https://doi.org/10.1080/13678868.2020.1780078>
- Dyduch, W. (2019). Entrepreneurial strategy stimulating value creation: Conceptual findings and some empirical tests. *Entrepreneurial Business and Economics Review*, 7(3), 65-82. <https://doi.org/10.15678/EBER.2019.070304>
- Filser, M., Kraus, S., Breier, M., Nenova, I., & Puumalainen, K. (2021). Business model innovation: Identifying foundations and trajectories. *Business Strategy and the Environment*, 30(2), 891-907. <https://doi.org/10.1002/bse.2660>
- Frank, A., Mendes, G., Ayala, N., & Ghezzi, A. (2019). Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. *Technological Forecasting and Social Change*, 141, 341-351. <https://doi.org/10.1016/j.techfore.2019.01.014>
- Galea, S., Merchant, R. M., & Lurie, N. (2020). The mental health consequences of COVID-19 and physical distancing. The need for prevention and early intervention. *JAMA Internal Medicine*, 180(6), 817-818. <https://doi.org/10.1001/jamainternmed.2020.1562>
- Gastaldi, L., Lessanibahri, S., Tedaldi, G., & Miragliotta, G. (2022). Companies' adoption of Smart Technologies to achieve structural ambidexterity: An analysis with SEM. *Technological Forecasting and Social Change*, 174. <https://doi.org/10.1016/j.techfore.2021.121187>
- Gręda, A. (2009). Application of the AHP/ANP in food quality management. Retrieved from http://www.isahp.org/2009Proceedings/Final_Papers/98_Greda_ANP_in_FoodQualityManagement.pdf
- Giones, F., Brem, A., & Berger, A. (2019). Strategic decisions in turbulent times: Lessons from the energy industry. *Business Horizons*, 62(2), 215-225. <https://doi.org/10.1016/j.bushor.2018.11.003>
- Gulati, R., & Reaiche, C. H. (2020). Soft skills: A key driver for digital transformation. Retrieved from https://www.researchgate.net/profile/Richa-Gulati/publication/346171713_Soft_Skills_A_Key_Driver_for_Digital_Transformation/links/5fbca7c0a6fdcc6cc65e38e1/Soft-Skills-A-Key-Driver-for-Digital-Transformation.pdf
- Gurzawska, A. (2021). Responsible innovation in business: Perceptions, evaluation practices and lessons learned. *Sustainability*, 13. <https://doi.org/10.3390/su13041826>
- Hoque, A.S., Gwadabe, U.M., & Rahman, A. (2017). Corporate entrepreneurship upshot on innovation performance: The mediation of employee engagement. *Journal of Humanities, Language, Culture*,

- and Business*, 1(6), 54-67. <http://inderscience.metapress.com/link.asp?id=py74f67qv8xevf83>
- Huang, R., Kahai, S., & Jestice, R. (2010). The contingent effects of leadership on team collaboration in virtual teams. *Computers in Human Behavior*, 26(5), 1098-1110. <https://doi.org/10.1016/j.chb.2010.03.014>
- Josten, C., & Lordan, G. (2021). The accelerated value of social skills in knowledge work and the COVID-19 pandemic. *LSE Public Policy Review*, 1(4), 1-10. <https://doi.org/10.31389/lseppr.31>
- Kane, G., Palmer, D., Phillips, A., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. *MIT Sloan Management Review*, July 14. Retrieved from <https://sloanreview.mit.edu/projects/strategy-drives-digitaltransformation/>
- Kohnke, O. (2016). It's not just about technology: The people side of digitization. In G. Oswald & M. Kleinemeier (Eds.), *Shaping the Digital Enterprise. Trends and Use Cases in Digital Innovation and Transformation* (pp. 69-91). Berlin: Springer International Publishing. https://doi.org/10.1007/978-3-319-40967-2_3
- Lepeley, M. T., Beutell, N. J., Abarca, N., & Majluf, N. (2021). *Soft Skills for Human-Centered Management and Global Sustainability*. New York: Routledge.
- Loan, L., Doanh, D., Thang, H., Viet Nga, N., Van, P., & Hoa, P. (2021). Entrepreneurial behaviour: The effects of the fear and anxiety of Covid-19 and business opportunity recognition. *Entrepreneurial Business and Economics Review*, 9(3), 7-23. <https://doi.org/10.15678/EBER.2021.090301>
- Lombardi Netto, A., Salomona, V.A.P., Ortiz-Barrios, M. A., Florek-Paszowska, A., Petrillo, A., & De Oliveira, O. J. (2020). Multiple criteria assessment of sustainability programs in the textile industry. *International Transactions in Operational Research*, 28(3), 1-23. <https://doi.org/10.1111/itor.12871>
- Lyke-Ho-Gland, H., Trees, L., & Morgan, L. (2019). Measures of digital transformation. *APQC Survey Summary Report*. Retrieved from <https://www.apqc.org/resource-library/resource-listing/measures-digital-transformation-survey-report>
- Marona, B., & Tomal, M. (2020). The COVID-19 pandemic impact upon housing brokers' workflow and their clients' attitude: Real estate market in Krakow. *Entrepreneurial Business and Economics Review*, 8(4), 221-232. <https://doi.org/10.15678/EBER.2020.080412>
- Masumba, D. (2019). *Leadership for Innovation: Three Essential Skill Sets for Leading Employee-Driven Innovation*. New York: Morgan James Publishing.
- Miceli, A., Hagen, B., Riccardi, M., Sotti, F., & Settembre-Blundo, D. (2021). Thriving, not just surviving in changing times: How sustainability, agility, and digitalization intertwine with organizational resilience. *Sustainability*, 13(4). <https://doi.org/10.3390/su13042052>

- Nasser, W. (2021). Innovation capital, sustainable entrepreneurial orientation, and the moderating role of entrepreneurial resilience. *Entrepreneurial Business and Economics Review*, 9(3), 73-85. <https://doi.org/10.15678/EBER.2021.090305>
- Palomares, I., Martínez-Cámara, E., & Montes, R. (2021). A panoramic view and SWOT analysis of artificial intelligence for achieving the sustainable development goals by 2030: Progress and prospects. *Applied Intelligence*, 51, 6497–6527. <https://doi.org/10.1007/s10489-021-02264-y>
- Pauli, U., & Poczowski, A. (2019). Talent management in SMEs: An exploratory study of polish companies. *Entrepreneurial Business and Economics Review*, 7(4), 199-218. <https://doi.org/10.15678/EBER.2019.070412>
- Pena-Boquete, Y., & Dios-Murcia, I. (2021). Factors behind the employment loss in Galicia: Great Recession of 2008 vs. the first wave of the COVID-19 pandemic. *Revista Galega De Economía*, 30(1), 1-18. <https://doi.org/10.15304/rge.30.1.7451>
- Philip, J. (2021). Viewing digital transformation through the lens of transformational leadership. *Journal of Organizational Computing and Electronic Commerce*, 31(2), 114-129. <https://doi.org/10.1080/10919392.2021.1911573>
- Pichlak, M., & Szromek, A.R. (2021). Eco-innovation, sustainability and business model innovation by open innovation dynamics. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2). <https://doi.org/10.3390/joitmc7020149>
- Pieroni, M., McAloone, T., & Pigosso, D. (2021). Circular economy business model innovation: Sectorial patterns within manufacturing companies. *Journal of Cleaner Production*, 286. <https://doi.org/10.1016/j.jclepro.2020.124921>
- Preghenella, N., & Battistella, C. (2021). Exploring business models for sustainability: A bibliographic investigation of the literature and future research directions. *Business Strategy and the Environment*, 30(5), 2505-2522. <https://doi.org/10.1002/bse.2760>
- Rohde, N., D'Ambrosio, C., & Tang, K.K. (2016). Estimating the mental health effects of social isolation. *Applied Research Quality Life*, 11, 853–869. <https://doi.org/10.1007/s11482-015-9401-3>
- Rueda Cantuche, J. M. (2021). The economy of the European Union in times of COVID-19. *Revista Galega De Economía*, 30(1), 1-17. <https://doi.org/10.15304/rge.30.1.7663>
- Rymarczyk, J. (2020). Technologies, opportunities and challenges of the industrial revolution 4.0: Theoretical considerations. *Entrepreneurial Business and Economics Review*, 8(1), 185-198. <https://doi.org/10.15678/EBER.2020.080110>
- Rzevski G., & Brebbia, C. A. (2016). *Complex Systems. Fundamentals and Applications*. Southampton, Boston: WIT Press.
- Sariwulan, T., Thamrin, S., Suyatni, M., Agung, I., Widiputera, F., Susanto, A. B., & Capnary, M. C. (2021). Impact of employee talent

- management. *Academic Journal of Interdisciplinary Studies*, 10(5), 184. <https://doi.org/10.36941/ajis-2021-0133>
- Song Ng, H. (2021). Are managers still necessary in the era of the fourth industrial revolution (4.0)? In *Future of Work, Work-Family Satisfaction, and Employee Well-Being in the Fourth Industrial Revolution* (pp. 81-98). Pennsylvania: IGI Global: International Academic Publisher. <https://doi.org/10.4018/978-1-7998-3347-5.ch006>
- Syrett, M., & Devine, M. (2012). *Managing Uncertainty: Strategies for Surviving and Thriving in Turbulent Times*. Hoboken, NJ: Wiley.
- Tang, D. (2021). What is digital transformation? *The EDP Audit, Control, and Security Newsletter*, 64(1), 9-13. <https://doi.org/10.1080/07366981.2020.1847813>
- Taran, Y., Boer, H., & Lindgren, P. (2015). A business model innovation typology. *Decision Sciences*, 46(2), 301-331. <https://doi.org/10.1111/dec.12128>
- Tassabehji, R., & Isherwood, A. (2014). Management use of strategic tools for innovating during turbulent times. *Strategic Change: Briefings in Entrepreneurial Finance*, 23, 63-80. <https://doi.org/10.1002/jsc.1960>
- Thambusamy, R., & Zafer, B. (2020). Virtual leadership in small businesses during the COVID-19 pandemic: Challenges and possibilities. *European Journal of Social & Behavioural Sciences*, 29(3), 3214-3224. <https://doi.org/10.15405/ejbs.2020.08.issue-3>
- Ujwary-Gil, A., & Potoczek, N.R. (2020). A dynamic, network, and resource-based approach to the sustainable business model. *Electronic Markets*, 30(4), 717-733. <https://doi.org/10.1007/s12525-020-00431-6>
- Veldhuizen, C. (2021). Conceptualizing the foundations of sustainability-focused innovation policy: From constructivism to holism. *Technological Forecasting and Social Change*, 162(C). <https://doi.org/10.1016/j.techfore.2020.120374>
- Ziadlou, D. (2021). Strategies during digital transformation to make progress in the achievement of sustainable development by 2030. *Leadership in Health Services*, 34(4), 375-391. <https://doi.org/10.1108/LHS-08-2020-0056>

Abstrakt

CEL: Zbadanie, jakie czynniki przedsiębiorczości i sukcesu mogą pomóc w osiągnięciu odporności i stabilności biznesu oraz osiągnięciu przewagi konkurencyjnej dzięki innowacjom w różnych krajach i realiach biznesowych w erze transformacji cyfrowej i turbulentnych czasach. **METODYKA:** Na podstawie narracyjnego przeglądu literatury przedstawiamy wyniki badań dotyczących nowych strategii i perspektyw dla innowacji biznesowych w czasach wielu niewiadomych. Każda organizacja chce znaleźć drogę do sukcesu i stworzyć swój unikalny model biznesowy, który może uchwycić tworzenie wartości i innowacyjność oraz być bardziej adaptacyjnym, odpornym i stabilnym w krytycznych momentach oraz zrównoważonym w czasie. **WYNIKI:** Artykuły przedstawione w tym numerze pozwalają odkryć podstawowe czynniki innowacyjności i sukcesu biznesowego w różnych organizacjach i środowiskach, w których te

przedsiębiorstwa funkcjonują. **IMPLIKACJE DLA TEORII I PRAKTYKI:** W artykule dokonano syntezy znaczenia prezentowanego pola badawczego, łącząc jego teoretyczne tło z praktycznymi badaniami. Zalecenia i implikacje dla przyszłych trendów tego nurtu badawczego mogą być również pomocne dla profesjonalistów i naukowców. **ORYGINALNOŚĆ I WARTOŚĆ:** Nowatorskie badania przedstawione w tym numerze zostały przeprowadzone w pięciu różnych (rozwijających się i rozwiniętych) krajach i sektorach biznesu, które przedstawiają różne ludzkie i pozaludzkie czynniki jako kluczowe do wzmocnienia transformacji biznesowej w złożonym świecie. Każda grupa elementów ma kluczowe znaczenie dla sukcesu biznesowego, a ich składniki są od siebie współzależne. Musimy patrzeć na interakcje i współzależności jego komponentów w dynamicznej i sieciowej formie i nie możemy upraszczać rzeczywistości, skupiając się tylko na jednej grupie komponentów biznesowych, ignorując pozostałe. Te unikalne badania zapewniły cenną perspektywę ustanowienia dynamicznych, adaptacyjnych ścieżek biznesowych w kierunku zrównoważonej i odpornej przyszłości organizacyjnej oraz pozwoliły na stworzenie propozycji przyszłych ścieżek badawczych potrzebnych do przeprowadzenia zmian strukturalnych w przedsiębiorstwach. **Słowa kluczowe:** model biznesu, innowacyjność, krytyczne czynniki sukcesu, transformacja cyfrowa, zarządzanie wiedzą, zarządzanie talentami, konkurencyjność, przywództwo, transformacja, zarządzanie zmianą, VUCA

Biographical notes

Anna Florek-Paszowska, Ph.D. in economics in management science, finished at the University of Warsaw, Poland. She works as a full-time professor at the Department of Management at Centrum Católica Business School PUCP (No.1 Business School in Peru and one of the best MBA business schools in the world with four accreditations). She is a student of prof. Thomas L. Saaty, USA (founder of Analytic Hierarchy and Network Processes – AHP/ANP) with over 20 years of experience applying and teaching AHP/ANP. The author of over 60 scientific articles, cooperates as a reviewer with publishers, i.e., Springer, Taylor & Francis, Emerald, Inderscience, International Journal of the Analytic Hierarchy Process, Associação Brasileira de Engenharia de Produção and Annals of Operations Research. She participated in eight research projects and the organization of international conferences and events in various countries. She is a member of the International Journal of the Analytic Hierarchy Process (IJAHPP) editorial board.

Anna Ujwary-Gil, Ph.D. Hab., is professor at the Institute of Economics, Polish Academy of Sciences in Warsaw, Poland. She received her Ph.D. and habilitation in economics and management from the Warsaw School of Economics, Poland. She is founder and president of the Cognitione Foundation for the Dissemination of Knowledge and Science. Her research interests include social (organizational) network analysis, knowledge management, intellectual

capital, resource-based views, and dynamic approaches to organization and management. She published her works in *Library & Information Science Research*, *Electronic Markets*, *Journal of Business and Industrial Marketing*, or *Economics & Sociology*.

Bianka Godlewska-Dzioboń, Ph.D., is assistant professor at the Cracow University of Economics (UEK) in the Department of Public Policies, Faculty of Public Economy and Administration. Moreover, she is the Vice-Rector for Cooperation and Development of the Podhale State Vocational University in Nowy Targ, Poland. Expert and trainer in research and implementation projects in the field of promoting academic entrepreneurship and competence development. Founder of the UEK Dialogue Laboratory, an initiative connecting the university community: students, research, and teaching staff with the business community and local government.

Conflicts of interest

The authors declare no conflict of interest.

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Survival of the funded: Econometric analysis of startup longevity and success

Daniel Keogh¹, Daniel K.N. Johnson² 

Abstract

PURPOSE: *The existing literature on the success of startup enterprises is thorough in investigating individual factors, but relatively weak in testing those factors in combination. This research tests for interactive effects, i.e., complementarities, between those factors.* **METHODOLOGY:** *We use a Cox proportional hazard model to estimate longevity in startups, supplementing it with maximum likelihood estimation of two metrics of success (employment and revenue). In each model, we explicitly test for interactions between terms, thus advancing the literature.* **FINDINGS:** *Panel data analysis shows that financing strategy matters to startup success, especially when combined with specific human and social capital attributes of the founders. For example, angel investors and venture capital investors benefit differently from founders with industry experience; founders with higher educational achievement generate more revenue than their peers specifically when their startups collaborate in university partnerships.* **IMPLICATIONS FOR THEORY AND PRACTICE:** *The paper suggests specific ways in which entrepreneurs should think about financing options that are complementary with their founder attributes. Further, it suggests that the literature must be very thoughtful, not only about the indicators of success but about advice to policymakers, financiers and entrepreneurs because of the nuanced nonlinearities and interactions we demonstrate.* **ORIGINALITY AND VALUE:** *We contribute to the literature on startup financing with a large dataset, careful modelling of interactive complementarities of between inputs, correction of the potential sample selection bias in previous studies, and a suite of modelled outcomes (survival, employment, and revenue) which allow for nuanced results.*

Keywords: *startup, business survival, revenues, venture financing, human capital, competitive advantage, new ventures, firm performance*

1 Daniel Keogh, Data Scientist, Quantum Metric, 10807 New Allegiance Dr, Ste 155, Colorado Springs, CO 80921, USA, e-mail: dansekeogh@gmail.com

2 Daniel K.N. Johnson, Ph.D., Professor of Economics, Colorado College, Department of Economics and Business, 14 E Cache la Poudre Street, Colorado Springs, CO 80903, USA, e-mail: djohnson@coloradocollege.edu (ORCID ID <https://orcid.org/0000-0002-5142-0940>).

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INTRODUCTION

There is a long literature about why new businesses fail. Yet that literature appears inadequate in light of the fact that the failure rate of new businesses is 90% (Carrigan, 2020) in the United States, where those same new businesses account for as much as 50% of new job creation year-to-year across a host of industries (Fairlie et al., 2016). That combination of facts has led to the development of new capitalization strategies, including venture capitalists (VCs) and angel investors, exclusively for high-risk investment scenarios. Our research here improves existing models of startup survival and success, adding to the literature in several critical ways. We use multiple alternative models of success, interaction terms to permit nonlinear outcome response functions, and nuanced estimation strategies, which all contribute to a more detailed understanding of startup success via financing choices.

Many investors in startups value analytical evidence on the quantitative traits of a firm which pre-determine success, but other investors look almost exclusively at the qualitative traits of the startup and the character traits of successful founders which predict survival (Kleinert et al., 2020; Wang et al., 2019). Still, others take a special interest in specific industries, with investment decisions informed largely by their familiarity and expertise in a certain field. These investment philosophies have likened startup investing to horse racing: one can bet on the jockey (the entrepreneur), the horse (the business), or the race (the industry/market), as pointed out by Kaplan et al. (2009). In practice, successful investors are informed by all three philosophies in tandem. Given that venture capital investment in startups exceeded \$300 billion in 2020 despite the pandemic (Teare, 2021), it is expensive if we place the wrong bets. While the literature has thoughtfully explored the separate contributors of success, it has been very limited in measuring the interactions between those same factors.

This paper will model and test potential complementarities between financing strategies and the personal attributes of the entrepreneurs, using survival rates as a measure of success. In other words, it might be critical to recognize that some financing strategies work best in conjunction with other inputs/factors and less well on their own. We recognize that survival (i.e., “continued existence”) masks a diversity of outcomes, so we also model revenue growth and employment levels to round out the picture. Finally, this is the first paper, of which we are aware, to correct for potential sample selection bias in performing startup-survival modeling. The resulting analysis is a test of the hypothesis that it is a combination of factors that matter for startup success, that no one financing strategy is superior on its own, but rather it is nuance and context (the presence of other factors) that are critical.

LITERATURE REVIEW

As young firms, startups lack long time-trends of metrics used to evaluate older businesses; the question of how to identify and measure startup success is an argument in the economic literature (Laitinen, 2019; Baluku et al., 2016). Research has diverged into predominantly two directions: a) through the presence of successful financing under the hypothesis that investment by a competitive source is a strong signal of success (e.g., Wang et al., 2019), and b) through metrics standard in evaluating older ventures. That latter path is exemplified by studies using firm survival (Hipp and Binz, 2020), sales growth (Bednar et al., 2018), turnover (Kim, 2020), or return on equity (Laitinen, 2019). Since objective success and financing outcomes are inextricably linked, investor financing may be determined, which then creates further success either objectively or via subsequent rounds of subjective investor decisions (Kleinert et al., 2021).

Typically, Cox proportional hazard functions are used to measure new-venture survival, although with varying levels of success (Cader & Leatherman, 2011; Delmar & Shane, 2006). Other survival-time regressions are also common depending on data availability (Bosma et al., 2004), and for non-binary indicators such as revenues or employment, more conventional maximum likelihood estimation of probits, logits, and tobits are traditional (Bosma et al., 2004; Delmar & Shane, 2006). However, there is inherent bias in these non-binary regressions as data panels are invariably unbalanced with missing values from failed firms; researchers have coped with this bias in a variety of ways (e.g., Boehmke et al., 2006; Cader & Leatherman, 2011).

The proposition that a firm's financing technique can explain success is a popular thought (Baum & Silverman, 2004; Huyghebaert et al., 2007; Ahmed & Cozzarin, 2009; Yankov et al., 2014). However, if that decision is itself endogenous, a function of characteristics of the market or founder, then the story and model must become more complex. Several studies model the first endogenous stage, investment criteria, via the effects of the entrepreneur, industry, and the firm's strategy on venture success (Kleinert et al., 2020; Wang et al., 2019; Van Gelderen, 2004). Previous literature has found strong links between the entrepreneur and the firm's financing, so this begs questions as to when both are accounted for, if either of these have effects on new venture success (Sanyal & Mann, 2010; Baum & Silverman, 2004).

In a two-stage model, financial intermediaries not only select which firms get financing but influence survival and other success outcomes. Baum and Silverman (2004) describe how venture capital, for example, identifies potential and offers validation as well as the coaching and resources that a startup needs to survive: not just funding but portfolio company alliances,

or advisors. However, the effects were entangled, since more funding correlated with founder characteristics, more alliances, more intellectual capital and more human or network capital, making it impossible to determine the true “causes” of success (Baum & Silverman, 2004) This opens debate about the differences between financial, human capital and social capital, and how each affect new-venture success (Bosma et al., 2004; Yankov et al., 2014; Larson, 1992). In a sense, founder traits come first, and determine the type and amount of funding that a startup may receive. In their research, Sanyal and Mann (2010) analyze how an entrepreneur’s assets, communication of relevant information, and personal characteristics predict what type of financing they pursue or attain. They find that more educated entrepreneurs are more likely to pursue debt-financing while serial entrepreneurs are just as likely to self-fund, pursue external debt, or external equity due to mitigated information opacity.

Given the choice of funding, Bosma et al. (2004) quantified the effects of financing strategy, controlling for talent. They conclude that human capital (such as education or startup experience) and social capital (such as a geographic location or ties to industry professionals) play a decisive role in predicting survival, profit, and employment. Cooper et al. (1994) conclude that general human capital such as education level and demographics play a stronger role in success than managerial know-how such as past entrepreneurial experience and advisors do. However, there is active debate on their relative effects (Baum & Silverman, 2004; Bosma et al., 2004; Yankov et al., 2014). Delmar and Shane (2006) added the additional insight that the distinction between general and managerial-specific human capital varies with the age of the startup. In essence, there is a strong correlation or complementarity between factors predictive of success, with little clarity on which comes first (Bapna, 2019).

Founder identity attributes were found to be statistically significant by Banir (2014) in his paper evaluating determinants of gender differentials in the entrepreneurial space. Models that closely resemble this study include such controls whenever the entrepreneur is evaluated (Bosma et al., 2004; Sandberg & Hofer, 1987). Clearly, factors beyond financing and founder attributes must also be considered. For example, Conti et al. (2013) found that patents, especially in certain industries, are significantly and largely predictive of new venture performance. Other studies use intellectual property variables to control for novelty of a product and innovative capacity of the firm (Baum & Silverman, 2004; Sanyal & Mann, 2010). Not controlling for industry or sector may skew the results (Yankov et al., 2014). With many investors looking exclusively at specific industries, it is important to account for the fact that this selection bias in the investment process may not be

explained by the venture financing variables (Sanyal & Mann, 2010; Cooper et al., 1994). Hence, we will be careful to include panel effects for each economic sector in the analysis that follows.

Building on this literature then, this paper proposes an empirical test of the hypothesis that financing strategy effectiveness is significantly dependent upon (and complementary with) founder characteristics. We hypothesize a structure for that exploration in the subsequent section, a model that reflects the complexity while attaining clear results.

METHODOLOGY

Suppose that survival is modeled as a binary outcome using the Cox proportional hazard function so that

$$\begin{aligned} Survival(t) = & \alpha_s(t) \exp \left(\sum \beta_{s,i} financing_i + \sum \gamma_{s,i} collaboration_i \right. \\ & + \sum \delta_{s,i} intellectual\ property_i + \sum \theta_{s,i} human\ or\ social\ capital_i \\ & + \sum \mu_{s,i} founder\ demographics_i + \sum \sigma_{s,i} industry_i \\ & \left. + \sum \tau_{s,i} interactions_i \right) + \varepsilon_s \end{aligned}$$

where coefficients are estimated for survival (s) on each input's separate subtypes (i), which might affect survival probabilities independently. Specifically, financing is divided into six categories: angels, equity companies, venture capital, debt, government funding, and Friends/Family/Fools (FFF) sourcing. Collaboration, or competitive advantage, is recorded as a series of four binary indicators for the presence/absence of university partnerships, company partnerships, existing patent protection, and government lab collaboration. Intellectual property (IP) is listed as three count variables, the number of copyrights, trademarks, and patents owned. Human or social capital is recorded as years of education of the founder, previous founder work experience, and industry experience. Founder demographics are listed as binary variables to indicate the founder's identity as Hispanic, Native American, Asian, Black, and/or White, along with the age of the founder. We include fourteen industry indicator variables to accommodate for sectoral differences and five interaction terms to test for potential complementarities between human/social capital and collaborative or financing strategies. Naturally, there is also an error term included.

Using the results of that estimation, we propose two other dependent variables—revenues and employment—each also used to measure new-

venture success (Hipp & Binz, 2020; Bednar et al., 2018; Kim, 2020; Groenewegen & de Langen, 2012; and others). Those additional dependent variables are modeled as conditional on survival to avoid sample selection bias by using only the surviving firms, but otherwise include the same explanatory variables. The model is therefore as follows, for revenue (with coefficients subscripted r) and for employment (with coefficients subscripted e):

$$\begin{aligned} \text{Revenue}(t) = & \alpha_r(t) \exp \left(\sum \rho_{r,i} \text{survival} + \sum \beta_{r,i} \text{financing}_i + \sum \gamma_{r,i} \text{collaboration}_i \right. \\ & + \sum \delta_{r,i} \text{intellectual property}_i + \sum \theta_{r,i} \text{human or social capital}_i \\ & + \sum \mu_{r,i} \text{founder demographics}_i + \sum \sigma_{r,i} \text{industry}_i \\ & \left. + \sum \tau_{r,i} \text{interactions}_i \right) + \varepsilon_r \end{aligned}$$

$$\begin{aligned} \text{Employment}(t) = & \alpha_e(t) \exp \left(\sum \rho_{e,i} \text{survival} + \sum \beta_{e,i} \text{financing}_i \right. \\ & + \sum \gamma_{e,i} \text{collaboration}_i + \sum \delta_{e,i} \text{intellectual property}_i \\ & + \sum \theta_{e,i} \text{human or social capital}_i + \sum \mu_{e,i} \text{founder demographics}_i \\ & \left. + \sum \sigma_{e,i} \text{industry}_i + \sum \tau_{e,i} \text{interactions}_i \right) + \varepsilon_e \end{aligned}$$

where survival is a set of three variables in a two-stage least squares correction for sample selection; those variables are a constant, the explicit instrument for survival and lagged revenues to correct for trend effects. Since these variables are continuous but non-negative, we use a limited information maximum likelihood approach with instrumental variables to eliminate concerns about non-normality and heteroskedasticity.

One of the critical and creative elements of this paper's model is a focus on the interaction vectors listed last in the models above, to test potential complementarities between inputs: the product of human capital with competitive advantage terms, and the interaction of human capital with venture financing. Our goal is to discern whether particular types or depths of human capital empower or erode the impact of other critical factors. To our knowledge, this paper is the first to test explicitly and empirically for the presence of those complementarities. In mathematical terms, our hypothesis is that the values of τ (coefficients on the interaction terms) are not zero, all other things are held equal.

Our data come from a noted primary source of startup data, the Kauffman Firm Survey (KFS), which was conducted annually by Mathematica Policy

Research (Kauffman Foundation, 2021). The sample observed 4,298 firms over the 2005-2012 period, registering questions on the founders and the firms spanning demographics, financials, strategy, and organization. Unfortunately, it would be impractical to collect those proprietary data ourselves, so we rely on the reputation of the KFS for data integrity and anonymization.

Survival is defined until a firm reported that it was out of business or failed to return the survey. If it reported having merged or been acquired, or if it missed a year of reporting before reappearing, it was removed from our sample entirely. Obviously, this researcher choice leads to potential bias, for example, if a firm failed to report in the last sample year but is still in business. It also leads to potential bias against firms that are successful, so successful that they were acquired or merged with other firms. However, from our perspective we could not discern the reasons for those events so we chose to avoid potentially false interpretations. Therefore, of our 3,768 sample firms, a little more than one-quarter fail in the first year, while more than one-third survive through all eight years.

Employment and revenues were more easily defined as self-reported by surveyed firms. In the first year of the sample, median employment is 1.5 employees, while in the last year surviving firms had a median employment of 4.1 employees. Median revenue level in the first sample year is 3.73 on a categorical survey scale where level 3 is \$1,001 - \$3,000 and level 4 is \$3,001 - \$5,000. Surviving firms in the final year showed a median revenue level of 7.25, consistent with \$25,001 - \$100,000.

The specific types of financing of interest are Friends, Family, and Fools (FFF) money, Venture Capital (VC), Angel financing, Government Investment, or Debt. The identification of these types is meant to capture the effects on performance that are implicit with different kinds of financing. By including these variables, one can explore what the combination of founder capital and types of financing have on the success of the firm.

Venture financing in our analysis is defined as a binary variable, because although there were survey questions about equity percentage, most respondents did not complete those questions. Debt financing was more thoroughly reported by respondents, but funding by Friends, Family, and Fools (FFF) was once again binary due to reporting limitations. In 2004, for example, there are 69 firms that received angel investment (~1.8%), 44 with company equity (~1.1%), 18 (~0.5%) with government investment, 20 (~0.5%) with VC investment, 129 (~3.4%) with FFF investment, and about 2,011 (~53%) that pursued debt financing. We treat the excluded category as implicitly self-funded, and of course, partial funding by one of the listed sources implies self-funding of the remainder as well. These listed percentages decrease over time but generally remain at a constant share of surviving firms.

The competitive advantages of the firm are broken down into partnerships that the firm has with different entities (university, government lab or research center, private company, or a patent advantage). On one hand, these advantages are often seen as the result of receiving certain types of funding, such as VCs linking up portfolio companies or facilitating a connection to government (Baum & Silverman, 2004). On another, pre-funding competitive advantages have been found to be one of the strongest predictors in receiving venture financing (Conti et al., 2013). All-in-all, these variables are key in measuring firm networks, as they are the most tangible input the data set has for relationships that may cause success.

Survey questions related to specific types of competitive advantages were only asked starting in 2007, as opposed to an aggregate question about the presence or absence of competitive advantages which was asked in 2004-2006. We assumed no change in the nature of those competitive advantages, and backfilled for years prior to 2007. Thus, in 2004-2007 there are 95 firms (~2.5% of the sample) with university partnership competitive advantages, 337 firms (~8.9% of the sample) with company partnership competitive advantages, 115 firms (~3% of the sample) with patent competitive advantages, and 40 firms (~1.1% of the sample) with a government lab competitive advantage. These absolute numbers typically fall over time, but rise as a percentage of firms that have survived. It is also worth controlling for the specific types of intellectual property (IP) that each startup controls: trademarks, copyrights, and patents. While our median sample firm held no IP of any sort, some prolific and heavily legally protected firms are worth respecting with this separation of IP types.

In the case of multiple founders, we included only the attributes of the primary founder. Education had to follow the initial survey style, which categorized the highest level of education attained on a scale of 1 (less than secondary school) through 10 (doctoral degree), and the median education value is 6.26 (between an associate's and bachelor's degree). Age was similarly constrained to a scale from 1 (ages 18-24 years) through 7 (over 75 years), with a median of 3.55 (where level 3 is ages 35-44 and level 4 is 45-54). Approximately one in 6 founders had relevant founder experience, and the average founder had 12.7 years of other professional experience.

The model will also contain founder characteristics, to control for non-human capital-based factors that a founder may bring to a startup that still may influence its performance, such as age and race. The vast majority of founders identified as white (82%). Naturally, we want to include control variables to isolate effects properly. The first group of control variables is industry specific controls, accounting for NAICS codes, as well as if the founder identifies the firm as high-tech. In our sample, 511 firms (13%) are

self-defined as “high-tech” at the beginning of the sample, a percentage that increases with attrition. The industries most strongly represented were manufacturing (18%) and professional services (25%).

RESULTS

Some of the Cox proportional hazard survival regression results are (happily) unsurprising. Robustness tests that included alternative control variables for size (whether measured by total assets, total liabilities, or total debt) or region showed no effect on the remaining coefficients, so they were omitted to avoid potential collinearity with the central variables of interest. Turning to the variables central to this study, we report their estimated impact on survival in Table 1.

Table 1. Survival regression results

Variable	Hazard Ratio	Std Error	Z-Statistic
Financing (β)			
Angels	0.2885**	0.1739	-2.06
Equity companies	0.4845	0.2525	-1.39
Venture capital	1.0343	0.4776	0.07
Debt	0.1381***	0.0093	-29.38
Government	3.6150***	1.4939	3.11
FFF	0.5581**	0.1623	-2.01
Competitive advantages and collaboration (γ)			
University	0.6829***	0.1583	-1.65
Company	0.1751***	0.0283	-10.76
Patent (yes/no)	0.5071	0.1332	-2.59
Government Lab	0.7629	0.1830	-1.13
Intellectual property (δ)			
Copyrights (count)	0.9330**	0.0283	-2.29
Trademarks (count)	0.6316***	0.0765	-3.8
Patents (count)	0.9998***	0.0000	-4.2
Human and social capital of founder (θ)			
Education level	0.9774**	0.0091	-2.46
Previous founder experience	1.0842	0.0550	1.59
Industry experience	0.9903***	0.0020	-4.82

Variable	Hazard Ratio	Std Error	Z-Statistic
Founder demographics (μ)			
Hispanic	1.2867***	0.1022	3.17
Native American	0.9757	0.0987	-0.24
Asian	0.8589	0.1068	-1.22
Black	1.1175	0.1065	1.17
White	0.8641	0.0698	-1.81
Age	0.9601***	0.0171	-2.28
Industry (σ)			
Mining	1.2445	0.7350	0.37
Construction	0.6574	0.3340	-0.83
Utilities	1.1000	0.0771	1.36
Manufacturing	1.0302	0.0605	0.51
Transportation and Warehousing	1.0937	0.1260	0.78
Information	0.8324	0.0938	-1.63
Financial Services	1.0458	0.1014	0.46
Real Estate	0.8250*	0.0962	-1.65
Professional Services	0.8898**	0.0519	-2.00
Management	2.0140***	0.4724	2.98
Waste management	0.9563	0.0727	-0.59
Education	0.8693	0.2271	-0.54
Recreation	0.9518	0.1277	-0.37
Food	1.3191**	0.1743	2.1
High tech	1.0171	0.0632	0.27
Selected interactions of human capital with competitive advantage (τ)			
Founder education x university collaborator	0.8944***	0.0256	-3.9
Relevant industry experience x company collaborator	0.1516***	0.0537	-5.33
Previous founder experience x company collaborator	0.9047***	0.0125	-7.25
Selected interactions of human capital with financing style (τ)			
Relevant industry experience x venture capital	0.5478	0.5419	-0.61
Relevant industry experience x equity company	0.4074	0.4322	-0.85

Note: * indicates significance the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level.

Most notably among financing variables (β), firms financed by a government source are much more likely to fail, at a hazard rate 3.6 times the failure rate of other sample firms. At the other extreme, FFF equity appears to improve survival, cutting hazard rates almost in half. Safest of all are angel investments and debt financing, which reduce the risk of failure by 71 and 86 percent respectively, both remarkable risk reductions not only statistically but financially. Other financing choices show no statistically significant effects.

Competitive advantages (γ) reduce the risk of failure demonstrably as well, especially for university partnerships (by 32 percent) and commercial partnerships (by 82 percent). Lab partnerships are associated with a hazard reduction but show no statistical significance. The presence of patents alone does not appear significant, but once the quantity of intellectual property (δ) is factored into the equation, more copyrights, more patents and especially more trademarks all serve to significantly reduce the risk of failure with each additional piece of IP.

Founder education and previous experience (θ) in the industry both help to reduce failure risk at statistically significant levels, but previous startup leadership by the founder has no statistical relevance.

Interestingly, among founder identities (μ), Hispanic founders have a significantly higher hazard rate than others, *ceteris paribus*, a pattern which bears further investigation by other scholars. Age serves to reduce risk, with older founders failing less often at the rate of roughly 4 percent per 10-year age tranche.

We found statistically significant industry effects (σ) in our sample, with real estate and professional services outperforming other sectors while management and food companies failed at a higher rate than their peers.

Most importantly, as evidence on our primary hypothesis (the significance of τ coefficients), there is strong and robust evidence that founder human capital interacts powerfully with a range of competitive advantage variables. In other words, more educated founders obtain even more benefit from a university collaboration, and more experienced founders (or repeat entrepreneurial founders) obtain exponential benefits from a commercial collaboration. Interestingly though, the same interaction does not hold true for financing strategy; founder human capital does not seem to complement financing strategy to broker survival success.

Revenues and employment are estimated with instrumental-variable, limited-information, maximum likelihood regressions. Survival is instrumented using survival predictions from the previous regression. To account for the effects of trend, lagged values are included as independent variables. Unfortunately, remember that revenues were reported on the survey on a range scale. Table 2 presents results for revenue on the left and

employment on the right. Notice first of all that the corrections for survival bias and lagged values (ρ) are all highly statistically significant.

Table 2. Revenues and employment by LIML IV Regression

Variable	Revenues			Employment		
	Coeff	Std Error	Z-Stat	Coeff	Std Error	Z-Stat
2SLS Controls (ρ)						
Constant	-0.599***	0.0771	-7.77	-0.433***	0.1218	-3.55
Survival instr	3.272***	0.3270	10.01	1.193***	0.4297	2.78
Lagged rev	0.528***	0.0193	27.41	0.873***	0.0221	39.45
Financing (β)						
Angels	0.550***	0.1840	2.99	0.314	0.3284	0.96
Equity comp	0.073	0.2435	0.30	0.459	0.3040	1.51
Venture capital	-0.068	0.3760	-0.18	-0.816	0.5249	-1.55
Debt	-0.165	0.1411	-1.17	-0.074	0.2315	-0.32
Government	-0.249	0.4721	-0.53	1.807	1.1797	1.53
FFF	-0.123	0.1614	-0.76	0.003	0.2418	0.01
Competitive advantages and collaboration (γ)						
University	-0.444***	0.1160	-3.83	0.138	0.1800	0.77
Company	0.078	0.0824	0.94	-0.112	0.1397	-0.80
Patent (yes/no)	0.096	0.1405	0.68	0.219	0.2797	0.79
Gov Lab	-0.052	0.0988	-0.52	-0.010	0.1998	-0.05
Intellectual property (δ)						
Copyrights (#)	0.001	0.0021	0.47	-0.002	0.0029	-0.78
Trademarks (#)	0.001	0.0001	1.64	0.001*	0.0001	1.71
Patents (#)	0.001	0.0001	-0.49	0.001	0.0001	-0.75
Human and social capital of founder (θ)						
Education level	0.015**	0.0059	2.47	0.003	0.0080	0.33
Founder exper	0.064*	0.0331	1.92	0.068	0.0515	1.33
Industry exper	0.003**	0.0012	2.08	0.003*	0.0016	1.92
Founder demographics (μ)						
Hispanic	-0.058	0.0556	-1.04	0.102	0.0821	1.24
Native Am	-0.1884**	0.0767	-2.46	-0.074	0.0849	-0.87
Asian	-0.1383*	0.0820	-1.69	0.024	0.1313	0.19
Black	-0.1033*	0.0604	-1.71	0.158	0.1021	1.55
White	0.0226	0.0515	0.44	0.037	0.0872	0.43
Age	-0.054***	0.0123	-4.37	-0.051***	0.0170	-2.98

	Industry					
Mining	-0.058	0.3437	-0.17	-0.058	0.1878	-0.31
Construction	-0.609	0.4339	-1.40	-0.418**	0.1962	-2.13
Utilities	0.018	0.0496	0.36	0.077	0.0697	1.11
Manufacturing	0.179***	0.0372	4.81	0.057	0.0515	1.1
Transport and Warehousing	0.109	0.0771	1.42	0.167	0.1068	1.56
Information	-0.049	0.0633	-0.78	-0.066	0.0797	-0.83
Finan Services	-0.088	0.0692	-1.27	-0.035	0.0686	-0.51
Real Estate	-0.215***	0.0737	-2.92	-0.034	0.0706	-0.48
Prof Services	0.051	0.0352	1.44	-0.061	0.0426	-1.43
Management	0.157	0.2387	0.66	0.113	0.5029	0.22
Waste mgmt	-0.075	0.0486	-1.55	-0.078	0.0581	-1.34
Education	-0.139	0.1540	-0.90	-0.181	0.1502	-1.21
Recreation	-0.039	0.0766	-0.51	-0.081	0.0756	-1.07
Food	-0.016	0.0977	-0.17	-0.494**	0.1967	-2.51
High tech	0.098**	0.0458	2.13	0.112	0.0753	1.49
Selected interactions of human capital with competitive advantage						
Founder educ x univ collaborator	-0.053***	0.0145	-3.63	0.018	0.0209	0.89
Industry exper x comp collab	0.118*	0.1157	1.02	0.337*	0.1955	1.72
Founder exper x comp collab	0.0037	0.0030	1.27	0.009	0.0042	0.21
Selected interactions of human capital with financing style						
Industry exper x angel investing	1.2132***	0.2775	4.37	1.616***	0.6413	2.52
Industry exper x venture capital	-1.399*	0.7909	-1.77	-3.075***	1.2444	-2.47
Industry exper x equity company	0.2391	0.3613	0.66	1.515**	0.5509	2.75

Note: * indicates significance the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level.

Among financing strategies (β), receiving angel equity is a strongly significant predictor of higher revenues, conditional upon survival. No form of financing strategy was significantly correlated with employment success. Competitive advantages and collaborations (γ) with universities resulted in lower revenues than other new firms, presumably because the emphasis might be more on scientific development and knowledge acquisition than on commercialization. No other form of collaboration or even form of intellectual property was notably correlated with either revenue or employment outcomes.

However, this is where founder attributes (θ and μ) start to shine. Founder education, previous startup experience and previous work in the industry all contribute meaningfully to increased revenues in the startup. Industry

experience also has a small positive employment effect. Disappointingly, there is also a racial impact obvious here, with white founders outperforming other ethnicities with statistical significance. Age also shows up here, with younger founders on average leading new firms to higher revenues.

While there are also a few industry-specific effects (σ), the most interesting part of the results table summarizes the importance of interaction terms (τ) as hypothesized between founder attributes and strategic collaborations. Founders with higher education levels are even more prone to earn lower revenues when collaborating with a university, while founders with more industry experience are more likely to earn higher revenues (and employ more workers) when collaborating with a commercial ally. This is completely consistent with the supposition that university partnerships might focus more on knowledge while business partnerships might focus more on commercialization and profit-generating strategies.

Finally, notice that angel investors get an additional boost from founders with relevant industry experience, both in terms of revenue and employment. That completely contrasts with the effects for venture capital firms, which see a decrease in revenues and employment from the same combination of founders with relevant industry experience. Equity companies look more like angel investors in this way, with positive employment outcomes but no significant revenue effects.

Robustness tests were performed exhaustively, to guard against endogeneity, unit roots, and mis-specification of functional form. All results signified correct specification. It should also be noted that for the model where adjusted R-squared or Wald tests apply, the model performs well in explaining variation; Wald scores are universally significant at the 99 percent level, and adjusted R-squared values exceed 0.68.

DISCUSSION

Our results show that human and social capital variables and collaborative or financing strategy both predict firm success, not only alone, as shown by the literature, but when interacted with each other (a new result). Thus, this paper contributes to the discussion about how to identify and measure startup success, alongside Hipp and Binz (2020), Kim (2020), Laitinen (2019), and Baluku et al. (2016).

We find strong survival effects of specific financing strategies like government, angel, debt and FFF investing (consistent with Yankov et al., 2014), but further conclude that all were reinforced with the presence of founder experience in the industry or education level (connecting our results

with Sanyal & Mann, 2010). Our results could very well inform subsequent rounds of investor decisions (in the flavor of Kleinert et al., 2021).

For example, highly educated founders were more successful than their peers in generating startup revenue specifically when they used a collaborative strategy involving partnership with a university. This suggests a latent effect, the potential for university alumni to collaborate with their former faculty or institution in a way that non-alumni cannot (but this must be confirmed via future research that matches founders with specific collaborative institutions).

In contrast, industry experience was most effective when combined with angel investing (to achieve both revenues and employment), whereas industry experience combined with venture capital worked against success. This is a completely new finding in the literature, one which points to a potentially important difference between financing strategies as they interact with experienced founders. This result is consistent with the literature and perhaps explains differences between the outcomes of previous studies (e.g., Baum & Silverman, 2004; Ahmed & Cozzarin, 2009; Davila et al., 2001; Huyghebaert et al., 2007; Yankov, 2014; Kleinert et al., 2020). We could hypothesize about reasons for this new result, perhaps around issues of control and strategic direction of the startup (hearkening back to Cooper et al., 1994), but call for further research on this question.

Competitive advantages played a strong role in survival but were much weaker in predicting subsequent revenues or employment, arenas where social and human capital played a larger role, a result unique in the literature. Most importantly, our results show that correcting for survival bias is statistically important; a result largely omitted elsewhere in the literature (e.g., Cader & Leatherman, 2011).

We must, of course, acknowledge remaining limitations encountered during the research process, limitations that might compromise our results. Survival itself is a constructed variable based on assumptions about respondents; revenues were coded in the original survey as level-indicator variables, so interpretations are not clean. Clearly, if our underlying data are not equally or randomly representative of different financing strategies (and there were relatively few equity-financed or venture capital-financed firms), our results may be unintentionally biased.

CONCLUSION

The findings of this study should inform the two major stakeholders in new ventures – entrepreneurs and investors. Both can conclude that new-firm survival is much less related to founder levels of experience than has been

typically thought. Instead, when starting a business or building a team of cofounders, entrepreneurs should be just as cognizant of the network that they may collectively have and their ability to leverage the network into creating a successful company.

On the other hand, our findings do validate the concept of investing in the entrepreneur versus the idea, if the goal is not only survival but revenue creation and eventual profitability. Furthermore, particular founders seem to pair more effectively with particular financing strategies; angels might do well not to fund the same founders that venture capital funds do. Further research might do well to investigate the reasons for this result.

Government policy might reasonably be influenced by our results as well. Although a limited sample size, government equity was the strongest predictor of failure in all the regressions taken, registering a dramatically increased likelihood of failure. This raises questions about how (and if) we support new firms who receive government funding, and whether the goals of those public funds are appropriately used in predictably short-lived enterprises. Perhaps that is indeed the goal, to secure an objective and then let the business close, but if the goal is to create an entrepreneurial ecosystem, then this policy is, on average, dramatically less successful at picking and sustaining than are other forms of private funding. Implementing policies that help induce more collaboration and partnerships, whether through tax incentives, business classifications, or grants, could see a strong increase in overall new-venture survival, and firm success. Research might wisely inspect the reasons for this potentially very unproductive result.

In conclusion, although some variables do not explicitly agree with past literature, those disagreements are perhaps appropriate clarifications given our treatment of survival bias and interaction terms. Our major results do an excellent job of giving credence to past research and give substantial fodder for further research. For example, it might be important to know whether these results apply in other jurisdictions and nations, whether the interaction terms are significant for all founder demographics or solely for white men (as mostly represented in our sample), and whether funding in the post-pandemic world will follow the same patterns or will shape new paths.

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References

- Ahmed, S.T., & Cozzarin, B.P. (2009). Start-up funding sources and biotechnology firm growth. *Applied Economics Letters*, 16(13), 1341-1345. <https://doi.org/10.1080/13504850701367338>
- Baluku, M.M., Kikooma, J.F., & Kibanja, G.M. (2016). Psychological capital and the startup capital–entrepreneurial success relationship. *Journal of Small Business & Entrepreneurship*, 28(1), 27-54. <https://doi.org/10.1080/08276331.2015.1132512>
- Bapna, S. (2019). Complementarity of signals in early-stage equity investment decisions: Evidence from a randomized field experiment. *Management Science*, 65(2), 933–952. <https://doi.org/10.1287/mnsc.2017.2833>
- Barnir, A. (2014). Gender differentials in antecedents of habitual entrepreneurship: Impetus factors and human capital. *Journal of Developmental Entrepreneurship*, 19(1), 1450001. <https://doi.org/10.1142/S1084946714500010>
- Baum, J.A.C., & Silverman, B.S. (2004). Picking winners or building them? Alliance, intellectual, and human capital as selection criteria in venture financing and performance of biotechnology startups. *Journal of Business Venturing*, 19(3), 411-436. [https://doi.org/10.1016/S0883-9026\(03\)00038-7](https://doi.org/10.1016/S0883-9026(03)00038-7)
- Bednar, R., Tariskova, N., & Zagorsek, B. (2018). Startup revenue model failures. *Montenegrin Journal of Economics*, 14(4), 141-157. <https://doi.org/10.14254/1800-5845/2018.14-4.1>
- Boehmke, F.J., Morey, D.S., & Shannon, M. (2006). Selection bias and continuous-time duration models: Consequences and a proposed solution. *American Journal of Political Science*, 50(1), 192-207. <https://doi.org/10.1111/j.1540-5907.2006.00178.x>
- Bosma, N., Van Praag, M., Thurik, R., & De Wit, G. (2004). The value of human and social capital investments for the business performance of startups. *Small Business Economics*, 23(3), 227-236. <https://doi.org/10.1023/B:SBEJ.0000032032.21192.72>
- Cader, H.A., & Leatherman, J.C. (2011). Small business survival and sample selection bias. *Small Business Economics*, 37(2), 155-165. <https://doi.org/10.1007/s11187-009-9240-4>
- Carrigan, M. (2020). 2019 small business failure rate: Startup statistics by industry. *National Business Capital and Services Report*, January. Retrieved from <https://www.nationalbusinesscapital.com/2019-small-business-failure-rate-startup-statistics-industry/>
- Conti, A., Thursby, M., & Rothaermel, F.T. (2013). Show me the right stuff: Signals for high-tech startups. *Journal of Economics & Management Strategy*, 22(2), 341-364. <https://doi.org/10.1111/jems.12012>
- Cooper, A.C., Gimeno-Gascon, F.J., & Woo, C.Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal*

- of *Business Venturing*, 9(5), 371-395. [https://doi.org/10.1016/0883-9026\(94\)90013-2](https://doi.org/10.1016/0883-9026(94)90013-2)
- Delmar, F., & Shane, S. (2006). Does experience matter? The effect of founding team experience on the survival and sales of newly founded ventures. *Strategic Organization*, 4(3), 215-247. <https://doi.org/10.1177%2F1476127006066596>
- Dickson, P.H., & Weaver, K.M. (1997). Environmental determinants and individual-level moderators of alliance use. *Academy of Management Journal*, 40(2), 404-425. <https://doi.org/10.5465/256888>
- Fairlie, R.W., Morelix, A., Reedy, E.J., & Russell, J. (2016). The Kauffman Index of Startup Activity: National Trends. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2883389
- Groenewegen, G., & de Langen, F. (2012). Critical success factors of the survival of start-ups with a radical innovation. *Journal of Applied Economics and Business Research*, 2(3), 155-171.
- Foster, G., Davila, T., & Gupta, M. & (2001). The impact of rounds of venture capital funding on the growth strategy of startups. Retrieved from <https://www.gsb.stanford.edu/gsb-box/route-download/317781>
- Hipp, A., & Binz, C. (2020). Firm survival in complex value chains and global innovation systems: Evidence from solar photovoltaics. *Research Policy*, 49(1), 103876. <https://doi.org/10.1016/j.respol.2019.103876>
- Kaplan, S.N., Sensoy, B.A. & Stromberg, P. (2009). Should investors bet on the jockey or the horse? Evidence from the evolution of firms from early business plans to public companies. *The Journal of Finance*, 64(1), 75-115. <https://doi.org/10.1111/j.1540-6261.2008.01429.x>
- Kauffman Foundation. (2021). Kauffman Firm Survey (KFS) Series. Retrieved from <https://www.kauffman.org/-entrepreneurship/research/data-resources/>
- Klabunde, A. (2016). How much should an investor trust the startup entrepreneur? A network model. *Journal of Economic Interaction and Coordination*, 11(2), 293-312. <https://doi.org/10.1007/s11403-015-0147-7>
- Kleinert S., Bafera J., Urbig D., & Volkmann C.K. (2021). Access denied: How equity crowdfunding platforms use quality signals to select new ventures. *Entrepreneurship Theory and Practice*, May. <https://doi.org/10.1177%2F10422587211011945>
- Kleinert, S., Volkmann, C., & Grünhagen, M. (2020). Third-party signals in equity crowdfunding: The role of prior financing. *Small Business Economics*, 54(1), 341–365.
- Kim, J. D. (2020). Startup acquisitions as a hiring strategy: Worker choice and turnover. University of Pennsylvania Wharton School of Business Working Paper. Retrieved from https://papers.ssrn.com/sol3/-Papers.cfm?abstract_id=3252784

- Laitinen, E. (2019). Discounted Cash Flow (DCF) as a measure of startup financial success. *Theoretical Economics Letters*, 9(8), 974-10. <https://doi.org/10.4236/tel.2019.98185>
- Larson, A. (1992). Network dyads in entrepreneurial settings: A study of the governance of exchange relationships. *Administrative Science Quarterly*, 37, 76-104. <https://doi.org/10.2307/2393534>
- MacMillan, Ian C., Siegel, R., & Narasimha, P.N.S. (1985). Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*, 1(1), 119-128. [https://doi.org/10.1016/0883-9026\(85\)90011-4](https://doi.org/10.1016/0883-9026(85)90011-4)
- Mann, C.L., & Sanyal, P. (2010). The financial structure of startup firms: The role of assets, information, and entrepreneur characteristics. Working Paper 10-17, Federal Reserve Bank of Boston. Retrieved from <http://hdl.handle.net/10419/5556>
- Mitter, C., & Kraus, S. (2011). Entrepreneurial finance—issues and evidence, revisited. *International Journal of Entrepreneurship and Innovation Management*, 14(2-3), 132-150. <https://doi.org/10.1504/IJEIM.2011.041728>
- Otani, K. (1996). A human capital approach to entrepreneurial capacity. *Economica*, 63, 273-289. <https://doi.org/10.2307/2554763>
- PriceWaterhouseCoopers & National Venture Capital Association. (2016). MoneyTree Report. Historical Trend Data. Retrieved from <https://www.pwc.com/us/en/industries/technology/moneytree/explorer.html#/>
- Sandberg, W.R., & Hofer, C.W. (1987). Improving new venture performance: The role of strategy, industry structure, and the entrepreneur. *Journal of Business Venturing*, 2(1), 5-28. [https://doi.org/10.1016/0883-9026\(87\)90016-4](https://doi.org/10.1016/0883-9026(87)90016-4)
- Sanyal, P., & Mann, C.L. (2010). The financial structure of startup firms: The role of assets, information, and entrepreneur characteristics. *Federal Reserve Bank of Boston Working Papers* No. 10-17. Retrieved from <https://www.econstor.eu/bitstream/10419/55565/1/642984506.pdf>
- Teare, G. (2021). Global VC Report 2020: Funding and Exits Blow Past 2019 Despite Pandemic Headwinds. *Crunchbase News*, January 13. Retrieved from <https://news.crunchbase.com/news/global-2020-funding-and-exit/>
- Van Gelderen, M. (2004). A framework for conjecturing entrepreneurial opportunities: An application to individualization of demand in the undertaking business. *Journal of Enterprising Culture*, 12(4), 351-371. <https://doi.org/10.1142/S021849580400018X>
- Yankov, B., Ruskov, R., & Haralampiev, K. (2014). Models and tools for technology start-up companies success analysis. *Economic Alternatives*, 3, 15-24. https://www.unwe.bg/uploads/Alternatives/2_broi_3_2014.pdf
- Wang, W., Mahmood, A., Sismeiro, C., & Vulkan, N. (2019). The evolution of equity crowdfunding: Insights from co-investments of angels and the crowd. *Research Policy*, 48(8), 1–37. <https://doi.org/10.1016/j.respol.2019.01.003>

Abstrakt

CEL: Istniejąca literatura na temat sukcesu przedsiębiorstw rozpoczynających działalność jest dogłębna w badaniu poszczególnych czynników, ale stosunkowo nieliczna w testowaniu tych czynników łącznie. Badanie to sprawdza efekty interaktywne, tj. komplementarność między tymi czynnikami. **METODYKA:** Stosujemy model proporcjonalnego hazardu Coxa do oszacowania długowieczności w startupach, uzupełniając go o oszacowanie maksymalnego prawdopodobieństwa dwóch miar sukcesu (zatrudnienie i przychody). W każdym modelu wyraźnie testujemy interakcje między terminami, tym samym rozwijając literaturę. **WYNIKI:** Analiza danych panelowych pokazuje, że strategia finansowania ma znaczenie dla sukcesu startupu, szczególnie w połączeniu z określonymi atrybutami kapitału ludzkiego i społecznego założycieli. Na przykład aniołowie biznesu i inwestorzy venture capital korzystają z nich inaczej niż założyciele z doświadczeniem w branży; założyciele z wyższym wykształceniem generują większe przychody niż ich rówieśnicy, zwłaszcza gdy ich startupy współpracują w ramach partnerstw uniwersyteckich. **IMPLIKACJE DLA TEORII I PRAKTYKI:** Artykuł sugeruje konkretne sposoby, w jakie przedsiębiorcy powinni myśleć o opcjach finansowania, które są komplementarne z atrybutami ich założycieli. Co więcej, sugeruje to, że literatura musi być bardzo przemyślana, nie tylko pod względem wskaźników sukcesu, ale także porad dla decydentów, finansistów i przedsiębiorców ze względu na zniuansowane nieliniowości i interakcje, które demonstrujemy. **ORYGINALNOŚĆ I WARTOŚĆ:** Wnosimy wkład w literaturę dotyczącą finansowania startupów za pomocą dużego zestawu danych, starannego modelowania interaktywnej komplementarności między danymi wejściowymi, korekty potencjalnego błędu doboru próby w poprzednich badaniach oraz zestawu modelowanych wyników (przeżycie, zatrudnienie i przychody) które pozwalają na zniuansowane wyniki.

Słowa kluczowe: startup, przetrwanie biznesu, przychody, finansowanie venture, kapitał ludzki, przewaga konkurencyjna, nowe przedsięwzięcia, wyniki firmy

Biographical notes

Dan Keogh is a Data Scientist based out of Boulder, Colorado. He received a bachelor's degree from Colorado College in Mathematical Economics in 2017. Currently, he builds anomaly detection and Natural Language Processing models for Quantum Metric, a Digital Experience Analytics company headquartered in Colorado. Prior to Quantum Metric, Dan was a Data Scientist for Seattle-area-based EagleView and in his own entrepreneurial pursuits, where he specialized in developing computer vision and geospatial machine learning models. His primary professional interests are developing machine learning models to process time-series, text, and image data, and the subsequent integration into modern software products.

Daniel K.N. Johnson is a Professor of Economics at Colorado College, has founded several businesses and holds advisory roles in a range of other startups. He is the author of over sixty refereed journal articles, commissioned pieces, and book chapters. Specializing in the economics of innovation and technological change, he frequently advises and lectures internationally on public policy related to intellectual property rights. In addition to his primary research on spillovers from researchers to the Global South (or other potential follower groups), he enjoys writing projects that apply economic models to unusual questions including predicting Olympic medal counts (on which he did a TedTalk), explaining game show contestant behavior, exploring philanthropic behavior, measuring the impact of WalMart on home prices, improving the marginal impact of microfinance lending programs, and quantifying the effect of structural racism on COVID infection and mortality rates.

Conflicts of interest

The authors declare no conflict of interest.

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The use of process benchmarking in the water industry to introduce changes in the digitization of the company's value chain

Natalia R. Potoczek¹ 

Abstract

PURPOSE: The review of the literature and numerous online sources, in particular the information platforms of international organizations supporting the activities of the water sector, was aimed at verifying research experiences in the field of digital maturity of enterprises, identifying research approaches used in benchmarking water utilities, and determining the level of interest in the analysis of the water supply industry value chain. It was found that there is no benchmarking methodology that would enable the observation of changes in the business processes of water supply companies under the influence of digital technologies. Therefore, this article presents a framework for benchmarking the digitization of business processes. The article also presents the premises for benchmarking the digitization of processes included in the value chain of a water supply company and the benefits of including digital technologies supporting processes from an economic, social, and environmental perspective. One of the key stages of creating the concept of benchmarking research is creating a matrix of variables relating to the objectives pursued by water supply companies. **METHODOLOGY:** The proposed concept of benchmarking the digitization of business processes included in the value chain of a water utility company was prepared based on literature studies and analysis of selected internet platforms of international organizations operating in the water sector. **FINDINGS:** The analysis of the decomposition of the enterprise value chain, the criteria, and levels of process maturity assessment, and the latest digital technologies made it possible to prepare two scenarios of the benchmarking stages of processes and use digital technologies depending on the level of process maturity and benchmarking experience. **IMPLICATIONS FOR THEORY AND PRACTICE:** The proposed model is highly conceptual and requires validation in pilot studies to verify the levels of decomposition of the

1 Natalia R. Potoczek, Ph.D., Hab., Professor of Institute of Economics, Polish Academy of Sciences, Laboratory of Process and Network Analysis, Nowy Swiat 72, 30-330 Warsaw, Poland, e-mail: npotoczek@inepan.waw.pl (ORCID: <https://orcid.org/0000-0002-7288-0321>).

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value chain, to select key digital technologies for research and to determine the scale of digital maturity for each of the technologies included in the study. Organizations conducting benchmarking research can broaden the scope of their research and provide water utilities with information on the latest digital technologies supporting business processes. **ORIGINALITY AND VALUE:** Using value chain taxonomy to assess the support of business processes by digital technologies is an original approach. It enables the acquisition of knowledge about the importance of digital technologies in all processes carried out in the enterprise.

Keywords: value chain, process benchmarking, process maturity, digital maturity, Industry 4.0.

INTRODUCTION

Dynamic social, demographic and environmental changes pose increasing challenges in the economic sphere for every sector, industry, and enterprise. This means the need to search for new technological and organizational solutions, as well as new competences that will contribute to the optimization of production costs while promoting access for all people. Benchmarking has been a widely used method supporting the development of an enterprise since the nineties of the twentieth century.

Benchmarking as a research method is invariably used to compare the performance of processes, products, or services. The use of this method helps enterprises to overcome barriers faster and optimize costs. The method of comparing oneself with recognized or best-in-class entities is to simultaneously search for own solutions and inspire innovation. The usefulness of the method is emphasized by the latest publications by Ahmed et al. (2020), presenting research on enterprises (SMEs) in the Greater Toronto Area (GTA), as well as studies by Francisco et al. (2020) on the use of benchmarking to reduce energy consumption in cities. Benchmarking is also used to create models for cost reduction at the national level. An interesting example is the research of the National Electricity Agency (ANEEL) in Brazil, which was presented in a recent article by Lopes et al. (2020).

The analysis of the latest benchmarking research shows that benchmarking is a cross-sectoral research method, which means that it can be applied in all sectors of the economy. This is evidenced by the latest research, for example: Morse et al. (2020) dedicated to bus performance in the US; studies by Luo et al. (2020) in the Chinese construction sector; studies by Salim et al. (2020) for the comparison of Indonesia's foreign trade with Singapore and Hong Kong; studies by Williams et al. (2020) including a cost-effectiveness analysis of water retail in England and Wales; Beath and Flynn's research in the financial sector (2020) comparing the performance of private equity portfolios of the largest

institutional investors in the world; a study by Ferreira and Marques (2021) on public–private partnerships in healthcare services in Portugal.

The benchmarking methodology is consistently improved, developed, and subject to systematic reviews. Among the latest publications, Daraio et al. (2020) works is the first attempt to systematically review all available empirical research in a wide range of efficiency and productivity analysis using the boundary estimation methodology. The research by Malik et al. (2021), which aimed to test and document a new approach to best practice benchmarking, is known as rapid benchmarking. They define rapid benchmarking as an approach to reduce drastically the typical time needed to conduct a successful best-practice benchmarking project. The latest research by Kulikowski (2021), aimed at filling the gap in the creation of theoretical models relating to human limitations in performance management, also seems valuable.

The article's main aim is to present the concept of extending benchmarking research in the water supply industry to identify digital technologies supporting business processes included in enterprise value chains. The classic research model based on key performance indicators (KPIs) indicates the possible level of improvement of the company or selected processes. However, contemporary social and environmental challenges force an increase in the pace of creating innovations and implementing modern technologies. It is assumed that the knowledge obtained from classic benchmarking studies, given the current technological challenges, does not sufficiently support the development strategies of water supply companies, which should take into account digital development. There is, therefore, a need to develop research methods to build knowledge on innovative digital technologies that make a significant contribution to improving water supply companies.

The importance of benchmarking, and at the same time its problematic nature, is strongly recognized in the water sector, especially in the water supply industry. The problem with the availability of drinking water and sewage services on a global scale is growing. Reports by international organizations, such as WHO, UNICEF, UNESCO, indicate that over 2 billion people do not have access to safely managed water services, 4.5 billion people are deprived of decent sanitary conditions, 80% of wastewater returns to the ecosystem without treatment or reuse, around 1.7 billion people live in areas where groundwater resources and / or groundwater-dependent ecosystems are under threat (WHO–UNICEF JMP 2017; World Water Development Report, UNESCO, 2017; Gleeson et al., 2012).

Given such data, it is believed that the global water sector is facing an urgent strategic change. Many international organizations and initiatives, such as the International Water Association (IWA), The International Benchmarking Network for Water and Sanitation Utilities (IBNET), and

various regional and national organizations, have developed a cooperation network for technological, organizational, and legal development. The IWA points out that it is necessary to build an interdisciplinary environment for the development of the water sector, bringing together scientists, researchers and technology companies, as well as water and sewage companies (Strategic Plan IWA 2019-2024).

The problems in the water sector outlined above represent major challenges for the various water resource operators, entities responsible for water treatment and supply, and all users. However, the involvement of national and local decision-makers is not sufficient in all regions of the world. Many cross-sectoral organizations of cross-sector importance initiate activities to build knowledge on water resource management for various stakeholder groups, e.g. World Bank Group (IBRD – IDA) with financial support from The International Bank for Reconstruction and Development (IBRD).

In this article, the author assumed that the most important development directions in water supply companies currently include the digitization of as many operational and support processes as possible. It is assumed that new digital technologies will help to solve water problems more quickly. The technology development so far, ranging from stationary computerization of workplaces through the Internet and mobile devices, has become a lever for the development of 4.0 technologies, such as the Internet of Things, artificial intelligence, robotization, and cloud solutions. Although it has always been a priority, technological development for water companies is now becoming a challenge, forcing the rapid acquisition of new digital competencies.

The water supply industry, like any other, is created by entities that are at various stages of implementing industrial innovations. Diffusion of innovation, according to the concept of Rogers (2010), takes place in many stages and requires making many decisions: taking action to obtain information, expanding knowledge about innovation, developing one's own position on innovation, making a decision on the use of innovation, implementation, and evaluation of the usefulness of innovation, the end of confirming the usefulness of the innovation. In the era of rapidly occurring technological changes, it is also necessary to search for methods that will significantly shorten the diffusion of innovation. These include benchmarking studies, and as long as they are not limited only to the obtained indicators and compare the methods or technologies of achieving them. Observations of the changes taking place in the value chain meet the demand for system solutions relating to all organization activities. The attempt made in the article to expand benchmarking research with an analysis of the value chain, allows the identification of innovations undertaken by enterprises from the perspective of the processes implemented in the value chain that create

a dynamic, multi-instance structure of tasks, resources, technologies, and competences. The innovations implemented by enterprises have a significant impact on the structure of the value chain.

The article presents the concept of benchmarking of business processes forming the value chain to identify, above all, innovative digital technologies and the benefits of using them in achieving higher efficiency and taking on new civilization challenges. Proposing the concept of benchmarking research in the field of digital support in processes requires, first of all, a reference to research on the digital maturity of enterprises, the nature of benchmarking research in the water supply industry, and research experience in the analysis of the value chain in the water supply industry. Hence, the presentation of the original research concept was preceded by the identification and analysis of research approaches to date. Therefore, the conducted research was aimed at answering the following questions:

RQ 1: What are the research experiences in the field of digital maturity of enterprises?

RQ 2: What research approaches are used in benchmarking water utilities?

RQ 3: What is the level of interest in water, value chain analysis?

RQ 4: What are the possible scenarios for process benchmarking research considering the use of digital technologies?

Each change made in the value chain structure is associated with a change in production costs, use of material and intangible resources, human resources and, above all, the quality of the products and services provided. Therefore, this consistency is an important premise for the development of benchmarking of digitization of the processes that make up the value chain in any enterprise.

METHODOLOGICAL PROCEEDING

The presented concept of the benchmarking study is dedicated to the water supply industry in the utility sector. When starting the new concept of the benchmarking methodology, it is assumed that benchmarking research should also provide information on the impact of the digital technologies used on the company's results. The use of digital technologies will be understood as a combination of various digital techniques (aimed at creating digital circuits and their application in digital devices) and information systems (including various hardware and software configurations) intended for information processing. In developing the benchmarking methodology, it is also

necessary to adopt the perspective of management science, which considers economic aspects and technical, human, and organizational aspects in the use of digital technologies in business processes. It is also necessary to adopt an appropriate perspective in understanding the concepts of digitization of business processes and value chains. In each of these cases, digitization is a technological process that uses digital techniques and devices and other tangible and intangible resources of an enterprise to improve business processes and optimize manufacturing costs.

Benchmarking based on the identification and comparison of performance indicators does not give an idea of the technologies used (including digital ones) or how those technologies have changed the enterprise. The presented approach is based on the analysis of the value chain structure and digital maturity of business processes. Both issues: value chain and digital maturity of processes are discussed in detail in the next part of the article.

The concept of extending benchmarking research with applied digital technologies in the entire value chain should enable answers to the following questions: 1) Which technological innovations have led to changes in the value chain?; 2) Which changes in the value chain structure made after the implementation of technological innovations have influenced the improvement of performance and quality indicators (KPIs)?

The author developed the concept of the benchmarking study after a critical review of the literature and the identification of the research gap. Due to the practical usefulness of the benchmarking methodology, she consciously used both scientific literature and research results from specialized organizations such as WHO, IWA, IBNET, World Bank Group (IBRD - IDA), EurEau. The review of the scientific literature was made primarily based on two scientific databases: Scopus and Web of Science (WoS). Other sources, mainly online, were collected according to the same keywords (tags) used in the review of scientific databases. Both literature studies and the analysis of online platforms run by the above-mentioned organizations allowed to recognize various research problems and concepts of comparative research in many sectors. The water sector was subject to detailed identification.

The research was carried out in the three stages presented below; the purpose was to answer the RQ1–RQ3 questions included in the Introduction.

Stage 1. Identification of research on the digital maturity of enterprises.

Stage 2. Identification of research approaches and methods used in benchmarking water utilities.

Stage 3. Analysis of the level of interest in analyzing the value chain in the water supply industry.

The Scopus and Web of Science research databases were reviewed within selected research areas and without any time limits. The subject area: Business Management Accounting is included in the Scopus database. The following WoS categories were selected: Management Business Economics and Operation Research Management.

Initial identification of literature sources was carried out based on titles, keywords, and abstracts, according to the following keywords:

Stage 1: “digital maturity”, “digitization”, “Industry 4.0”.

Stage 2: “benchmarking methodology”, “benchmarking” and “utilities”, “benchmarking” and “water sector”.

Stage 3: “value chain analysis”, “value chain” and “utilities”, “value chain” and “water sector”.

Finally, 32 publications in the first stage, 45 publications in the second stage and 43 publications in the third stage were selected for in-depth analysis. All selected publications were in English and the vast majority (approx. 90%) was published in open access.

The answer to the fourth question (RQ4) concerning the scenarios of using benchmarking of digitization of processes in the value chain was included in the last part of the article. Ultimately, two benchmarking research scenarios depending on the benchmarking experience and the level of digitization were proposed. Then, presented examples of variable matrices for the analysis of digital maturity of the value chain in water supply companies. The presented concept does not contain technical and tool details. These stages of benchmarking conceptualization should be designed adequately to the scope of research: subject, subjective, temporal, and spatial.

LITERATURE REVIEW

Digital transformation of value chains

The value chain concept is a standard in economics today because it explains in a consistent and logical way the systemic structure of activities necessary to create and deliver value to the customer, which is contained in a product or service. The sets of activities included in individual elements of the first model developed by Porter (1985) were distinguished according to the functional area of the enterprise. The reference to the key functions of an enterprise in the value chain model resulted from the commonly dominant functional orientation of enterprises. Currently, functional orientation in the

company is giving way to a process approach that has been developing for several decades, mainly due to information systems and digital technologies (Shafagatova & Van Looy, 2021; Glavan, 2020; Christiansson & Rentzhog, 2020; Looy, 2020; Novak & Janeš, 2019; Ponomarenko, 2019; van Assen, 2018; Broberg et al., 2018; Miri-Lavassani & Movahedi, 2018; Potoczek, 2017; Khosravi, 2016; Movahedi et al., 2016). The contemporary approach to the value chain primarily exposes the processes implemented in the enterprise, the organization of which resembles the structure of the Porter value chain in its basic assumption. An important component of the original model was the margin obtained by the enterprise, the amount of which reflected the level of competitiveness. Currently, the margin reflects the level of customer satisfaction, but also the results of performance management (Goni et al., 2021; Muntean, 2018; Baldwin & Venables, 2015). The value chain concept is much more applicable today than it was in the 1980s. It is used in many sectors, and it can be used in any organization where value is created for the recipient of products or services. Thus, both the commercial and public sectors can structure their activities according to the value chain and thus have a greater impact on creating value for the customer.

The subject of many studies is the changes taking place in value chains, and the observations concern both the structure of the chain, its decomposition from processes, through sub-processes, to various activities undertaken by teams and individuals. The changes taking place in the structure of the value chain are a consequence of planned and unplanned activities. They are both the result of applying methods of improving processes, introducing innovations, expanding activities (Bustinza et al., 2015), and internal omissions or late reactions to changes in the environment, resulting in short life cycles of processes.

The last strong trend in research on value chains in enterprises is the identification of changes under the influence of digital technologies used in processes. Robotization and process automation, which was initiated in the last decades of the twentieth century, is gaining a new pace and a new quality today, thanks to the Internet, Internet of Things (IoT), artificial intelligence, cloud computing, working on large data sets, or the use of augmented reality. Analytical skills in enterprises and digital skills of employees are developed to an unprecedented extent. The impact of new digital technologies on changes in enterprise value chains, on productivity growth and economic growth, is the subject of many studies (Garzoni et al., 2020; Bickauske et al., 2020; Telnov et al., 2020; Sommarberg & Makinen, 2019; Valdez-De-Leon, 2019; Trabucchi et al., 2018; Fonseca, 2018; Pagani & Pardo, 2017; Graetz & Michaels, 2018). Accelerated digitization of processes is driven by technological innovation, rapidly changing customer needs, and a variety of environmental, social, political, and health factors.

Various studies on value chains show that the use of digital technologies has influenced the crossing of functional boundaries and affects the entire value chain in the company, and therefore all groups of processes. Many authors, such as Nagy et al. (2018), point to the evolution of value chains due to the increasingly used digital technologies. Operational processes such as production, procurement, logistics, marketing and sales, and customer service are supported by various technologies, e.g. robot automation and autonomization, RFID sensors, M2M technologies, network technologies, customer relationship management, CRM in real-time, blockchain, and the analysis of big data on customer behavior. Supporting processes are also developed using advanced technologies, e.g. ensuring data security, financial data analysis or real-time controlling, remuneration management based on current work results. For the area carrying out tasks related to human resources, the challenge is to manage the disappearing and new areas of work caused by the implementation of digital technologies. The progressive implementation of digital technologies helps to increase the flexibility and adaptability of enterprises to the environment, to cooperate with other market players, and especially to participate in shared supply chains. Digital technologies significantly accelerate the maturation of processes in organizations and increase enterprises' ability to implement processes with external partners.

The process maturity of enterprises has been the subject of many studies. Over the last two decades, there have been many proposals for methods of testing process maturity (Röglinger et al., 2012). There were also a number of studies identifying and classifying models for testing process maturity, which had the greatest impact on the progress of research in this area. Undoubtedly, the English-language publications had the greatest impact on the progress of research, although many researchers published their model proposals in their native languages. More important model combinations can be found in Harmon's (2009) publication, where he referred to fourteen articles presented in BPTrends.com during the period 2003–2009. The quoted articles refer to proposals from various environments: academia, industrial and industry centers, or consulting companies. Some publications are complete and provide the full set of information needed to implement the model in business practice, while other publications present the main framework of the model and the benefits of application. However, the full versions have been commercialized. The identification and comparison of the most recognizable models were also made by Rosemann and vom Brocke (2015), who presented nine models of process maturity that are the most important in the BPM trend. Another important analysis of business process maturity assessment models was made by Röglinger, Pöppelbuß, and Becker (2012), who identified further publications devoted to process maturity assessments, including: Willaert et

al. (2007), McCormack (2007), Magdaleno et al. (2008), McCormack et al. (2009), Rohloff (2009). The study by Röglinger et al. (2012) is of particular value for researchers and practitioners, because the authors select the previously identified ten models due to their usefulness in managing business processes. At the same time, they analyze the spread of the models, indicate the lowest and highest level of process maturity, and provide a variety of information about the nature, purpose, adaptability and many other features of models, including sources of information about the models.

In view of the objectives of this study, the range of maturity of the processes included in individual models seems to be particularly important. The ongoing implementation of digital technologies supporting the implementation and management of business processes constitute the basis and the need to develop the concept of process maturity assessment. Of the ten models reported by Röglinger et al. (2012), only in two cases is the highest level of maturity associated with the use of integrated IT systems. This applies to the Business Process Maturity Model (BPMM) (Fisher, 2004), in which the lowest level of maturity is associated with a distributed and uncoordinated activity in the organization on process optimization, and the highest level means the creation of an intelligent operational network, thanks to which the efficiency of the entire chain is optimized and information flows freely, in real-time. The second model that directly relates to IT support is the Process and Enterprise Maturity Model (PEMM) (Hammer, 2007). The author of the model at the first indicated level of process maturity (P1) assumes that the process has not been designed as a comprehensive one, and that it is also supported by fragmented older IT systems. The highest level of maturity (P4) means that the process design matches the customer and supplier processes, and there is a modular IT architecture. Other models indicated in the study, such as BPM Maturity Model (BPM MM) (Rosemann & Bruin, 2005); Process Performance Index (PPI) (Rummler & Brache, 2012); BPR Maturity Model (BPR MM) (Maull et al., 2003); Process Management Maturity Assessment (PMMA) (Rohloff, 2009); BPO Maturity Model (BPOMM) (K. McCormack et al., 2009); Process Maturity Ladder (PML) (Harmon, 2019) and Business Process Maturity Model (BPMMOMG) (Weber et al., 2008), indicate maturity in a systemic perspective as the highest level of process maturity, but mainly in relation to process management systems and without indicating specific digital technologies that would be used in supporting implementation and process management.

The natural consequence is the continuation of research on the digital maturity of the organization. Various paths of digital maturity research have been outlined in the literature. So far, many research reports have been published presenting the current level of digital advancement of enterprises and forecasts for further development.

For the analysis of changes in value chains, it is desirable to develop a method and methodologies for assessing the digital maturity of processes, so that it is possible to have a systemic view of the importance of digital technologies in achieving the business, social and environmental goals of various economic entities. The current proposals for a model approach to digital maturity, group the symptoms of digital maturation of enterprises in several areas, which gives the opportunity to develop them along with the development of digital technologies and progressing implementations. For example, the concept of Gill and Van Boskirk (2016) presented by Forrester includes four dimensions determining process maturity:

- 1) Culture – indicates the company’s approach to digitally controlled innovation and the way in which it provides employees with access to digital technology.
- 2) Technology – defines the use and adoption of new technology by the company.
- 3) Organization – explains how the company adapted to support, manage and implement the digital strategy.
- 4) Insights – determines how well the company uses customer data and business data to measure success and create strategies.

In similar configurations, other models of digital maturity are presented, many of which can already be found, for example:

- Connected Enterprise Maturity Model (2016) developed at Rockwell Automation Inc. The maturity model includes a five-step approach to the implementation of Industry 4.0 (Assessment; Secure and upgraded network and controls; Defined and organized working data capital (WDC); Analytics; Collaboration). The assessment focused on the use of 4.0 technologies in the improvement of inventory management, delivery time, customer service, and efficiency;
- IMPULS – Industrie 4.0 Readiness (2015) developed in collaboration with VDMA, RWTH Aachen, and IW Consult. The model enables assessment in six dimensions including 18 items indicating readiness on five levels; defined barriers in moving to the next stage, as well as advice on how to overcome them;
- A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises (Schumacher et al., 2016). The model is based on nine dimensions, to which 62 items have been assigned to assess the maturity of Industry 4.0. The test is based on a three-step procedure;
- Industry 4.0 maturity model – PwC (2016) covers four levels of digital enterprise maturity: 1. Digital Novice, 2. Horizontal (Internal

Processes) Integrator, 3. Cooperating Vertically (with External Partners), 4. Digital Champion. Assessment of digital maturity is carried out according to seven groups of criteria:

- digital business model and customer access;
- digitization of the product portfolio;
- digitization, horizontal and vertical integration of the value chain;
- data and analysis as a key capability;
- agile IT structure;
- complaints handling, security, law and taxes;
- organization, employees, and digital culture.

The author of the article believes that the desirable direction would be to combine the assessment of process maturity and digital maturity for a better understanding of the changes taking place in the processes themselves and in their systemic approach in the value chain. An important question that should be asked is how to assess the digital maturity of a company, whether through technologies used in main production processes, where in the classic sense it is mainly focused on increasing efficiency, or in all processes, including supporting ones, which reflect the general level of digital competences of the enterprise, and therefore its development potential.

Benchmarking research in the water sector

Benchmarking initiatives are an important contribution to building knowledge in the water sector, especially on improving the performance of water utilities. Benchmarking research is, as a rule, relative. The obtained results refer to the real results regarding the quality of products and services and the efficiency of the activities of all enterprises, which was indicated by the researchers in the early periods of benchmarking, e.g. Partovi et al. (1994). Research on production capacity and costs is carried out in various scientific environments, both technical and economic disciplines. The application of the obtained research results, both in enterprises and by regulators, is unsatisfactory, especially in countries with middle and low incomes. Berg and Marques (2011), followed by Cetrulo et al. (2019), indicate examples of over two hundred quantitative studies, the importance of which for regulatory purposes turned out to be insignificant, for various reasons. They indicate a low level of trust in the conducted research, often also barriers on the side of technical competences, which are usually missing in the circles responsible for creating public policies. Berg's many years of research in collaboration with other researchers (Mugisha & Berg, 2008; Berg, 2010; Berg & Marques, 2011; Berg, 2013; Berg & Phillips, 2017) and other researchers as Cabrera (2010) or Mugisha (2011) were devoted to the search for research methods

that would increase the usefulness of the obtained research results, both for the main entities of the water sector, i.e. water companies, regulators and entities responsible for creating public policy in the industry.

By far, the most popular over the last two decades have been benchmarking studies based on key performance indicators (KPIs). Such examples are provided by the International Water Association (IWA) or The International Benchmarking Network for Water and Sanitation Utilities (IBNET) initiatives at the global level, the European Federation of National Association of Water Services (EurEau) at the European level, and various initiatives at the national or regional level, e.g. AQUABENCH, a special purpose company established by water companies from Germany, Austria and Switzerland, which started benchmarking in 1996. The impulse for such research was the remarkable development of the water supply industry in recent decades and undoubtedly the still strongly sustained pace of development. The observed increase in water production, distribution and wastewater treatment is due not only to the improvement of people's living standards in various regions, but also due to economic development in various sectors, where water is one of the most important resources. Water companies still face many challenges, the scale of which varies in different regions of the world, mainly due to the abundance and availability of water resources, or the level of advancement in environmental protection and, at the same time, protection of water resources. The challenges for the water sector highlighted in recent years, such as water quality and scarcity in many places around the world, aging infrastructure, stricter national and international regulatory requirements, climate change and pressure on environmental impact, bearing operating costs and capital investment, and changing demographics, are clearly reflected in research into the efficiency of water utilities. Examples include the US Environmental Protection Agency (EPA), which supports research in the development of water quality and safety legislation.

Comparative research conducted in the water sector, based primarily on performance indicators, is the result of changes in the understanding and research of business in connection with the dissemination of the concept of sustainable development based on multi-indicator analysis. In the scientific literature and business sources, many sets of indicators can be grouped and generalized. For example, KPI Institute (Minelli, 2021) conducted a secondary benchmarking study for the utilities sector, entitled Performance Benchmarking in the Water Utilities Sector. A total of 178 key performance indicators (KPIs) in five main areas are included in the report, of which the operational area is the best documented:

- 1) Operation (68 KPIs, e.g. net energy consumption from water, tanks cleaned, restoration of unscheduled water supply within five hours, average time to restore sewers to service, etc.).
- 2) Customers (25 KPIs, e.g. water quality complaints per 100 customers, overall communication rate, billing accuracy, number of calls answered within 30 seconds, etc.).
- 3) Environment (22 KPIs, e.g. greenhouse gas emissions, % waste going to landfill, % solid waste recycled, paper consumption, total net CO2 emissions, etc.).
- 4) Human capital (61 KPIs, e.g. senior managers, share of women in senior management positions, rate of accidents related to lost time, male employees, % of senior managers, etc.).
- 5) Corporate governance (2 KPIs, number of meetings, number of employees entitled to participate in meetings).

Benchmarking studies evolve over time. According to Watson (1993a), the first benchmarking studies, which he classified as the first generation, had the most simplified form, related to product design (reverse benchmarking), comparing its most important features, functionality and possibilities in relation to other competing products. This type of comparative research dominated until the end of the 1980s. According to Watson, the second generation is competitive benchmarking, which dominated the next decade of the 1990s. This type of benchmarking was closely related to the development of various methods of strategic analysis of the environment. The third generation of comparative research development was dominated by process benchmarking, which developed on the basis of the popular Porter value chain model (Porter, 1980), initially based on basic functions and activities, later developed in relation to all processes carried out in enterprises. Hence, the next generation of research has been associated with the strategic importance of benchmarking in enterprises, relating to all its areas. Strategic benchmarking differs from the previous one in terms of greater scope and depth. This approach resulted in institutionalization of this activity in enterprises in the 90s. The next generation of comparative research was associated with the strong development of globalization and, at the same time, with easier access to information thanks to the global Internet network (Evans et al., 2012; Meybodi, 2015; Trento et al., 2016; Ebner et al., 2016; Ebner et al., 2019).

The Watson model has been the subject of many analyses and modifications, taking into account new trends in the economy. Many scholars have contributed to the development of knowledge on benchmarking, including Ahmed and Rafiq (1998), Kyrö (2003), Andad and Kodali (2008), Blanchard et al. (2008), and Meybodi (2009). Recent research shows that new types of benchmarking are developing, e.g. intellectual capital benchmarking

(Marti, 2000; Wudhikarn et al., 2020), competency benchmarking (Maciel & Wallendorf, 2017; Castka & Balzarova, 2018; Al Khamisi et al., 2019; Zhang, 2020; Brazinskas et al., 2021) or network benchmarking (De Toni & Meneghetti, 2000; Walther & Spengler, 2004; Zagkas & Lyridis, 2011; Tsironis & Matthopoulos, 2015). An essential contribution to the organization of knowledge on benchmarking was also made by Evans et al. (2012).

The newest, developing trend is Industry 4.0. Benchmarking is already used to make comparisons in the application of new digital technologies. You can already learn about this application of benchmarking from the article by Peruzzini et al. (2017), where they make comparisons in terms of communication and interaction of people and production systems in terms of work ergonomics. The impact of digital technologies on the organization studied using benchmarking has been presented in recent years by Lokuge et al. (2019), Gurbaxani and Dunkle (2019), Keller et al. (2019), and Härting et al. (2019).

Benchmarking studies also in water supply companies are carried out in all possible forms used so far. Undoubtedly, the most popular benchmarking projects, especially those with the greatest reach and scope, are based on the ratio analysis in terms of quality and efficiency obtained at the level of the entire enterprise. In line with the observation presented above, comparing indicators (KPIs) at the level of the entire enterprise gives a picture of possible achievements, perhaps facilitates the formulation of challenges, provides a vision for the development of the enterprise, and even business goals. However, it is of limited use in the operationalization of goals at the level of business processes.

Value chain analysis

The use of the value chain concept in the development of processes in the enterprise is now an indispensable starting point for understanding the role of the process approach in enterprise management. The value chain concept is now firmly established in business theory and practice. The value chain is a structure that allows one to organize various activities in organizations regardless of the sector of the economy or, in a narrower sense, an industry focused around a specific product or service. Therefore, the value chain has quickly become an attractive field of comparison for various economic actors. First of all, it allows you to get to know the structure of the activity, the connections of individual areas of the enterprise that occur in the processes, and the flows of resources and products taking place within them and between them, in order to ultimately deliver the expected value to customers. The deeper the analysis of the value chain is carried out, the more the field of observation for the various elements and their connections increases.

Value chain analysis is used to achieve various corporate goals, not only business but also social and environmental. Interesting examples are provided by the studies of Villamayor-Tomas et al. (2015) on the use of value chain analysis to study the water–food–energy relationship, similarly to the studies by White et al. (2018). Other examples are also provided by research in the area of sustainable development (Ockwell et al., 2019), in which value chain analysis was used to develop payment methods (e.g., for water, energy) in line with the current real resource consumption. An important contribution to the development of this systems approach is the new research presented by Chofreh et al. (2019). They presented the benefits of mapping the water and wastewater value chain to contribute to sustainable development. The particular value of these studies is also expressed in their uniqueness because, from an academic perspective, there are few studies devoted to mapping the processes of the value chain of water and sewage systems. The research was carried out in a water company in Iran, and the results obtained by the researchers indicate the lack of integration of sustainable development in the water management system, which in turn leads to ineffectiveness. Experts' opinions in the presented studies indicate that mapping the value chain itself enables organizations to increase operational efficiency and eliminate waste by approx. 57%. Other research examines the relationship between cost management tools and pricing policies to improve the price of potable water, which helps cover production costs on the one hand and rationalizes the consumption of the product on the other. This is done by utilizing the Activity-Based Costing (ABC) and Value Chain Analysis (VCA) to fix the cost and price of potable water (Al-Hashimi & Jabbar, 2019). An equally interesting example of the use of value chain analysis is provided by the team of researchers, Choi et al. (2020). In their document, they presented the value chain and the stakeholder-oriented, product platform design process. Various options for the Water Treatment Products Platform were generated and assessed for their impact on the value chain, such as organizational structure, production line configuration, economic effect, and various stakeholders' preferences.

The starting point for carrying out a value chain analysis is to identify and organize the main and supporting business activities, i.e. value chain mapping (Vasanth Kumar et al., 2020). The constantly developing scope of activities undertaken in the enterprise, both basic and supportive, is most often the main reason for organizational and competence problems, and consequently for incurring larger, poorly controlled costs. Value chain mapping enables setting process boundaries and a precise definition of responsibilities, as well as process goals, necessary resources, and expected results. Mooney (2014), in his research, indicates the importance of subsequent stages of the value chain analysis for improving the quality and effectiveness of assessments of

the obtained business results. When analyzing the usefulness of the value chain analysis for the needs of transforming business towards sustainable development, he pointed to several important benefits, e.g. the mapping process and further stages of the value chain analysis are also a platform for communication and discussion with stakeholders of water management.

The use of an appropriate methodology for mapping and analyzing the value chain requires an interdisciplinary perspective. The greatest experience in this area has been gathered by researchers of production processes, such as Haefner et al. (2014), who presented a value stream mapping method in order to design the required product quality in manufacturing companies. Tonelli et al. (2016) applied value mapping techniques to identify the value chain in manufacturing companies. Saguin (2018) used value chain mapping to identify access mechanisms in the value chain of urban aquaculture on a lake. This analysis was carried out to assess the social, economic and environmental relationships of urban aquaculture, reduce poverty and develop aquaculture strategies to promote sustainable development.

The latest trend of research using the concept of the value chain to conduct business activity is undoubtedly related to the possibilities provided by the latest digital technologies, which enable the collection of large amounts of data and the possibility of processing them and using them for business analytics. The current challenge is not how to get or produce data, but how to use it and turn it into something with a business character and value. Many researchers note the importance of understanding how companies apply the well-known Ackoff DIKW (Data, Information, Knowledge, and Wisdom) hierarchy in their value chains. This ability to turn data into wisdom in real-time mode puts pressure on companies to follow digital transformation (Welchman, 2015; Rothberg & Erickson, 2017). Also, in the utilities sector, the way of thinking about using IT systems as a tool of strategic added value in decision-making is changing (Nagy et al., 2018; Schumacher et al., 2016; Liboni et al., 2018; Alcácer & Cruz-Machado, 2019). This means that it is no longer a mere technological support activity as originally defined by Porter (1985) in his concept of the value chain. Currently, companies are already developing digital development strategies to better control and improve their value chains.

FRAMEWORK APPROACH TO BENCHMARKING THE DIGITIZATION OF PROCESSES IN VALUE CHAINS

Premises for benchmarking the digitization of processes

Research to date shows that digitization makes value chains, both at the company level and globally, more efficient, flexible, and better customer-oriented. The greatest potential of digital value chains to this prime is believed to be in Industry 4.0 and the fourth industrial revolution. It is assumed that ultimately, as digital technologies are implemented, virtually every area of business will be transformed through the vertical integration of R&D, production, marketing and sales, and customer service along with all the supporting processes and activities. As a result, the economy is evolving towards an entire digital ecosystem based on technologies such as clouds (cloud), big data, the Internet of Things, 3D printing, augmented reality, and many others. The technologies themselves have already contributed to building new business partnerships and creating new digital business models. It is predicted that the next stage of economic development, possibly also revolutionary, may take place due to digital ecosystems in which already used and new technologies will be combined. This means even greater progress in making the value chain network more flexible and integrated, the possibility of virtualizing customer processes and interfaces, and tightening industry cooperation, which has already been articulated in research on the needs of various market entities (Transformation through innovation, ecosystems and sustained outcomes, PwC, May 28, 2021).

Low process competences are definitely one of the biggest implementation barriers. The use of a process approach in managing a water company, especially in smaller entities, is still at the implementation stage, and often pre-implementation. It is hard to disagree that the implementation of business process management is in itself a tedious and time-consuming process. Identifying the value chain, decomposing the chain within individual categories and groups of processes, and then mapping and measuring the processes requires a lot of work, developing appropriate process competences and implementing systems supporting process management, such as BPMS (Business Process Management System). Taking into account the different level of process maturity of water supply companies, different scenarios for making comparisons should be assumed. Process benchmarking conducted within the water supply industry, at the national or regional level, should undoubtedly take into account the level of process maturity of enterprises so that the knowledge provided by selected patterns (benchmarks) is useful and

possible to be quickly used in enterprises using benchmarking. The presented concept of process benchmarking in the water supply industry serves primarily:

- quick recognition of digital technologies used in leading enterprises;
- obtaining information on the level of process and digital maturity of leading companies;
- assessment of the benefits obtained from the use of technologies (business, social and environmental);
- gaining knowledge about implementation processes and the necessary competences;
- assessment of the costs of purchasing and implementing new technologies.

Benchmarking the digitization of processes should primarily take into account:

- information on the processes (and their key elements) supported by digital technologies;
- information about the technologies used in the tested processes;
- information on the place of the analyzed processes in the structure of the value chain;
- information on the expected and obtained business, social and environmental benefits from the applied digital technologies;
- presentations of reference models of processes supported by digital technologies.

Even though process benchmarking is a valuable method used in the improvement of the organization, it has its limitations due to the time-consuming nature and different standards of documenting processes. Therefore, there is a need to create benchmarking methodologies that will make it easier for enterprises to focus on those processes and technologies that release added value faster, understood both in a business, social and environmental sense.

Scenarios for the use of the benchmarking methodology

The presented approach to creating a benchmarking methodology for digitizing the value chain in water supply companies considers two alternative research scenarios. The first scenario (Figure 1) assumes using the current results obtained in benchmarking projects related to key performance indicators (KPIs). The previously identified indicators will make it possible to shorten the research process through a faster transition to the second stage

of benchmark identification. It can be assumed that enterprises achieving more favorable performance indicators indicate a higher level of process and digital maturity. Thus, the probability of recruiting the most mature enterprises for research in the third stage increases. The assessment of process and digital maturity requires the use of maturity models adapted to the specifics of the entire industry, taking into account both legal regulations relating to the quality of supplied water and treated wastewater and environmental and social conditions. Determining the level of process and digital maturity of the analyzed processes is an important point of reference in designing measures for assessing the contribution of digital technologies in achieving company goals.

Benchmarking stages

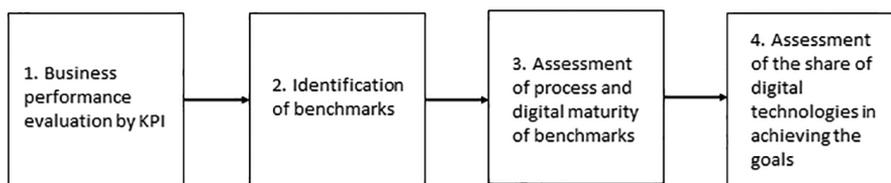


Figure 1. Stages of the research process - Scenario 1

The second scenario (Figure 2) is more demanding and increases the usefulness of the obtained research results for enterprises that would like to use this knowledge to develop their own business. The first stage of benchmarking research requires assessing the process and digital maturity of enterprises, taking into account both 3.0 and 4.0 technologies. For many companies, clients of benchmarking research, it is also important to refer not only to past technologies but also those that fit into the standards of water management. It is assumed that the above-average level of process and digital maturity should nominate companies to remain benchmarks. The process maturity scale should reach a range adequate to the target level of meeting stakeholders' expectations, the profitability of the conducted activity, and the acceptable environmental footprint.

The assessment of the digital advancement of enterprise processes in the third stage requires a multi-level creation of a matrix of processes in combination with digital technologies. The use of the enterprise value chain as a starting point for designing the levels of data refinement dictates decomposing the model.

Benchmarking stages

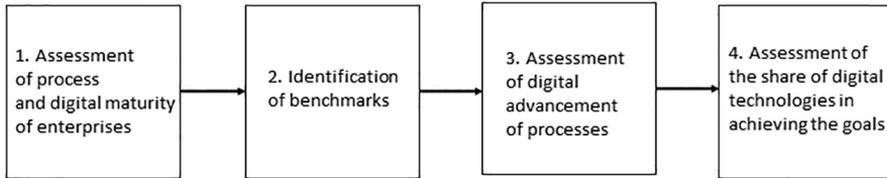


Figure 2. Stages of the research process - Scenario 2

The starting point for building a matrix is to establish the structure of the value chain and the set of digital technologies that will be the subject of the study. One of the most recognizable benchmarking models is the Process Classification Framework (PCF) model developed by the American Productivity & Quality Center (APQC). The summary in Figure 3 relates to a PCF dedicated to Utilities. The PCF covers the decomposition of the value chain on five levels:

- 1) Process categories (14 categories).
- 2) Groups of processes within each category.
- 3) Processes within each group of processes.
- 4) Activities within each process.
- 5) Activities within the activity.

The use of an appropriate model of value chain decomposition should consider the specificity of enterprises within the industry under study.

Building a matrix for the purposes of benchmarking analysis results from the adopted structure of the value chain, and the analysis of the use of digital technologies can be performed at every level of the value chain, depending on the set research goals. Sample matrices are included in Figure 3. Each matrix in Figure 4 contains 14 process categories in the first column. This set, according to the PCF-Utilities/APQC model, starts with operational processes (1–6), and then supporting processes (7–14). The following columns contain: 1) First matrix: digital technologies selected for research; 2) Second matrix: functionalities of selected technologies; 3) Third matrix: the level of replacing human labor with machines; 4) Fourth matrix: the level of cost reduction by applying a given digital technology.

1.0 Develop Vision and Strategy	2.0 Develop and Manage Products and Services	3.0 Market and Sell Products and Services	4.0 Deliver Physical Products	5.0 Deliver Services	6.0 Manage Customer Service
7.0 Develop and Manage Human Capital					
8.0 Manage Information Technology (IT)					
9.0 Manage Financial Resources					
10. Acquire, Construct, and Manage Assets					
11. Manage Enterprise Risk, Compliance, Remediation, and Resiliency					
12. Manage External Relationships					
13. Develop and Manage Business Capabilities					
14. Operate Utility Assets					

Figure 3. Value chain of a water utility company

Source: Own study based on [https://www.apqc.org/resource-library?f\[0\]=industry:2317](https://www.apqc.org/resource-library?f[0]=industry:2317)

The number of matrices will depend on the scope of the research. Adding matrices is conceptual work. The number of matrices should depend on the research questions and, consequently, the structure of the research tools with which the data will be collected. The matrices presented in Figure 4 should answer the following questions: 1) What digital technologies are used in each process category?; 2) What functionalities of the selected technologies have been implemented?; 3) What is the level of replacing human work with digital technologies?; 4) What level of cost reduction in processes was achieved after the implementation of the selected technology?

Matrices used to assess the digitization of enterprise processes should include technologies already used in a given industry (in the case of water and sewage) or are likely to be implemented in the future. The sources used in the article indicate preliminary experiences and research and development works relating to many key technologies for Industry 4.0, e.g. mobile devices, IoT platforms, location detection technology, advanced human-machine interfaces, authentication and fraud detection, intelligent sensors, Big analytics Data and advanced algorithms, multi-level interactions with customers and their profiling, augmented reality or cloud computing.

Process categories in the value chain	Digital technologies									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										

Process categories in the value chain	Functionalities of selected technologies									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										

Process categories in the value chain	The level of replacing human work by technologies									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										

Process categories in the value chain	The level of reduction of process costs through the use of technology									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										

Figure 4. Selected process digitization assessment matrices resulting from the decomposition of the value chain

The last stage of benchmarking research in the second scenario is assessing the share of digital technologies in achieving company goals (Figure 2). The knowledge obtained in process benchmarking is an opportunity to broaden the perspective of assessing business, social and environmental goals. Tracking changes in the structure of the value chain and in specific processes that occur thanks to digital technologies help develop knowledge about all elements of processes and their configuration. Each process is a specific system of goals, tasks, decisions, material and non-material resources, organizational roles, human and financial resources, quality and performance measures, risks and control activities, or flows and collaboration. The use of more and more advanced digital technologies leads to more and more significant changes in such systems. In line with the objectives of Business Process Improvement (BPI), benefits are obtained in the field of eliminating human and technical errors, reducing human activity in favor of intelligent machines, obtaining information about the course of processes in real-time, fast data processing,

and decision making, e.g. thanks to the use of artificial intelligence, and above all, shortening the time of process implementation and reducing the consumption of resources, not only in production or operational processes but in all processes of the organization.

Process benchmarking potential

The essence of the benchmarking method relating to comparing oneself with more advanced or mature entities indicates unlimited possibilities for formulating goals, subject and subjective, spatial and temporal scopes, and research methodologies covering both the quantitative and qualitative approaches. Increasingly serious water management challenges arise before the management of any water company. Social expectations regarding unlimited access to high-quality water and sewerage services are at the same time related to the expectation of low prices for water and sewage services. Regulations concerning the shaping of tariffs are variable and do not always secure all water management stakeholders in the same way. Entities obliged to conduct collective water supply (e.g., local government units) and entities authorized to collect and treat water and collect and treat wastewater (plants, municipal companies) are obliged to conduct sustainable activities in the economic, social and environmental sense. Due to the level of technological advancement, legal obligations will become more and more detailed and demanding. An example of new research and regulatory perspectives is developing research into water and environmental footprint assessment. The ability to precisely measure the footprint of human activity and achieve better and better indicators should also be an important goal of benchmarking the digitization of business processes. Figure 5 shows the stages of benchmarking studies aimed at helping companies to identify the Environmental Footprint (similarly to Water Footprint) and to make efforts to improve their performance in this respect.

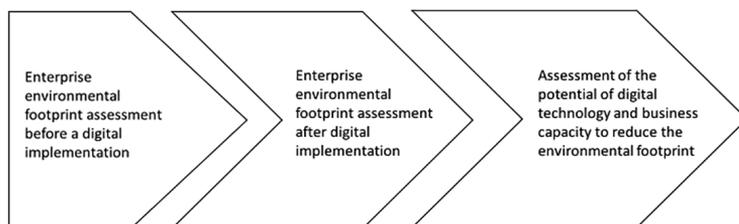


Figure 5. Assessment of the achievement of environmental goals in benchmarking

Making an effort in enterprises to reduce the negative consequences of their activities requires rethinking their processes and taking actions towards their improvement or innovative reformulation. Therefore, it is necessary to develop the potential of benchmarking research, which, as a rule, should contribute to the diffusion of knowledge and improve the competencies of enterprises.

CONCLUSIONS

Digital technologies increasingly determine economic development, and therefore increasingly contribute to raising people's living standards and protecting the natural environment. Process benchmarking, as a method of improvement focused on building digital competences, is an important contribution to the digital development of enterprises. Observation and comparison of changes in processes under the influence of implemented digital technologies creates conditions for the interpretation of performance and quality indicators. From an enterprise business process-management perspective, it is easier to understand the impact of digital technologies because cost analysis is already at the process level rather than at the enterprise level. Assessment of the impact of digital technology on the increase in process efficiency allows for an evolutionary increase in digital maturity of processes. Observation of changes in enterprise value chains related to the digital technologies used should facilitate shortening the process of experimenting and learning on own implementation projects, and thus shortening implementation cycles and reducing the costs of implementing new technologies.

During the conducted literature studies and other sources of knowledge, mainly from business practice, which were presented in the article, the author tried to answer the research questions posed in the introduction. Research experiences in the field of digital maturity are steadily increasing. In response to the first question (RQ1) and after the analysis of Scopus and WoS database resources, it can be stated that starting from 2006, individual studies on the digital maturity of various entities were published. In both cases, 2018 saw a two-fold increase in Scopus and a three-fold increase in the number of publications in WoS devoted to digital maturity. One can also notice an increasing dynamics of interest in research issues. Research is carried out in many sectors, but there are still no examples relating to water utilities. The combination of digital process maturity methodology and value chain analysis was also not identified. The author initiated the concept of researching the digital maturity of the processes forming the value chain,

filling the research gap in the benchmarking methodology in the water sector. The research concept can also inspire similar research in other sectors.

In the next stage of the literature review, the author looked for an answer to the question (RQ2): what research approaches are used in benchmarking water supply companies? The identification and analysis of scientific sources as well as the review of websites and internet platforms allows us to conclude that benchmarking of water companies based on KPIs definitely dominates in both the scientific and business environments. Work on defining indicators related to digital technologies is progressing, but they are not popular in the water sector. In summing up the analysis relating to the next question (RQ3), it should be noted that there is also little interest in the analysis of the value chain in the water supply industry. There are individual articles indexed in Scopus and WoS that demonstrate the application of the value chain to comparative research in the water sector. However, compared to other sectors, the popularity of the issue is low. Therefore, it can be concluded that this is further evidence of a research gap.

The fourth research question (RQ4) concerned the concept of benchmarking methodology. After analyzing the applied benchmarking research and examining the popularity of process benchmarking, two possible research scenarios were proposed. The first scenario takes into account the achievements so far in the benchmarking respondents based on KPIs. Knowledge of the obtained performance indicators allows you to shorten the time of benchmark identification and focus on selected, key processes for water supply companies. The second scenario of benchmarking research assumes a systemic approach to research, which uses the structure of the value chain and the already popularized methodologies for assessing process maturity. Such research allows for a complete picture of the involvement of digital technologies in enterprise value chains. The author tried to emphasize the same role of digitization of operational and supporting processes and their impact on the achievement of economic, social and environmental goals of enterprises. In the analysis of the environment of a modern water company and its value chain, the issue of sustainable development cannot be ignored, which she also tried to highlight.

Process benchmarking is valuable not only for technologically less developed companies but also for technology leaders in the industry. Comparing yourself with other leading entities serves to look for inspiration to create innovative solutions, as well as build business and public–business partnerships in order to increase economic, social and environmental value. Benchmarking studies are conducted by individual enterprises, but the most popular, both in the scientific and business environment, are studies conducted on a wider scale (regional, national or international). Hence, the

initiated concept of benchmarking the digitization of the value chain can also be developed on a larger scale, for example by industry organizations, in public initiatives, and in public–private partnership.

Further directions of research on the benchmarking methodology for digitizing the value chain should be aimed at establishing a set of indicators and levels of digital maturity for current and future digital technologies in the water sector. The next stage in developing the proposed benchmarking methodology requires empirical identification of indicators and testing of scales to determine the levels of digital maturity of processes.

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Reference

- Ahmed, P., & Rafiq, M. (1998). Integrated benchmarking: A holistic examination of select techniques for benchmarking analysis. *Benchmarking for Quality Management & Technology*, 5(3), 225–242. <https://doi.org/10.1108/14635779810234802>
- Ahmed, T., Fung, A. S., & Kumar, R. (2020). Energy benchmarking and ventilation related energy saving potentials for SMEs in Greater Toronto Area. *Journal of Cleaner Production*, 246. <https://doi.org/10.1016/j.jclepro.2019.118961>
- Al Khamisi, Y. N., Khan, M. K., & Munive-Hernandez, J. E. (2019). Knowledge-based lean six sigma system for enhancing quality management performance in healthcare environment. *International Journal of Lean Six Sigma*, 10(1), 211–233. <https://doi.org/10.1108/IJLSS-06-2017-0066>
- Al Nuseirat, A. A., El Kahlout, Z. M., Abbas, A., Adebajo, D., Punnakitkashem, P., & Mann, R. (2019). An analysis of a structured benchmarking project: The case of Dubai Electricity and Water Authority's benchmarking project. *Benchmarking*, 26(5), 1431–1450. <https://doi.org/10.1108/BIJ-02-2018-0032>
- Alcácer, V., & Cruz-Machado, V. (2019). Scanning the Industry 4.0: A literature review on technologies for manufacturing systems. *Engineering Science and Technology, an International Journal*, 22(3), 899–919. <https://doi.org/10.1016/j.jestch.2019.01.006>
- Aldrich, H. E. (1999). *Organizations Evolving*. London, Thousand Oaks, New Delhi: Sage Publications.
- Al-Hashimi, A. M., & Jabbar, A. A.-H. (2019). Role of integrating ABC and VCA through the use of supply chain management in improving potable water tariff in Iraq. *International Journal of Supply Chain Management*, 8(1), 546–561.

- Allan, F. (1993). Benchmarking—Practical aspects for information professionals. *Special Libraries*, 84(3), 123–130.
- Allard, A. (1967). *Evolution and Human Behavior*. New York: Natural History Press.
- Anand, G., & Kodali, R. (2008). Benchmarking the benchmarking models. *Benchmarking-an International Journal*, 15(3), 257–291. <https://doi.org/10.1108/14635770810876593>
- Baldwin, R., & Venables, A. J. (2015). Trade policy and industrialization when backward and forward linkages matter. *Research in Economics*, 69(2), 123–131. <https://doi.org/10.1016/j.rie.2015.02.008>
- Beath, A., & Flynn, C. (2020). Benchmarking the performance of private equity portfolios of the World's largest institutional investors: A view from CEM benchmarking. *Journal of Index Investing*, 30(1), 67–87. <https://doi.org/10.3905/joi.2020.1.155>
- Berg, S. (2010). *Water Utility Benchmarking: Measurement, Methodologies and Performance Incentives*. London: IWA Publishing. Retrieved from <https://www.iwapublishing.com/books/9781843392729/water-utility-benchmarking>
- Berg, S. (2013). Advances in benchmarking to improve water utility operations: A review of six IWA books. *Water Policy*, 15(2), 325–333. <https://doi.org/10.2166/wp.2012.089>
- Berg, S., & Marques, R. (2011). Quantitative studies of water and sanitation utilities: A benchmarking literature survey. *Water Policy*, 13(5), 591–606. <https://doi.org/10.2166/wp.2011.041>
- Berg, S. V., & Phillips, M. A. (2017). Data availability as a key tool for regulating government-owned water utilities. *Utilities Policy*, 49, 30–37. <https://doi.org/10.1016/j.jup.2017.06.012>
- Bickauske, D., Simanavičienė, Z., Jakubavicius, A., Vilys, M., & Mykhalchyshyna, L. (2020). Analysis and perspectives of the level of enterprises digitalization (Lithuanian manufacturing sector case). *Independent Journal of Management & Production*, 11(9), 2291–2307. <https://doi.org/10.14807/ijmp.v11i9.1404>
- Blanchard, C., Comm, C. L., & Mathaisel, D. F. X. (2008). Adding value to service providers: Benchmarking Wal-Mart. *Benchmarking-an International Journal*, 15(2), 166–177. <https://doi.org/10.1108/14635770810864875>
- Brazinskas, S., Pipirienė, V., & Khayrzoda, S. (2021). Digital platforms: Drivers for competence and competitiveness growth. *International Journal of Learning and Change*, 13(4–5), 490–509. <https://doi.org/10.1504/IJLC.2021.116695>
- Broberg, P., Umans, T., Skog, P., & Theodorsson, E. (2018). Auditors' professional and organizational identities and commercialization in audit firms. *Accounting, Auditing and Accountability Journal*, 31(2), 374–399. <https://doi.org/10.1108/AAAJ-02-2014-1607>
- Bustanza, O. F., Bigdeli, A. Z., Baines, T., & Elliot, C. (2015). Servitization and competitive advantage: The importance of organizational structure and

- value chain position. *Research-Technology Management*, 58(5), 53–60. <https://doi.org/10.5437/08956308X5805354>
- Cabrera, E. Jr., Dane, P., Haskins, S., & Theuretzbacher-Fritz, H. (2010). *Benchmarking Water Services: Guiding Water Utilities to Excellence*. London: IWA Publishing. Retrieved from <https://www.iwapublishing.com/books/9781843391982/benchmarking-water-services>
- Camp, R. C. (1989). Benchmarking: The search for industry best practices that lead to superior performance. *Quality Progress*, 22(4), 62–69.
- Campbell, D. (1969). Variation and selective retention in socio-cultural evolution. *General Systems*, 14, 69-85.
- Castka, P., & Balzarova, M. A. (2018). An exploration of interventions in ISO 9001 and ISO 14001 certification context – A multiple case study approach. *Journal of Cleaner Production*, 174, 1642–1652. <https://doi.org/10.1016/j.jclepro.2017.11.096>
- Cetrulo, T. B., Marques, R. C., & Malheiros, T. F. (2019). An analytical review of the efficiency of water and sanitation utilities in developing countries. *Water Research*, 161, 372–380. <https://doi.org/10.1016/j.watres.2019.05.044>
- Chofreh, A. G., Goni, F. A., Zeinalnezhad, M., Navidar, S., Shayestehzadeh, H., & Klemes, J. J. (2019). Value chain mapping of the water and sewage treatment to contribute to sustainability. *Journal of Environmental Management*, 239, 38–47. <https://doi.org/10.1016/j.jenvman.2019.03.023>
- Choi, S. C., Suh, E. S., & Park, C. J. (2020). Value chain and stakeholder-driven product platform design. *Systems Engineering*, 23(3), 312–326. <https://doi.org/10.1002/sys.21527>
- Christiansson, M.-T., & Rentzhog, O. (2020). Lessons from the “BPO journey” in a public housing company: Toward a strategy for BPO. *Business Process Management Journal*, 26(2), 373–404. <https://doi.org/10.1108/BPMJ-04-2017-0091>
- Daniels, S. (1996). Benchmarking. *Work Study*, 45(3), 18–20.
- Daraio, C., Kerstens, K., Nepomuceno, T., & Sickles, R. C. (2020). Empirical surveys of frontier applications: A meta-review. *International Transactions in Operational Research*, 27(2), 709–738. <https://doi.org/10.1111/itor.12649>
- De Toni, A., & Meneghetti, A. (2000). Production planning process for a network of firms in the textile-apparel industry. *International Journal of Production Economics*, 65(1), 17–32. [https://doi.org/10.1016/S0925-5273\(99\)00087-0](https://doi.org/10.1016/S0925-5273(99)00087-0)
- Delpachitra, S., & Beal, D. (2002). Process benchmarking: An application to lending products. *Benchmarking*, 9(4), 409–420. <https://doi.org/10.1108/14635770210442725>
- Ebner, K., Mueller, B., & Ahlemann, F. (2019). Understanding the success of strategic IT benchmarking—Exploring the role of the individual level. *Information and Management*, 56(5), 640–656. <https://doi.org/10.1016/j.im.2018.10.005>

- Ebner, K., Urbach, N., & Mueller, B. (2016). Exploring the path to success: A review of the strategic IT benchmarking literature. *Information and Management*, 53(4), 447–466. <https://doi.org/10.1016/j.im.2015.11.001>
- Evans, M. T. P., Tisak, D. J., & Williamson, D. F. (2012). Twenty-first century benchmarking: Searching for the next generation. *Benchmarking-an International Journal*, 19(6), 760–780. <https://doi.org/10.1108/14635771211284314>
- Fernandez, P., Mccarthy, I. P., & Rakotobe-Joel, T. (2001). An evolutionary approach to benchmarking. *Benchmarking: An International Journal*, 8(4), 281–305. <https://doi.org/10.1108/14635770110403783>
- Ferreira, D. C., & Marques, R. C. (2021). Public-private partnerships in health care services: Do they outperform public hospitals regarding quality and access? Evidence from Portugal. *Socio-Economic Planning Sciences*, 73. <https://doi.org/10.1016/j.seps.2020.100798>
- Fisher, D. M. (2004). The business process maturity model. A practical approach for identifying opportunities for optimization. *BPTrend*. Retrieved 2 May, 2021, from <https://www.bptrends.com/bpt/wp-content/publicationfiles/10-04%20ART%20BP%20Maturity%20Model%20-%20Fisher.pdf>
- Fonseca, L. M. (2018). Industry 4.0 and the digital society: Concepts, dimensions and envisioned benefits. *Proceedings of the International Conference on Business Excellence*, 12(1), 386–397. <https://doi.org/10.2478/picbe-2018-0034>
- Francisco, A., Mohammadi, N., & Taylor, J. E. (2020). Smart city digital twin-enabled energy management: Toward real-time urban building energy benchmarking. *Journal of Management in Engineering*, 36(2). [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000741](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000741)
- Garzoni, A., De Turi, I., Secundo, G., & Del Vecchio, P. (2020). Fostering digital transformation of SMEs: A four levels approach. *Management Decision*, 58(8), 1543–1562. <https://doi.org/10.1108/MD-07-2019-0939>
- Gill, M., & Van Boskirk, S. (2016). *The Digital Maturity Model 4.0. Benchmarks: Digital Business Transformation Playbook*. Forrester Research, Inc. Retrieved 5 May, 2021, from <https://forrester.nitro-digital.com/pdf/Forrester-s%20Digital%20Maturity%20Model%204.0.pdf>
- Glavan, L. M. (2020). An investigation of business process maturity: Report on Croatian companies. *Business Systems Research*, 11(2), 159–165. <https://doi.org/10.2478/bsrj-2020-0022>
- Gleeson, T., Wada, Y., Bierkens, M. F. P., & Van Beek, L. P. H. (2012). Water balance of global aquifers revealed by groundwater footprint. *Nature*, 488(7410), 197–200. <https://doi.org/10.1038/nature11295>
- Goni, F. A., Gholamzadeh Chofreh, A., Estaki Orakani, Z., Klemes, J. J., Davoudi, M., & Mardani, A. (2021). Sustainable business model: A review and framework development. *Clean Technologies and Environmental Policy*, 23(3), 889–897. <https://doi.org/10.1007/s10098-020-01886-z>

- Graetz, G., & Michaels, G. (2018). Robots at work. *Review of Economics and Statistics*, 100(5), 753–768. https://doi.org/10.1162/rest_a_00754
- Gurbaxani, V., & Dunkle, D. (2019). Gearing up for successful digital transformation. *MIS Quarterly Executive*, 18(3), 209–220. <https://doi.org/10.17705/2msqe.00017>
- Haefner, B., Kraemer, A., Stauss, T., & Lanza, G. (2014). Quality value stream mapping. *Procedia CIRP*, 17, 254–259. <https://doi.org/10.1016/j.procir.2014.01.093>
- Hammer, M. (2007). The process audit. *Harvard Business Review*. April, 111–123. Retrieved 15 November, 2020, from <https://hbr.org/2007/04/the-process-audit>
- Harmon, P. (2009). Process maturity models. *BPTrends*, 2(5). Retrieved 5 May, 2021 from https://www.bptrends.com/bpt/wp-content/publicationfiles/spotlight_051909.pdf
- Harmon, P. (2019). *Business process change: A business process management guide for managers and process professionals*. Burlington: Morgan Kaufmann. <https://doi.org/10.1016/C2017-0-02868-9>
- Härting, R.-C., Reichstein, C., & Sochacki, R. (2019). Potential benefits of digital business models and its processes in the financial and insurance industry. *Smart Innovation, Systems and Technologies*, 143, 205–216. https://doi.org/10.1007/978-981-13-8303-8_18
- Hoekstra, A. Y., Chapagain, A. K., & van Oel, P. R. (2019). Progress in water footprint assessment: Towards collective action in water governance. *Water (Switzerland)*, 11(5). <https://doi.org/10.3390/w11051070>
- Hurmelinna, P., Peltola, S., Tuimala, J., & Virolainen, V.-M. (2002). Attaining world-class R&D by benchmarking buyer-supplier relationships. *International Journal of Production Economics*, 80(1), 39–47. Scopus. [https://doi.org/10.1016/S0925-5273\(02\)00241-4](https://doi.org/10.1016/S0925-5273(02)00241-4)
- Keller, T., Bayer, C., Bausch, P., & Metternich, J. (2019). Benefit evaluation of digital assistance systems for assembly workstations. *Procedia CIRP* 81, 441–446. <https://doi.org/10.1016/j.procir.2019.03.076>
- Khosravi, A. (2016). Business process rearrangement and renaming: A new approach to process orientation and improvement. *Business Process Management Journal*, 22(1), 116–139. <https://doi.org/10.1108/BPMJ-02-2015-0012>
- Kulikowski, K. (2021). Cognitive biases policy (CBP) in performance improvements – the example of benchmarking. *International Journal of Productivity and Performance Management*. <https://doi.org/10.1108/IJPPM-02-2020-0060>
- Kyrö, P. (2003). Revising the concept and forms of benchmarking. *Benchmarking*, 10(3), 210–225. <https://doi.org/10.1108/14635770310477753>
- Liboni, L. B., Liboni, L. H. B., & Cezarino, L. O. (2018). Electric utility 4.0: Trends and challenges towards process safety and environmental protection. *Process Safety and Environmental Protection*, 117, 593–605. <https://doi.org/10.1016/j.psep.2018.05.027>

- Lichtblau, K., Stich, V., Bertenrath, R., Blum, M., Bleider, M., Millack, A., Schmitt, K., Schmitz, E., & Schröter, M. (2015). *Industry 4.0 Readiness*. The IMPULS Foundation of the German Engineering Federation (VDMA). Retrieved 25 February, 2021, from <http://industrie40.vdma.org/documents/4214230/5356229/Industrie%204.0%20Readiness%20Study%20English.pdf/f6de92c1-74ed-4790-b6a4-74b30b1e83f0>
- Lokuge, S., Sedera, D., Grover, V., & Dongming, X. (2019). Organizational readiness for digital innovation: Development and empirical calibration of a construct. *Information and Management*, 56(3), 445–461. <https://doi.org/10.1016/j.im.2018.09.001>
- Looy, A. V. (2020). Capabilities for managing business processes: A measurement instrument. *Business Process Management Journal*, 26(1), 287–311. <https://doi.org/10.1108/BPMJ-06-2018-0157>
- Lopes, A. L. M., De Barros Mesquita, R., Lambertucci, M., & Lara, J. E. (2020). The evolution of the benchmarking methodology data envelopment analysis—DEA in the cost regulation of the Brazilian electric power transmission sector: A critical look at the renewal of concessions. *Gestao e Producao*, 27(1). <https://doi.org/10.1590/0104-530X3940-20>
- Luo, M., Fan, H. Q., & Liu, G. (2020). Measuring regional differences of construction productive efficiency in China: A distance friction minimization approach. *Engineering, Construction and Architectural Management*, 27(4), 952–974. <https://doi.org/10.1108/ECAM-04-2019-0195>
- Maciel, A. F., & Wallendorf, M. (2017). Taste engineering: An extended consumer model of cultural competence constitution. *Journal of Consumer Research*, 43(5), 726–746. <https://doi.org/10.1093/jcr/ucw054>
- Magdaleno, A. M., Cappelli, C., Baião, F. A., Santoro, F. M., & Araujo, R. (2008). Towards collaboration maturity in business processes: An exploratory study in oil production processes. *Information Systems Management*, 25(4), 302–318. <https://doi.org/10.1080/10580530802384159>
- Malik, R., Mann, R., & Knapman, R. (2021). Rapid benchmarking: The case of a multinational dairy company. *Benchmarking-an International Journal*, 28(3), 1031–1058. <https://doi.org/10.1108/BIJ-03-2020-0099>
- Marti, J. M. V. (2000). ICBS Intellectual Capital Benchmarking Systems. *International Journal of Technology Management*, 20(5–8), 799–818. <https://doi.org/10.1504/IJTM.2000.002890>
- Mauil, R. S., Tranfield, D. R., & Mauil, W. (2003). Factors characterizing the maturity of BPR programmes. *International Journal of Operations and Production Management*, 23(5–6), 596–624. <https://doi.org/10.1108/01443570310476645>
- McCormack, D. K. (2007). *Business Process Maturity: Theory and Application*. Charleston: BookSurge.
- McCormack, K., Willems, J., van den Bergh, J., Deschoolmeester, D., Willaert, P., Štemberger, M. I., Škrinjar, R., Trkman, P., Ladeira, M. B., de Oliveira, M. P. V., Vuksic, V. B., & Vlahovic, N. (2009). A global investigation of key turning

- points in business process maturity. *Business Process Management Journal*, 15(5), 792–815. <https://doi.org/10.1108/14637150910987946>
- Meybodi, M. Z. (2009). Benchmarking performance measures in traditional and just-in-time companies. *Benchmarking-an International Journal*, 16(1), 88–102. <https://doi.org/10.1108/14635770910936531>
- Meybodi, M. Z. (2015). Consistency of strategic and tactical benchmarking performance measures: A perspective on managerial positions and organizational size. *Benchmarking*, 22(6), 1019–1032. <https://doi.org/10.1108/BIJ-07-2013-0074>
- Minelli, A. (2021). *Performance Benchmarking in the Water Utilities Sector*. Melbourne: KPI Institute. Retrieved 2 February, 2021, from <https://www.performancemagazine.org/benchmarking-water-utilities-sector/>
- Miri-Lavassani, K., & Movahedi, B. (2018). Achieving higher supply chain performance via business process orientation. *Business Process Management Journal*, 24(3), 671–694. <https://doi.org/10.1108/BPMJ-07-2016-0140>
- Mooney, C. L. (2014). *Five reasons corporate responsibility professionals need a value chain map*. GreenBiz. Retrieved 5 February, 2021, from <https://greenbiz.com/blog/2014/01/09/5-reasons-cr-professionals-needvalue-chain-map>
- Morse, L., Trompet, M., Barron, A., Anderson, R., & Graham, D. J. (2020). A benchmarking framework for understanding bus performance in the US. *Benchmarking*, 27(4), 1533–1550. <https://doi.org/10.1108/BIJ-08-2019-0367>
- Movahedi, B., Miri-Lavassani, K., & Kumar, U. (2016). Operational excellence through business process orientation: An intra- and inter-organizational analysis. *TQM Journal*, 28(3), 467–495. <https://doi.org/10.1108/TQM-12-2013-0147>
- Mugisha, S. (2011). *Utility benchmarking and regulation in developing countries: Practical application of performance monitoring and incentives*. London: IWA Publishing.
- Mugisha, S., & Berg, S. V. (2008). State-owned enterprises: NWSC's turnaround in Uganda. *African Development Review*, 20(2), 305–334. <https://doi.org/10.1111/j.1467-8268.2008.00188.x>
- Muntean, M. (2018). Business intelligence issues for sustainability projects. *Sustainability*, 10(2), 335. <https://doi.org/10.3390/su10020335>
- Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of industry 4.0 and the internet of things on the business strategy of the value chain-the case of hungary. *Sustainability (Switzerland)*, 10(10). <https://doi.org/10.3390/su10103491>
- Novak, R., & Janeš, A. (2019). Business process orientation in the Slovenian power supply. *Business Process Management Journal*, 25(4), 780–798. <https://doi.org/10.1108/BPMJ-05-2017-0130>
- Ockwell, D., Atela, J., Mbeva, K., Chengo, V., Byrne, R., Durrant, R., Kasprowicz, V., & Ely, A. (2019). Can pay-as-you-go, digitally enabled business

- models support sustainability transformations in developing countries? Outstanding questions and a theoretical basis for future research. *Sustainability (Switzerland)*, 11(7). <https://doi.org/10.3390/su10022105>
- Pace, L. A., & Kelly, E. P. (1998). TQM at Xerox: Lessons worth duplicating. *International Journal of Technology Management*, 16(4–6), 326–335. <https://doi.org/10.1504/ijtm.1998.002678>
- Pagani, M., & Pardo, C. (2017). The impact of digital technology on relationships in a business network. *Industrial Marketing Management*, 67, 185–192. <https://doi.org/10.1016/j.indmarman.2017.08.009>
- Partovi, F. Y., & Hopton, W. E. (1994). Analytic hierarchy process as applied to two types of inventory problems. *Production and Inventory Management Journal*, 35(1), 13–19.
- Peruzzini, M., Grandi, F., & Pellicciari, M. (2017). Benchmarking of tools for User eXperience analysis in Industry 4.0. *Procedia Manufacturing, 27th International Conference on Flexible Automation and Intelligent Manufacturing, Faim2017*, 11, pp. 806–813. <https://doi.org/10.1016/j.promfg.2017.07.182>
- Ponomarenko, V. (2019). The applicability of process-orientation to software development projects: The applicability of process-orientation to software development projects. *International Journal of Information Technology Project Management*, 10(2), 1–7. <https://doi.org/10.4018/IJITPM.2019040101>
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. London: Collier Macmillan.
- Porter, M. E. (1980). *Competitive strategy: Techniques for analyzing industries and competitors*. New York: Free Press.
- Potoczek, N. (2017). The role of human resource management in achieving process maturity by organizations. In Z. Ndaba & T. Mokoteli (Eds.), *Proceedings of the 5th International Conference on Management, Leadership and Governance* (pp. 371–379). Johannesburg, South Africa: University of Witwatersrand, Wits Business School. Retrieved from <https://www.webofscience.com/wos/woscc/summary/f4fd8e94-8c50-4178-b53a-557eb1014f4f-06c58406/relevance/1>
- Röglinger, M., Pöppelbuß, J., & Becker, J. (2012). Maturity models in business process management. *Business Process Management Journal*, 18(2), 328–346. <https://doi.org/10.1108/14637151211225225>
- Rohloff, M. (2009). Case study and maturity model for business process management implementation. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 5701 LNCS, 128–142. https://doi.org/10.1007/978-3-642-03848-8_10
- Rosemann, M., & Bruin, T. (2005). Towards a Business Process Management Maturity Model. *ECIS 2005 Proceedings*. Retrieved from <https://aisel.aisnet.org/ecis2005/37>

- Rosemann, M., & vom Brocke, J. (2015). The six core elements of business process management. In *Handbook on Business Process Management 1* (pp. 105–122). Berlin Heidelberg: Springer-Verlag. <https://doi.org/10.1007/978-3-642-45100-3>
- Rothberg, H. N., & Erickson, G. S. (2017). Big data systems: Knowledge transfer or intelligence insights? *Journal of Knowledge Management*, 21(1), 92–112. <https://doi.org/10.1108/JKM-07-2015-0300>
- Rummler, G. A., & Brache, A. P. (2012). *Improving Performance: How to Manage the White Space on the Organization Chart*. New York: John Wiley & Sons.
- Saguin, K. (2018). Mapping access to urban value chains of aquaculture in Laguna Lake, Philippines. *Aquaculture*, 493, 424–435. <https://doi.org/10.1016/j.aquaculture.2017.01.030>
- Salim, Z., Pranata, N., & Sabilla, K. (2020). Benchmarking Singapore and Hong Kong to develop Indonesia's trade facilitation. *International Journal of Business and Globalisation*, 26(1–2), 119–147. <https://doi.org/10.1504/IJBG.2020.109829>
- Schumacher, A., Erol, S., & Sihni, W. (2016). A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises. In A. Nassehi & S. Newman (Eds.), *Sixth International Conference on Changeable, Agile, Reconfigurable and Virtual Production* (Vol. 52, pp. 161–166). Amsterdam: Elsevier Science Bv. <https://doi.org/10.1016/j.procir.2016.07.040>
- Shafagatova, A., & Van Looy, A. (2021). A conceptual framework for process-oriented employee appraisals and rewards. *Knowledge and Process Management*, 28(1), 90–104. <https://doi.org/10.1002/kpm.1644>
- Shetty, Y. (1993). Aiming high—Competitive benchmarking for superior performance. *Long Range Planning*, 26(1), 39–44. [https://doi.org/10.1016/0024-6301\(93\)90231-4](https://doi.org/10.1016/0024-6301(93)90231-4)
- Sommarberg, M., & Makinen, S. J. (2019). A method for anticipating the disruptive nature of digitalization in the machine-building industry. *Technological Forecasting and Social Change*, 146, 808–819. <https://doi.org/10.1016/j.techfore.2018.07.044>
- Telnov, Y. F., Kazakov, V. A., & Trembach, V. M. (2020). Developing a knowledge-based system for the design of innovative product creation processes for network enterprises. *Biznes Informatika-Business Informatics*, 14(3), 35–53. <https://doi.org/10.17323/2587-814X.2020.3.35.53>
- Tonelli, F., Demartini, M., Loleo, A., & Testa, C. (2016). A novel methodology for manufacturing firms value modeling and mapping to improve operational performance in the Industry 4.0 Era. *Procedia CIRP*, 57, 122–127. <https://doi.org/10.1016/j.procir.2016.11.022>
- Trabucchi, D., Buganza, T., Dell'Era, C., & Pellizzoni, E. (2018). Exploring the inbound and outbound strategies enabled by user generated big data: Evidence from leading smartphone applications. *Creativity and Innovation Management*, 27(1), 42–55. <https://doi.org/10.1111/caim.12241>

- Trento, C. R., Stüker, T., Pereira, G. M., Borchardt, M., & Viegas, C. V. (2016). Strategic benchmarking of service pricing based on the value added. *Benchmarking*, 23(4), 754–767. <https://doi.org/10.1108/BIJ-07-2013-0073>
- Tsironis, L. K., & Matthopoulos, P. P. (2015). Towards the identification of important strategic priorities of the supply chain network: An empirical investigation. *Business Process Management Journal*, 21(6), 1279–1298. <https://doi.org/10.1108/BPMJ-12-2014-0120>
- Valdez-De-Leon, O. (2019). How to develop a digital ecosystem: A practical framework. *Technology Innovation Management Review*, 9(8), 43–54. <https://doi.org/10.22215/timreview/1260>
- van Assen, M. (2018). Process orientation and the impact on operational performance and customer-focused performance. *Business Process Management Journal*, 24(2), 446–458. <https://doi.org/10.1108/BPMJ-10-2016-0217>
- Vasanth Kumar, D., Madhan Mohan, G., & Mohanasundaram, K. M. (2020). Lean supply chain management in garment industry using value stream mapping. *International Journal of Services and Operations Management*, 37(1), 133–143. <https://doi.org/10.1504/IJSOM.2020.109440>
- Villamayor-Tomas, S., Grundmann, P., Epstein, G., Evans, T., & Kimmich, C. (2015). The water-energy-food security nexus through the lenses of the value chain and the institutional analysis and development frameworks. *Water Alternatives*, 8(1), 735–755.
- Walker, R. (1992). Rank Xerox-Management revolution. *Long Range Planning*, 25(1), 9–21. [https://doi.org/10.1016/0024-6301\(92\)90305-l](https://doi.org/10.1016/0024-6301(92)90305-l)
- Walther, G., & Spengler, T. (2004). Empirical analysis of collaboration potential of SMEs in product recovery networks in Germany. *Progress in Industrial Ecology*, 1(4), 363–384. <https://doi.org/10.1504/PIE.2004.005853>
- Watson, G. H. (1993a). *Strategic Benchmarking*. New York: John Wiley and Sons.
- Watson, G. H. (1993b). The benchmarking workbook—Adapting best practices for performance improvement. *Training & Development*, 47(5), 103–103.
- Weber, C., Curtis, B., & Gardiner, T. (2008). *Business Process Maturity Model 1.0*. Object Management Group. Retrieved from <https://www.omg.org/spec/BPMM/1.0/PDF>
- Welchman, L. (2015). *Managing Chaos: Digital Governance by Design*. New York: Rosenfeld Media.
- White, D. J., Hubacek, K., Feng, K., Sun, L., & Meng, B. (2018). The water-energy-food nexus in East Asia: A tele-connected value chain analysis using inter-regional input-output analysis. *Applied Energy*, 210, 550–567. <https://doi.org/10.1016/j.apenergy.2017.05.159>
- Willaert, P., Van Den Bergh, J., Willems, J., & Deschoolmeester, D. (2007). The process-oriented organization: A holistic view developing a framework for business process orientation maturity. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence*

- and *Lecture Notes in Bioinformatics*), 4714 LNCS, 1–15. https://doi.org/10.1007/978-3-540-75183-0_1
- Williams, S., Pickard, C., Glass, K., & Glass, A. (2020). Benchmarking water retail cost efficiency in England and Wales. *International Journal of the Economics of Business*, 431–467. <https://doi.org/10.1080/13571516.2020.1790979>
- Wudhikarn, R., Chakpitak, N., & Neubert, G. (2020). Improving the strategic benchmarking of intellectual capital management in logistics service providers. *Sustainability (Switzerland)*, 12(23), 1–23. <https://doi.org/10.3390/su122310174>
- Zagkas, V. K., & Lyridis, D. V. (2011). A framework for modelling and benchmarking maritime clusters: An application to the maritime cluster of Piraeus. In X. J. Yang, J. M. W. Low & L. C. Tang (Eds.), *Advances in maritime logistics and supply chain systems* (pp. 131–156). Singapore: World Scientific Publishing Co. https://doi.org/10.1142/9789814329866_0006
- Zairi, M., & Whymark, J. (2000). The transfer of best practices: How to build a culture of benchmarking and continuous learning – part 2. *Benchmarking: An International Journal*, 7(2), 146–167. <https://doi.org/10.1108/14635770010326212>
- Zhang, F. (2020). EMNC technological knowledge flow patterns: An overview of the US patents granted. *Multinational Business Review*, 28(1), 129–155. <https://doi.org/10.1108/MBR-03-2019-0021>

Internet sources

- Industry 4.0: Building the digital enterprise (2016). PwC. Retrieved 2 February, 2021, from <https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf>
- Performance Benchmarking in the Water Utilities Sector. The KPI Institute. Retrieved 15 May, 2021, from <https://www.performancemagazine.org/benchmarking-water-utilities-sector/>
- Polish Waterworks Chamber of Commerce (Izba Gospodarcza Wodociągi Polskie - IGWP). Retrieved 25 May, 2021, from <https://www.igwp.org.pl/index.php/nasza-aktywnosc/benchmarking>
- Progress on Drinking Water, Sanitation and Hygiene (2017). WHO-UNICEF JMP. Retrieved 5 February, 2021, from <https://data.unicef.org/resources/progress-drinking-water-sanitation-hygiene-2017-update-sdg-baselines/>
- Strategic Plan IWA 2019-2024, Retrieved 12 December, 2020, from https://iwa-network.org/wp-content/uploads/2015/12/IWA_Strategic-Plan-2019-2024.pdf
- Supporting Countries in Unprecedented Times. The World Bank Annual Report 2020. Retrieved 5 August, 2021, from <https://www.worldbank.org/en/about/annual-report#anchor-annual>

- Sustainable Development Goals (2015). United Nations Department of Economic and Social Affairs. Retrieves 2 May, 2021, from <https://sdgs.un.org/goals>
- The Connected Enterprise Maturity Model (2016). Rockwell Automation Inc. Retrieved 25 February, 2021, from https://literature.rockwellautomation.com/idc/groups/literature/documents/wp/cie-wp002_-en-p.pdf
- The European Federation of National Associations of Water Services (EurEau). Retrieved 25 May, 2021, from <https://www.eureau.org/>
- The International Benchmarking Network for Water and Sanitation utilities (IBNET). Retrieved 5 February, 2021, from <https://www.ib-net.org/>
- Transformation through innovation, ecosystems and sustained outcomes (2021). PwC. Retrieved 7 June, 2021, from <https://www.pwc.com/gx/en/newsroom/analyst-citations/2021/transformation-through-innovation.html>
- UN World Water Development Report, Wastewater: The Untapped Resource. (2017). UNESCO. Retrieved 5 May, 2021, from <https://www.unep.org/resources/publication/2017-un-world-water-development-report-wastewater-untapped-resource>
- US EPA Environmental Protection Agency. Redrived 25 May, 2021, from <https://www.epa.gov/environmental-topics/water-topics>

Abstrakt

CEL: Przegląd literatury oraz licznych źródeł internetowych, w szczególności platform informacyjnych międzynarodowych organizacji wspierających działalność sektora wodnego, miał na celu weryfikację doświadczeń badawczych w zakresie dojrzałości cyfrowej przedsiębiorstw, identyfikację podejść badawczych stosowanych w benchmarkingu wodociągów, oraz określenie poziomu zainteresowania analizą łańcucha wartości branży wodociągowej. Stwierdzono, że brak jest metodyki benchmarkingu, która umożliwiłaby obserwację zmian zachodzących w procesach biznesowych przedsiębiorstw wodociągowych pod wpływem technologii cyfrowych. Dlatego w niniejszym artykule przedstawiono ramy do benchmarkingu cyfryzacji procesów biznesowych. W artykule przedstawiono również przesłanki do benchmarkingu cyfryzacji procesów wchodzących w skład łańcucha wartości przedsiębiorstwa wodociągowego oraz korzyści płynące z włączenia technologii cyfrowych wspierających procesy z perspektywy ekonomicznej, społecznej i środowiskowej. Jednym z kluczowych etapów tworzenia koncepcji badań benchmarkingowych jest stworzenie macierzy zmiennych odnoszących się do celów realizowanych przez przedsiębiorstwa wodociągowe. **METODYKA:** Proponowana koncepcja benchmarkingu cyfryzacji procesów biznesowych wchodzących w skład łańcucha wartości przedsiębiorstwa wodociągowego została przygotowana w oparciu o studia literaturowe oraz analizę wybranych platform internetowych międzynarodowych organizacji działających na rzecz sektora wodnego. **WYNIKI:** Analiza dekompozycji łańcucha wartości przedsiębiorstwa, kryteriów i poziomów oceny dojrzałości procesowej oraz najnowszych technologii cyfrowych pozwoliła na przygotowanie dwóch scenariuszy etapów benchmarkingu procesów oraz wykorzystanie technologii cyfrowych w zależności od poziomu dojrzałości procesowej

oraz doświadczeń benchmarkingowych. **IMPLIKACJE DLA TEORII I PRAKTYKI:** Zaproponowany model jest wysoce koncepcyjny i wymaga walidacji w badaniach pilotażowych w celu weryfikacji poziomów dekompozycji łańcucha wartości, wyboru kluczowych technologii cyfrowych do badań oraz określenia skali dojrzałości cyfrowej dla każdej z uwzględnionych w badaniu technologii. Organizacje prowadzące badania benchmarkingowe mogą poszerzać zakres swoich badań i dostarczać przedsiębiorstwom wodociągowym informacje o najnowszych technologiach cyfrowych wspierających procesy biznesowe. **ORYGINALNOŚĆ I WARTOŚĆ:** Wykorzystanie taksonomii łańcucha wartości do oceny wsparcia procesów biznesowych przez technologie cyfrowe jest oryginalnym podejściem. Umożliwia zdobycie wiedzy o znaczeniu technologii cyfrowych we wszystkich procesach realizowanych w przedsiębiorstwie.

Słowa kluczowe: łańcuch wartości, benchmarking procesów, dojrzałość procesowa, dojrzałość cyfrowa, Przemysł 4.0.

Biographical note

Natalia R. Potoczek (Ph.D., Hab.), Professor at Institute of Economics, Polish Academy of Sciences (INE PAN) in Warsaw. She is a researcher at the Laboratory of Process and Network Analysis at INE PAN, and she works to transfer knowledge between science, business, and the public sphere. She is an Associate Professor at the Wyższa Szkoła Biznesu – National-Louis University. Also, she carries out research and implementation projects. In research and consulting, she combines her knowledge and many years of experience in two areas: business process management and business models.

Conflicts of interest

The author declares no conflict of interest.

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Entrepreneurial self-efficacy and entrepreneurial intention: The mediating role of the need for independence

Victor Osadolor¹ , Emmanuel K. Agbaeze² 
Ejikeme Emmanuel Isichei³ 
Samuel Taiwo Olabosinde⁴ 

Abstract

PURPOSE: The paper focuses on assessing the direct effect of entrepreneurial self-efficacy and entrepreneurial intention and the indirect effect of the need for independence on the relationship between the constructs. Despite increased efforts towards steering the interest of young graduates towards entrepreneurial venture, the response rate has been rather unimpressive and discouraging, thus demanding the need to account for what factors could drive intention towards venture ownership among graduates in Nigeria. **METHODOLOGY:** A quantitative approach was adopted and a data set from 235 graduates was used for the study. The data was analyzed using the partial least square structural equation model (PLS-SEM). **FINDINGS:** It was found that self-efficacy does not significantly affect intention. It was also found that the need for independence affects entrepreneurial intention. The study found that the need for independence fully mediates the relationship between entrepreneurial self-efficacy and entrepreneurial intention. **PRACTICAL IMPLICATIONS:** This paper provides new insight into the behavioral reasoning theory, through its application in explaining the cognitive role of the need for independence in decision-making, using samples from a developing economy. **ORIGINALITY AND VALUE:** The study advances a new perspective on the underlining factors that account for an entrepreneur's intent to start a business venture, most especially among young graduates in Nigeria, through the lens of the behavioral reasoning theory. We further support the

1 Victor Osadolor, Lecturer, Department of Business Administration, Edo State University, Uzairue, Nigeria, e-mail: osadolor.victor@edouniversity.edu.ng (ORCID ID: <https://orcid.org/0000-0002-1116-9974>).

2 Kalu Emmanuel Agbaeze, Professor of Entrepreneurship, Department of Management, University of Nigeria, Enugu, Nigeria, e-mail: emmanuel.agbaeze@unn.edu.ng (ORCID ID: <https://orcid.org/0000-0002-8952-7612>).

3 Ejikeme Emmanuel Isichei, Lecturer, Department of Business Administration, Federal University Wukari, Nigeria, e-mail: e.isichei@fuwukari.edu.ng (ORCID ID: <https://orcid.org/0000-0002-3816-9958>).

4 Samuel Taiwo Olabosinde, Lecturer, Department of Business Administration, Federal University Wukari, Nigeria, e-mail: olabosinde@yahoo.com (ORCID ID: <https://orcid.org/0000-0002-3324-1674>).

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application of the theory in entrepreneurship literature, given the paucity of studies that have adopted the theory despite its relevance.

Keywords: *self-efficacy, entrepreneurial intention, independence, self-belief, PLS-SEM*

INTRODUCTION

Entrepreneurship has been advanced globally to be a viable instrument for sustained economic growth and development. This explains the current focus on entrepreneurship as a means through which economic growth and development, progress, employment generation, creativity, and improvement of a nation can be attained (Urbano & Aparicio, 2015). Entrepreneurship is germane to economic development, the answer to joblessness and other societal issues. Hence, it is important to understand and account for factors that would steer its development in a country (Staniewski & Awruk, 2015).

Scholars have opined that entrepreneurial activities depend on the intention to act in a certain manner. This means intention is a paramount determinant of action (Solesvik, 2013). Entrepreneurial intention (EI) has been described as not just a desire to start, but also as a sincere motivation and willingness to engage in an entrepreneurial venture. It has been said to be an essential element of entrepreneurship (Liñán & Fayolle, 2015; Valencia, Montoya, & Montoya, 2016), hence, making it necessary to account for the factors that could trigger the intent of individuals to engage in a venture of their own.

One major individual psychological trait that has attracted scholarly attention in the literature, and has been found to affect intention, is entrepreneurial self-efficacy (Miao, Qian, & Ma, 2017; Newman et al., 2019). Entrepreneurial self-efficacy (ESE) denotes an individual's belief in deploying available resources, skills, and expertise to successfully accomplish or undertake a task (Torres & Watson, 2013). The belief that a person has the right skills and expertise could make them start a business of their own. However, there have been inconsistencies in the findings on the link between ESE and EI, as scholars have found divergent findings in the relationship (Densberger, 2014; Setiawan, 2013; Yurtkoru, Acar, & Teraman, 2014; Zhao, Seibert, & Hills, 2005), thus necessitating an investigation into other factors that could account for the inconsistencies in the findings.

Drawing on the behavioral reasoning theory, we proposed the need for independence as the mediating variable that accounts for the link between ESE and EI. The desire for independence is mostly regarded as the foremost element of inspiration as to why individuals become entrepreneurs (Walter & Block, 2016; Verheul, Thurik, Hessels, & van der Zwan, 2010). The need

for independence denotes having the ability to make your own decisions and manage your business yourself without external interference (Shava & Chinyamurindi, 2019). The business climate in Nigeria offers little to young adults in terms of support towards venture creation. It thus implies that developing the need for independence as an entrepreneur could account for the process through which their self-belief is triggered towards steering the need to start, own and manage a venture.

Recent studies have accounted for a number of mediating variables in the link between ESE and EI (Arshad, Farooq, Sultana, & Farooq, 2016; Pihie & Bagneri, 2013; Tsai, Chang, & Peng, 2016). However, there are few studies that have accounted for the role of the need for independence as a mediating variable. The need for independence is a strong internal persuasive pressure that steers the quest for control and achievement. As such, when ESE is channeled through it, there is a greater chance that it will lead to EI. The motivation towards self-employment starts with the need for independence (Barba-Sánchez & Atienza-Sahuquill, 2018). As such, this motivational reason could account for the extent to which one's self-confidence would affect one's intent to engage in a venture, irrespective of any perceived barriers.

Further, there have been calls for more research on ESE and intention, given the difficulty in drawing conclusions on intention and since entrepreneurial pursuits are created and evolving (Hsu, Wiklund, & Cotton 2017; Phipps & Prieto, 2015; Newman et al., 2019). While there have been studies that account for the link between ESE and EI in postgraduate students (Douglas & Fitzsimmons, 2013; Vanevenhoven & Liguori, 2016), undergraduates (Pfeifer, Šarlija, & Zekic Sušac, 2016; Horvath, 2016), and secondary school students (Sanchez, 2013), there has been a dearth of studies that account for this relationship among young graduates. It is necessary to close this gap given the fact that, when compared to actual entrepreneurs, the validity of these studies cannot be generalized. Hence, the need for a study that covers individuals with the educational and technical capacity to engage as entrepreneurs.

In Nigeria, there have been diverse government support efforts to see the development of an entrepreneurial mindset among young adults. The efforts are evident in the creation of agencies such as the small and medium enterprise development agency of Nigeria (SMEDAN), the national directorate of employment (NDE), the small and medium industries equity investment scheme (SMIEIS), and the development Bank of Nigeria (DBN). All were established to ensure entrepreneurship development within the country, but they have all contributed minimally to steering EI among Nigerian graduates. Also, despite the introduction of entrepreneurship education for all levels of education, the number of start-ups among young graduates has remained unimpressive, with the unemployment rates rising continually.

Thus, it makes one wonder what role self-belief would have in steering a graduate's intention towards starting a venture and what influence the need for independence would have in supporting a graduate's self-belief as a tool in advancing graduates' start-up intentions. This has become necessary owing to the growing rate of unemployment and the inability of the private sector to absorb the growing number of graduates in the country.

THEORETICAL AND HYPOTHESES DEVELOPMENT

There have been diverse models proposed to explain the behaviors and intentions of entrepreneurs. However, a major challenge with most of these theories is their inability to account, truly, for the reason for the behaviour or intention. The inability to account for the reason for behavior only limits the knowledge of a true inherent, intrinsic factor(s) that supports or negates a behavior or intention. Hence, the behavioral reasoning theory was adopted to explore the link between ESE and EI in this paper.

The behavioral reasoning theory is concerned with the role of reason in explaining specific intentions. It seeks to explain the reason for and against an action (Westaby, Probst, & Lee, 2010). The central premise of the theory is centered around its position that actions are not without in-depth complex reasoning processes, and it is necessary to have a good understanding of what might drive, positively or negatively, a course of action given their effect on the formation of intentions (Calza, Cannavale, & Nadali, 2020).

The theory is rooted in the explanation and reason-based models, as it is believed that reasons are fundamental components of individuals' intentions (Ryan & Casidy, 2018). It is the basis for individual actions and validates behaviors that are not entirely common to general evaluations (Westaby, 2005). Gigerenzer and Goldstein (1996) opined that, based on an individual's reasons, intentions can be formed almost immediately rather than undertaking general global motives before the individual takes a course of action. The reason is the foundation for individuals to believe that reason could trigger another course of outcome or action and that future behaviors can be premised on that reason (Westaby, 2005).

The theory concisely explains a comprehensive knowledge of behaviors because it takes into cognizance context-specific reasons that individuals adopt to justify and defend their behavior (Norman, Conner, & Stride, 2012). The theory's adoption in entrepreneurial literature has been limited (Miralles, Giones, & Gozun, 2017; Norman et al., 2012), but it has become increasingly necessary because it allows for explaining intention beyond the domain of self-belief by attempting to account for the reason for the self-belief.

The application of this theory to this paper is based on our argument that the need for independence is the reason that accounts for young graduates' faith in their capacity to gather and utilize necessary assets, talents, and expertise towards engaging in entrepreneurial activities.

Entrepreneurial self-efficacy and entrepreneurial intention

Self-efficacy is when an individual has faith in his/her capacity to gather and utilize necessary assets, talents, and expertise to achieve or implement a job (Neneh, 2020). An individual with advanced self-efficacy will exert more effort over a longer period of time, and withstand all odds till they accomplish their goal, while setting complex objectives and establishing improved tactics and schemes for the job. An individual with self-efficacy has the capacity to accept disapproval in a more optimistic way (Torres & Watson, 2013). Self-efficacy is germane in the entrepreneurship process, as the procedure requires much determination, perseverance, and preparation. ESE includes prospects that can be viewed as distinguishing and typical physiognomies of an entrepreneur (Ayodele, 2013).

Entrepreneurial self-efficacy denotes belief in one's own ability, which must be translated into genuine entrepreneurial task outcomes to impact an organization's performance (Torres & Watson, 2013; Khedhaouria, Guru, & Torrès, 2014). This means that the more an entrepreneur believes in his/her ability to complete an entrepreneurial task effectively, the more likely they are to galvanize their business venture to greater success. Individuals with higher ESE have a greater tendency to develop their intent to have control, achieve inspiring goals, and choose diverse tactics towards accomplishing them.

Kautonen, Gelderen, and Fink (2015) defined EI as a person's drive to commence a commercial venture in which the inward drive serves as a favorable insight in commencing a commercial venture. It is an inward recognized persuasion by an individual that he or she should establish commercial outlets as well as carefully project to act accordingly at any point in time (Lorz & Volery, 2011). Saeed, Yousafzai, Yani-De-Soriano, and Muffatto (2015) view entrepreneurship as the course of producing risks by which EI develop the link amid the notion and the performance, ensuring the viability of an entrepreneurial process.

EI means a resolution by a person to convert from joblessness or paid job to owning a business. The resolution to own a business is done with alertness, as it is deliberate and pre-meditated (Verheul, Thurik, Hessel, & van der Zwan, 2010). Linan, Nabi, and Krueger (2013) defined EI as a pre-meditated decision and resolution by a person to start an ingenious commercial outlet. The examination of EI serves as a major clarification for the establishment

of businesses, hence, the reason to explore elements that make individuals develop their intent to start their own business (Devonish, Alleyne, Charles-Soverall, Marshall, & Pounder, 2010; Liñán & Fayolle, 2015; Obschonka & Rodermund, 2010; Valencia, Montoya, & Montoya, 2016).

Since EI is a purposeful action to engage in a venture, as such, an individual's self-appraisal of their ability to take advantage of an opportunity and convert it into venture creation would most likely drive their willingness to engage in the venture. An individual's belief in their ability to undertake a task drives their interest (Ayodele 2013), which is most likely to define the individual's decision to become an entrepreneur. When ESE drives EI, there are greater chances for increased performance, most especially for small-scale ventures (Shinnar, Hsu, & Powell, 2014). This is because the judgment and actions of the business's founder have a direct impact on the enterprise's direction and overall performance (Neneh, 2015). ESE facilitates the connection between tactical disposition and EI and also coordinates the linkage between tactical disposition and increased entrepreneurial intent (Prabhu, McGuire, Drost, & Kwong, 2012).

Self-efficacy determines an individual's capacity to attain a particular level of accomplishment. It is seen as an element that has a huge influence on EI or the decision to become an entrepreneur because of an individual's confidence in their entrepreneurial capacity (Ayodele, 2013). ESE can also influence the type of venture in which an entrepreneur actively engages in, since the venture was borne out of interest that is triggered from the individuals self-belief in their ability; hence, there will be a greater propensity of perseverance that would aid in the creation of inspiring progress forecasts for the venture, and help in providing the consistency with which pressure is applied in order to meet pre-determined targets.

Further, since the self-belief is largely dependent on the individual's level of knowledge and expertise in that field, there is a greater tendency that it will steer the individual towards owning and managing a venture of their interest, which will allow the individual to apply their knowledge, gain new experience and explore their networks towards ensuring the sustainability of their venture.

Akhtar, Hongyuan, Iqbal, Yaw, and Ankomah (2020) found ESE affects EI. Shahab, Chengang, Arbizu, and Haider (2018) study also showed that self-efficacy affects EI. An evaluation of the relationship between ESE and EI was carried out by Chu, Sun, Yang, Zheng, and Li (2020), and their study found that ESE positively affects EI.

According to this paper, an individual's decision to act is influenced by their self-belief in their ability to achieve an expected result, so the higher the self-efficacy of young adults, the more likely they are to engage in a venture.

The study by Wang and Huang (2019) supported this argument with their findings revealing that ESE has a significant and positive effect on EI. Garaika and Margahana's (2019) study also showed that ESE has an adverse effect on entrepreneurship intentions. Hence, we hypothesize that:

H₁: Entrepreneurial self-efficacy has a significant effect on Entrepreneurial Intention among graduates in Nigeria.

Mediating role of the need for independence on entrepreneurial self-efficacy and EI

The need for independence entails bearing the burden of depending on one's decision, which differs from relying on and following the decision of others. It means being in charge of one's life rather than leaving it in the hands of others (Shava & Chinyamurindi, 2019). Moreover, entrepreneurship requires independence, as an entrepreneur must go after opportunities that are not usually visible to others and he or she bears the burden of the consequence of his/her decision regardless of whether it is favorable or not. Independence in relation to entrepreneurship means a disposition to be able to make a judgment without influence from peripheral elements. It also depicts a yearning for independence, with no superior control and the ability to design one's job (Giacomin, Janssen, Guyot, & Lohest, 2011).

Independence depicts a person's craving for autonomy, management, and plasticity. To Peng and Kang (2012), it is a desire to chase the entrepreneurial professional lane. The idea of independence to an entrepreneur may be a leeway to his or her inbuilt character and may express his or her fundamental thought process. It is an everyday resolve to lead his or her life and establishment. It is noted that individuals who are self-employed are more satisfied because of the freedom they enjoy managing their business affairs (Lange, 2012). Pursing independence entails individuals wanting to separate themselves from apparent restrictions within the environment they find themselves in (Eijdenberg & Masurel, 2013).

The need for independence is a psychological step towards an individual's desire to own and manage a business of their own. It is expected to affect a person's intent to engage in a venture because independence denotes being your own boss, managing and making decisions without external interference (Croson & Minniti, 2012). Dalborg and Wincent (2015) asserted that independence is the major benefit of entrepreneurship. The need for independence is a major psychological, motivational driver towards an entrepreneurial decision of an individual (Nsahlai, Zogli, Lawa, & Dlamini, 2020). There are greater chances that an individual who seeks the

need to be independent will start up a venture of their own, because, most often, independence is what forms a major part and reason for an individual who decided to become an entrepreneur.

Moreover, it was found that independence and other elements like character, principles, and self-sufficiency increase job satisfaction. Hence, people who are more inclined towards non-financial facets of job relationships are more prepared to let go of a salary in order to enhance the non-financial facet of their work (Croson & Minniti, 2012). Tyszka, Cieřlik, Domurat, and Macko (2011) reiterated that entrepreneurs are probably more driven by the need to be independent than any other motivation, which also helps in shaping their intention and actions to start a business of their own. The study by Omar et al. (2019) found that the need for independence affects students' intention to start a venture. Barba-Sánchez and Atienza-Sahuquillo's (2018) study confirms that the need for independence accounts for the intent to start a new venture. Malebana (2021) also found that the need for independence affects EI. Hence, we hypothesize that:

H₂: The need for independence has a significant effect on the Entrepreneurial Intention of graduates in Nigeria.

The importance of self-efficacy on entrepreneurship cannot be overemphasised, as it has been demonstrated to have a positive effect on the performance of individuals (Haddad & Taleb, 2016). Haddad and Taleb (2016) further pointed out that self-efficacy can be seen in four facets, namely experience, vicarious experience, verbal persuasion and emotional cues, and all these facets except the last one had a favourable effect on performance. This implies that self-efficacy may not be sufficient towards driving intention, as it is dependent on a reason. For EI to evolve, there is a need for the drive to be self-employed, as well as an awareness of apparent entrepreneurial prospects and the availability of resources that will aid the process of becoming self-employed.

The need for independence is a psychological force that stimulates self-belief and drives individual resolution towards a course of action. It has mainly been characterized as entrepreneurial motivation in the literature (Shava & Chinyamurindi, 2019). Kautonen et al. (2013) asserted that although the theory of planned behavior identified individual and societal elements that can lead to EI, the theory did not take into account the probability of EI being foiled as a result of obstacles that are avoidable and non-avoidable. This is significant because, regardless of one's self-belief, there are obstacles that can deter them from embarking on a venture. However, when there is a need for independence, it can instill a greater depth of perseverance that allows

the individual to be persistent and overcome any obstacle, which is a gap that this study seeks to close, as we propose that the need for independence is a factor in the process between ESE and EI.

However, ESE is not the only factor responsible for intention, but its favorable effect on intention has been largely captured in the literature (Shinnar, Hsu, & Powell, 2014; Bae, Qian, Miao, & Fiet, 2014). The essential role self-efficacy plays on EI is buttressed as it helps towards having a regulatory effect on mere creative disposition and an actual willingness to start and engage in a venture. Individuals may decide to be an entrepreneur so as to be independent. This decision is the reason that accounts for the process through which self-efficacy is developed towards ensuring that they become entrepreneurs, as self-efficacy does not just develop immediately. When an individual develops a need for independence, which is often referred to as the need for autonomy (Shava & Chinyamurindi, 2019), it is most likely that the individual will rely on their experience in making the decision to start a venture.

The intention of starting a business is not easily developed given the fact that most entrepreneurs are aware of the obstacles that could deter them from engaging in a venture. However, when an individual desires to be their own boss, it acts as a propeller that steers the individual to develop not just interest but also the ability to identify opportunities, engage in them, and drive self-sufficiency. Further, specific peculiarities serve as the basis for the establishment of an ingenious commercial venture, as what is considered a prospect by a prospective entrepreneur may be considered a requisite by another (Giacomin, Janssen, Pruet, Shinnar, Llopis, & Toney, 2010). Furthermore, the decision to start a business is usually thoroughly considered; thus, individuals with a greater depth of apparent prestige, practicability, and a favorable disposition toward entrepreneurship, combined with a desire for independence as well as apparent attitude regulation, are more likely to develop EI (Solesvik, Westhead, Kolvereid, & Matlay, 2012).

Also, an entrepreneur's extent of perseverance even in the midst of obstacles depends on his or her desire for independence (Martinez & Bryant, 2014). Differences in the desire for independence could depend on openness to experience, which allows an entrepreneur to see obstacles as a means of acquiring knowledge and expanding their knowledge base. Hence, having an appropriate entrepreneurial mindset that desires independence is the means by which ESE can influence EI. Maes, Leroy, and Sels (2014) opined that individual behavior as well as observed conduct act incidentally with societal beliefs in developing an individual's intention in respect of starting a business. The need for independence is drawn from inward regulation, and Maes et al. (2014) observed that inward regulation is connected to an

individual's capacities, which, as an attitudinal regulation, has a favorable impact on intention.

Paez and García (2011) and Mora (2011) opined that the desire for independence is an element that has a considerable influence on promoting EI. Hence, Lortie and Castogiovanni (2015) opined that intention comes first before any action is taken. Intentions are comprehended by apprehending elements of incentive that affect attitude and by the extent of effort the person with the intention to implement possesses, so as to achieve his/her goal. Our paper argues that the need for independence is the internal mechanism that accounts for the changes in an individual's ESE, since we believe that ESE is dynamic and not static (Bledow, 2013; Newman et al., 2019). Hence, we hypothesize that:

H₃: The need for independence mediates the relationship between Entrepreneurial Self-efficacy and Entrepreneurial Intention.

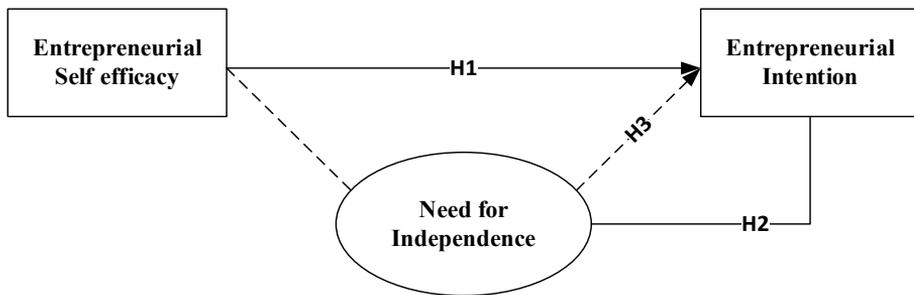


Figure 1. Conceptual model showing the link between ESE, the need for independence and EI

METHODOLOGY

Survey design was used, and this technique's choice was premised on the need to collect data from a large population. The study sample was 350 graduates participating in the National Youth Service Corp in twelve states in Nigeria. The study selected two states in each of the six geopolitical zones in the country. The selection of the respondents for the study was based on the willingness of the graduates to participate in the survey. This corps of graduates was chosen because they are young graduates who have recently graduated from university and have participated in entrepreneurship education programs at the university, which means they have a higher likelihood of intending to start a business. Also, this was done to close gaps in studies that mainly focused

on students, most especially on studies on EI, with limited studies accounting for new graduates, who would have better responses on EI. The study made use of a technique known as purposive sampling. The internal consistency method was used for reliability, while construct and content were used for the validity of the instrument. The partial least square structural equation model (PLS-SEM) was used for the analysis of the study data and this was done with the aid of SmartPLSv3.

Measures

Entrepreneurial self-efficacy

The scale for ESE was adapted from the study by Zhao, Seibert, and Hills (2005). The scale consists of four items. However, we added two new items to make the total items in the scale to be six and these were used to measure the construct. The scale was created using a five-point Likert format, with values ranging from 1 (no confidence) to 5 (complete confidence). Content validity was carried out on the items on the scale and a V-rating of 0.811 was obtained, indicating the items were rated highly. Two examples from the scales are “I have the capacity to raise resources for my business,” and “I can create a working environment that supports new initiatives and ways of doing things.”

Need for independence

The study adapted the unidimensional scale from the study of Singelis (1994), measuring independent self-construal. However, the scale was slightly modified to suit the current study. The instrument was created in the form of a 7-point Likert scale. The scale consists of 15 items, and samples from the scale are “I prefer to be direct and forthright when dealing with things that affect me,” “I value having my peace of mind and being in good health above other things” and “I am able to act the same way in every action that affects me.” The scale was subjected to content validity using two experts in psychology and entrepreneurship and a V-rating of 0.812 was obtained for the scale.

Entrepreneurial intention

The study adapted the instrument of Shahab, Chengang, Arbizu, and Haider (2018) for measuring EI. The instrument is made up of six Likert scale-style items. The choice of the instrument is because of its reliability and validity

of the instrument. The instrument was subjected to content validity by two experts, one entrepreneurship and measurement and evaluation. A V-ratio of 0.792 was obtained, indicating a high rating of the items on the scale. Samples from the scale are “I am ready to start a business of my own,” “I desire to establish a business that will solve problems” and “I do not have the willingness to start a business.”

Since the instrument was adapted from previous studies and the need to confirm the independence of the constructs, we conducted a confirmatory and exploratory factor analysis respectively from a sample of 120 final-year students at Federal University Wukari and Enugu State University. The exploratory factor analysis provided support that the constructs are separate and independent. The two-model approach was adopted in the confirmatory factor analysis using SPSS AMOS, as the one-factor model for the variables confirmed a fit of the models for all the variables. An overall fit was then further assessed and the result produced a much better fit. The indices obtained were in line with a scholarly position (MacCallum & Hong, 1997; Hooper et al., 2008). The fits were satisfactory as (CMIN/DF) = 312, $p < 0.01$, GIF = 0.911, SRMR = 0.008, CFI = 0.920 and RMSEA = 0.644.

RESULT AND DISCUSSIONS

We ensured that the instruments were separated into sections. This was done to avoid bias in responses, since the same respondents were providing responses on the constructed scales. Also, we conducted a factor analysis and found none of the factors accounted for more than 50%, as the need for independence had the highest figure and accounted for 33% of the variance. This implies the result from the study would not be affected by common method variance (Podsakoff, MacKenzie & Podsakoff, 2012). We also ran an independent sample t-test on the retrieved items to see if there was a difference between the instruments that were rejected and those that were used in the study. The result showed that there was no significant difference ($F=213$, $p < 0.01$). Further, two hundred and thirty-five questionnaires, which constitute 67% of the total distributed questionnaires, were found usable out of the three hundred and fifty that were distributed across the six states selected from the six geopolitical zones in the country.

The demographic characteristics of the respondents from Table 1 show that males are 126 (54%) while females are 109 (46%).

Respondents that have started a business before were 7 (3%), those that have never were 182 (77%) while those that have managed for others were 46 (20%). The age distribution shows that respondents between the ages of

18–21 years were 129 (55%), those within the age of 22–25 years were 91 (39%), those within the age of 26–30 years were 15 (6%).

Table 1. Characteristics of respondents

Demographic features	Frequency
Gender	
Male	126 (54%)
Female	109 (46%)
Total	235 (100%)
Previous business experience	
Never started a business	182 (77%)
Had started a business before	7 (3%)
Managed a business for others	46 (20%)
Total	235 (100%)
Age	
18–21 years	129 (55%)
22–25 years	91 (39%)
26–30 years	15 (6%)
Total	235 (100%)

Since the current study was interested in only young adults that are graduates, the age bracket of the respondents was limited to persons within the ages of 18–30 years. Also, the National Youth Service Corp from which the participants were selected from does not allow persons above 30 years of age to partake in the scheme.

Measurement model

The disjoint two-stage approach was used and the result from the analysis produced a measurement of the model first. The result, as presented in Table 2 below, shows the factor loading of the constructs. Given the values were above 0.70, all items on the scale were sufficiently loaded, and as a result, none of the items was removed (Hair, Howard, & Nitzl, 2020). The rho_A and Cronbach alpha was an internal consistency measure of reliability and the result shows that scale was reliable given that the coefficient obtained from the analysis was within the threshold of above 0.70 (Hair, Risher, Sarstedt, & Ringle, 2019). Convergent validity was also confirmed with the result. It showed that the average variance extracted (AVE) was above 0.50, which implies a high level of convergent validity (Hair et al., 2020).

Table 2. Result on Entrepreneurial Self-efficacy, Need for Independence, and Intention

	Loadings	rho_A	Cronbach (∞)	Average Variance Extracted (AVE)	Composite Reliability
Entrepreneurial Self-efficacy		0.849	0.762	0.557	0.834
ESE 1	0.784				
ESE 2	0.711				
ESE 3	0.755				
ESE 4	0.774				
ESE 5	0.750				
ESE 6	0.764				
Need for Independence		0.899	0.892	0.601	0.908
NFI 1	0.798				
NFI 2	0.701				
NFI 3	0.721				
NFI 4	0.756				
NFI 5	0.717				
NFI 6	0.774				
NFI 7	0.780				
NFI 8	0.775				
NFI 9	0.710				
NFI 10	0.785				
NFI 11	0.735				
NFI 12	0.742				
NFI 13	0.728				
NFI 14	0.741				
NFI 15	0.769				
Entrepreneurial Intention		0.849	0.841	0.564	0.884
ENI 1	0.846				
ENI 2	0.776				
ENI 3	0.760				
ENI 4	0.823				
ENI 5	0.755				
ENI 6	0.717				

Henseler, Ringle and Sarstedt (2015) opined that the heterotrait-monotrait (HTMT) was a more robust discriminant validity criterion when compared to the Fornell and Larcker criterion and the cross-loadings when using a variance-based SEM. Table 3 below shows the heterotrait-monotrait (HTMT) values for the study. The result indicates that the discriminant validity criterion was satisfied, given that none of the values was above 0.85 (Henseler et al., 2015; Hair et al., 2020). This implies that discriminant validity was confirmed for this study. We then followed the recommendation of Franke and Sarstedt (2019) and conducted a 95% bootstrap-based confidence interval. This was done to confirm that the threshold is within the intervals. The result also confirms that none of the HTMT values was statistically different from 1, which is a further confirmation of the discriminant validity of the study.

Table 3. Heterotrait-Monotrait Ratio (HTMT)

	Entrepreneurial Self-efficacy	Entrepreneurial Intention	Need for Independence
Entrepreneurial Self-efficacy			
Entrepreneurial Intention	0.137		
Need for Independence	0.149	0.759	

Structural model

The structural path model for the study was further assessed. The result from the loading shows the presence of a weak relationship between ESE and EI. However, when the relationship was mediated by the need for independence, the relationship was stronger. The result shows a moderate relationship between ESE and the need for independence. The significance of the paths was conducted using the bootstrapping approach, which was conducted with 5,000 samples and using the no sign changes option, bias-corrected and accelerated (BCa) bootstrap confidence interval, and two-tailed testing at 0.05. A summary of the results is presented in Table 4 below. The result shows that the path between ESE and EI was not significant, as the p-value was above 0.05. The need for independence was found to have a significant effect on EI; as a result, it shows that the p-value was less than 0.05 and, finally, the result shows that the path indicates the mediating effect of the need for independence on ESE and EI was found to be positive and significant.

The significance of the path loadings is shown in Figure 2 below. The diagram confirms the summarised table result that shows that ESE does not significantly affect EI, given the t-value is less than 1.96. The path between the need for independence and intention was confirmed.

Table 4. Result and Decision on HRM Practices and performance

	T-Statistics	P-Value	Outcome
Self-efficacy -> Intention	0.181	0.857	Reject H ₁
Independence -> Intention	12.300	0.000	Accept H ₂
Self-efficacy -> Independence -> Intention	9.997	0.000	Accept H ₃
Entrepreneurial intention =	R-Square	Q²	
Need for independence =	55.8%	0.336	
	63.4%	0.529	

Note: N.B: Q² = predictive validity.

This implies that H₁ is not supported by the findings of this study, while H₂ and H₃ are supported based on the result of the analysis. The model in-sample fit was determined using R-square, and the result shows that the model explains 63.4% and 55.8% of variance in the need for independence and EI, respectively. The remaining 36.6% and 44.2% could be attributable to other factor(s) not captured in the model.

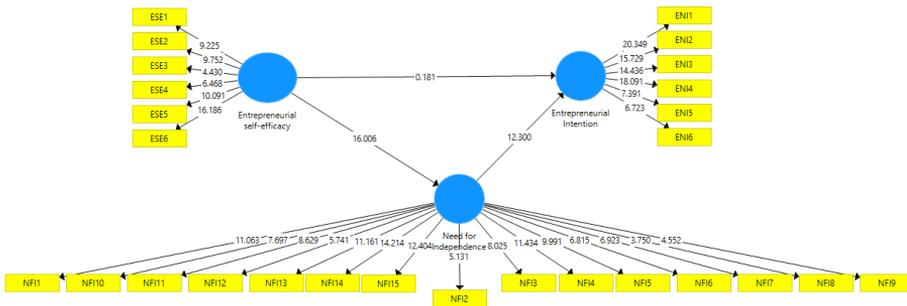


Figure 2. Significance of the link between ESE, the need for independence, and EI
 Source: Researchers’ SmartPLS output.

We also used PLSpredict to assess the predictive power of the study model. Shmueli et al. (2019) stated that Q²-values above zero indicate good predictive relevance. Since the values from Table 4 were above zero, it thus implies that the model has a good predictive relevance. Model fit was assessed using the standardized root mean square (SRMR), and the result shows an index of 0.042. Hair et al. (2017) recommended that for model fit using SRMR values, the values should be below 0.08. Hence, given the SRMR value for this study is 0.042, it thus implies that the model is fit.

The paper examined the mediating effect of the need for independence between ESE and EI. The two hundred and thirty-five usable instruments retrieved from respondents were used for the further analysis of the study.

The measurement model shows the criterion was satisfied, which justified the structural model assessment. The structural assessment produced quite startling results that provide a new insight for scholars.

The outcome of the analysis confirmed that ESE does not have a significant effect on EI. The result showed the t-value to be less than 1.96 and a p-value greater than 0.05. This result is quite surprising given the relevance of self-efficacy in an individual's decision-making process. This result differs from the study of Akhtar et al. (2020), Shahab et al. (2018), Chu et al. (2020), and Wang and Huang (2019). The difference in findings could be because of differences in geographical scope where the studies were undertaken. The differences could also be because self-efficacy is not equal in all individuals, most especially when the current study used fresh graduates, as experience and knowledge have been found to affect self-efficacy, which the majority of the young graduates may not have.

Further, it was found that the need for independence affects EI. This result is consistent with the findings of Omar et al. (2019), and Barba-Sánchez and Atienza-Sahuquillo (2018) that found that the need for independence affects EI. Also, this result supports Hessels, Rietveld, and van der Zwan (2017) position that the tendency to be an entrepreneur is greater owing to the need for independence and job control. This implies that the need for independence is vital for young graduates, as it is a necessary trigger to stimulate EI. The link between the need for ESE and the need for independence was also found to be significant, though not hypothesized in this study. This implies that when entrepreneurs develop a need for independence, it would account for their ability to develop an inner state of self-belief that drives self-confidence.

Finally, the mediating role of the need for independence on ESE and EI was found to be positive and significant. The result is consistent with the views of Bledow (2013) and Newman et al. (2019) on the presence of an internal mechanism that accounts for changes in ESE. This implies that for an individual's self-efficacy to result in a string of intentions to start a business, it then means that the individual must first develop an interest in being independent. Young adults have a strong quest for independence and, when attained, it develops confidence and self-belief, which is useful in encouraging them towards starting a venture of their choice Chu et al. (2020). The result confirms that the need for independence fully mediates the link between ESE and EI. This implies that when an entrepreneur can channel its self-efficacy through the need for independence, both of which are psychological actions, it will produce greater inner confidence towards starting a venture of interest, as self-belief is obviously not enough.

CONCLUSION

In the hope of addressing the gap in studies that accounts for the reason for the low EI, despite increasing government efforts steering young graduates towards venture creation and accounting for the factors that could cognitively support their interest in venture creation, this study broadened our understanding on how the need for independence indirectly accounts for the process between a graduate's self-efficacy and entrepreneurial intention. To this end, we conclude that graduates' self-belief cannot drive the intention towards starting a venture. Therefore, it may be right to assume that graduates' inability to drive venture creation could be because of external factor(s) such as the evident inability to access capital or support funds to establish a business of their own and the hostile business climate in Nigeria that is relatively harsh to new entrants.

Further, the study concludes that a young graduate's decision to create a venture could be best achieved through a cognitive process that demands an individual's need for independence. Therefore, it may be judicious to assume that the evident poor job security, inability to access capital, hostile business environment and weak labor practices in the country weakens their self-belief, thus demanding a cognitive process that deliberately highlights the need for independence, as a precursor towards entrepreneurial intention.

This paper presents both theoretical and practical implications for research on unraveling the link between ESE, the need for independence, and EI among young graduates in Nigeria. We drew upon the behavioral reasoning theory to enhance our understanding of how ESE transmits its effect on young graduates' intentions to be entrepreneurs. Though our study found ESE not to be the reason that could account for young graduates' intentions to be entrepreneurs, it did, however, indicate that when their individual ESE is channeled through the desire to be independent, there is a greater chance that young graduates in the country would desire to be entrepreneurs.

This paper provides new insight into the behavioral reasoning theory through its application in explaining the cognitive role in decision-making, using samples from a developing economy. The study validates the behavioral reasoning theory and supports its application in entrepreneurship literature given the paucity of studies that have adopted the theory, despite its relevance in emphasizing unraveling fundamental underlining reasons that account for an entrepreneur's action.

Further, the study advances the need for increased personality development modules for young adults in the country. There is a need for them to explore their self-belief in their abilities and skills through a deliberate desire to be independent, as it will be useful towards ensuring that they focus

less on the threats that could deter them from being entrepreneurs. This is also important in view of the challenges that are faced in starting a business in the country. This paper confirms that their self-belief may not be enough, as there is a need to educate them on the benefits of being independent. This is very important given the time we are in as a nation, where there are limited white-collar jobs to go around and the spiraling rise in unemployment and crime in the country.

In addition, this paper immensely contributes to the entrepreneurship literature by providing an empirical study that advances a new perspective on ESE by providing scholarly evidence of the factors that cause within-person variance or fluctuations in ESE, which is a gap not previously covered in the literature. The paper highlights the need for more insight into personality traits, uncovering newer dimensions not accounted for in the literature.

Despite the far-reaching relevance of this study to the entrepreneurial literature, there are some limitations that arise from this study. First, the study was limited to a survey design, and, as such, future studies could adopt a longitudinal design towards accounting for the link between ESE and EI. Next, the study was limited to young graduates who had just completed their university education. Therefore, future studies could undertake a comparison between fresh graduates and students who are still in school. Also, as the study was limited to a quantitative perspective, future studies could adopt a qualitative paradigm to the study and, where possible, a mixed-method approach.

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References

- Akhtar, S., Hongyuan, T., Iqbal, S., Yaw, F., & Ankomah, F. (2020). Impact of need for achievement on entrepreneurial intentions: Mediating role of self-efficacy. *Journal of Asian Business Strategy*, 10(1), 114-121. <https://doi.org/10.18488/journal.1006.2020.101.114.121>
- Arshad, M., Farooq, O., Sultana, N., & Farooq, M. (2016). Determinants of individuals' entrepreneurial intentions: A gender-comparative study. *Career Development International*, 21(4), 318-339. <http://dx.doi.org/10.1108/CDI-10-2015-0135>

- Ayodele, K. (2013). Demographics, entrepreneurial self-efficacy and locus of control as determinants of adolescents' entrepreneurial intention in Ogun State, Nigeria. *European Journal of Business and Social Sciences*, 1(12), 59-67. <https://publication.babcock.edu.ng/asset/docs/publications/EDFO/9454/3281.pdf>
- Bae, J., Qian, S., Miao, C., & Fiet, J. (2014). The relationship between entrepreneurship education and entrepreneurial intentions: A meta-analytic review. *Entrepreneurship Theory and Practice*, 38(2), 217-254. <http://dx.doi.org/10.1111/etap.12095>
- Barba-Sánchez, V., & Atienza-Sahuquillo, C. (2018). Entrepreneurial intention among engineering students: The role of entrepreneurship education. *European Research on Management and Business Economics*, 24(1), 53-61. <http://dx.doi.org/10.1016/j.iedeen.2017.04.001>
- Bledow, R. (2013). Demand-perception and self-motivation as opponent processes: A response to Bandura and Vancouver. *Journal of Management*, 39(1), 14–26. <http://dx.doi.org/10.1177/0149206312466149>
- Calza, F., Cannavale, C., & Zohoorian Nadali, I. (2020). How do cultural values influence entrepreneurial behavior of nations? A behavioral reasoning approach. *International Business Review*, 29(5), 101725-101730. <https://doi.org/10.1016/j.ibusrev.2020.101725>
- Chu, C., Sun, B., Yang H., Zheng, M., & Li, B. (2020). Emotional competence, entrepreneurial self-efficacy, and entrepreneurial intention: A 'study based on China college students' social entrepreneurship project. *Frontiers in Psychology*, 11, 2883. <http://dx.doi.org/10.3389/fpsyg.2020.547627>
- Croson, D. C., & Minniti, M. (2012). Slipping the surly bonds: The value of autonomy in self-employment. *Journal of Economic Psychology*, 33(2), 355–365. <http://dx.doi.org/10.1016/j.joep.2011.05.001>
- Dalborg, C., & Wincent, J. (2014). The idea is not enough: The role of self-efficacy in mediating the relationship between pull entrepreneurship and founder passion - a research note. *International Small Business Journal*, 33(8), 974–984. <http://dx.doi.org/10.1177/0266242614543336>
- Densberger, K. (2014). The self-efficacy and risk-propensity of entrepreneurs. *Journal of Enterprising Culture*, 22(4), 437-462. <https://doi.org/10.1142/S0218495814500186>
- Devonish, D., Alleyne, P., Charles-Soverall, W., Marshall, A., & Pounder, P. (2010). Explaining entrepreneurial intentions in the Caribbean. *International Journal of Entrepreneurial Behaviour and Research*, 16(2), 149-171. <https://doi.org/10.1108/13552551011027020>
- Douglas, E., & Fitzsimmons, J. (2013). Intrapreneurial intentions versus entrepreneurial intentions: Distinct constructs with different antecedents. *Small Business Economics*, 41(1), 115–132. <https://doi.org/10.1007/s11187-012-9419-y>
- Eijdenberg, E.L., & Masurel, E. (2013). Entrepreneurial motivation in a least developed country: Push factors and pull factors among MSEs IN Uganda.

- Journal of Enterprising Culture*, 21(1), 19–43. <https://doi.org/10.1142/s0218495813500027>
- Franke, G. R., & Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: A comparison of four procedures. *Internet Research*, 29(3), 430–447. <https://doi.org/10.1108/IntR-12-2017-0515>
- Garaika, G., & Margahana, H. (2019). Self efficacy, self personality and self confidence on entrepreneurial intention: Study on young enterprises. *Journal of Entrepreneurship Education*, 22(1), 1-12. <https://www.abacademies.org/articles/self-efficacy-self-personality-and-self-confidence-on-entrepreneurial-intention-study-on-young-enterprises-7647.html>
- Giacomin, O., Janssen, F., Pruett, M., Shinnar, R., Llopis, F., & Toney, B. (2010). Entrepreneurial intentions, motivations, and barriers: Differences among American, Asian and European Students. *International Entrepreneurship Management Journal*, 7(2), 219-238. <https://doi.org/10.1007/s11365-010-0155-y>
- Giacomin, O., Janssen, F., Guyot, J., & Lohest, O. (2011). Opportunity and/or necessity entrepreneurship? The impact of the socio-economic characteristics of entrepreneurs. MPRA Paper 29506, University Library of Munich, Germany. Retrieved from https://mpra.ub.uni-muenchen.de/29506/2/MPRA_paper_29506.pdf
- Gigerenzer, G., & Goldstein, D. G. (1996). Reasoning the fast and frugal way: Models of bounded rationality. *Psychological Review*, 103(4), 650–669. <https://doi.org/10.1037/0033-295X.103.4.650>
- Haddad, S., & Taleb, R. (2016). The impact of self-efficacy on performance: An empirical study on business faculty members in Jordanian universities. *Computers in Human Behavior*, 55(1), 877-887. <https://doi.org/10.1016/j.chb.2015.10.032>
- Hair, J. F., Binz Astrachan, C., Moisescu, O. I., Radomir, L., Sarstedt, M., Vaithilingam, S., & Ringle, C. M. (2020). Executing and interpreting applications of PLS-SEM: Updates for family business researchers. *Journal of Family Business Strategy*, 100392, <https://doi.org/10.1016/j.jfbs.2020.100392>
- Hair, J. F., Black, B., Babin, B., & Anderson, R. E. (2014). *Multivariate data analysis* (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- Hair, J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 109, 101-110. <https://doi.org/10.1016/j.jbusres.2019.11.069>
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Hair, J.F., Hult, G.T.M., Ringle, C.M., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, 2nd ed.. Thousand Oaks, CA.: Sage Publications.

- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science*, 43(1), 115-135. <http://doi.org/10.1007/s11747-014-0403-8>
- Hessels, J., Rietveld, C. A., & van der Zwan, P. (2017). Self-employment and work-related stress: The mediating role of job control and job demand. *Journal of Business Venturing*, 32(2), 178–196. <https://doi.org/10.1016/j.jbusvent.2016.10.007>
- Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6(1), 53-60. <https://academic-publishing.org/index.php/ejbrm/article/view/1224/1187>
- Horvath, Z. E. (2016). Assessing calling as a predictor of entrepreneurial interest. *Society and Economy*, 38(4), 513–535. <https://doi.org/10.1556/204.2016.38.4.5>
- Hsu, D. K., Wiklund, J., & Cotton, R. D. (2017). Success, failure, and entrepreneurial reentry: An experimental assessment of the veracity of self-efficacy and prospect theory. *Entrepreneurship Theory and Practice*, 41(1), 19-47. <https://doi.org/10.1111/etap.12166>
- Kautonen, T., Gelderen, M. V., & Tornikoski, T. (2013). Predicting entrepreneurial behaviour: A test of the theory of planned behaviour. *Applied Economics*, 45(6), 697-707. <https://doi.org/10.1080/00036846.2011.610750>
- Kautonen, T., Gelderen, M., & Fink, M. (2015). Robustness of the theory of planned behavior in predicting entrepreneurial intentions and actions. *Entrepreneurship Theory and Practice*, 39(3), 655-674. <https://doi.org/10.1111/2Fetap.12056>
- Kautonen, T., Hatak, I., Kibler, E., & Wainwright, T. (2015). Emergence of entrepreneurial behaviour: The role of age-based. *Journal of Economic Psychology*, 50, 41–51. <https://doi.org/10.1016/j.joep.2015.07.004>
- Khedhaouria, A., Gurau, C., & Torrès, O. (2014). Creativity, self-efficacy, and small-firm performance: The mediating role of entrepreneurial orientation. *Small Business Economics*, 44(3), 485-504. <https://doi.org/10.1007/s11187-014-9608-y>
- Lange, T. (2012). Job satisfaction and self-employment: Autonomy or personality? *Small Business Economics*, 38(2), 165–177. <https://doi.org/10.1007/s11187-009-9249-8>
- Liñán, F., & Fayolle, A. (2015). A systematic literature review on entrepreneurial intentions: Citation, thematic analyses, and research agenda. *International Entrepreneurship and Management Journal*, 11(4), 907-933. <https://doi.org/10.1007/s11365-015-0356-5>
- Linan, F., Nabi, G., & Krueger, N. (2013). British and Spanish entrepreneurship intentions: A comparative study. *Revista de Economía Mundial*, 33, 73–103. <http://www.redalyc.org/articulo.oa?id=86626373004>

- Linan, F., Rodriguez-Cohard, C., & Rueda-Cantuche, M. (2011). Factors affecting entrepreneurial intension levels: A role for education. *International Entrepreneurship Management Journal*, 7(2), 195-218. <https://doi.org/10.1007/s11365-010-0154-z>
- Lortie, J., & Castogiovanni, G. (2015). The theory of planned behavior in entrepreneurship research: What we know and future directions. *International Entrepreneurship and Management Journal*, 11(4), 935-957. <https://doi.org/10.1007/s11365-015-0358-3>
- Lorz, M. (2011). *The Impact of Entrepreneurship Education on Entrepreneurial Intention* (Doctoral dissertation). Gallen: University of St. Gallen.
- MacCallum, R. C., & Hong, S. (1997). Power analysis in covariance structure modeling using GFI and AGFI. *Multivariate Behavioral Research*, 32(2), 193–210. https://doi.org/10.1207/s15327906mbr3202_5
- Maes, J., Leroy, H., & Sels, L. (2014). Gender differences in entrepreneurial intentions: A TPB multi-group analysis at factor and indicator level. *European Management Journal*, 32(5), 784–794. <https://doi.org/10.1016/j.emj.2014.01.001>
- Malebana, M. J. (2021). The effect of entrepreneurial motivation on entrepreneurial intention of South African rural youth. *Academy of Entrepreneurship Journal*, 27(3), 1-14. <https://www.abacademies.org/articles/the-effect-of-entrepreneurial-motivation-on-entrepreneurial-intention-of-south-african-rural-youth-10395.html>
- Martinez, C., & Bryant, P.T. (2017). What keeps entrepreneurs entrepreneurial? A regulatory focus theory of entrepreneurial persistence. *Academy of Management Proceedings*, 2014(1). <http://dx.doi.org/10.5465/ambpp.2014.14802abstract>
- Meyer, D. (2011). The reinvention of academic entrepreneurship. *Journal of Small Business Management*, 49(1), 1-8. <https://doi.org/10.1111/j.1540-627X.2010.00311.x>
- Miao, C., Qian, S., & Ma, D. (2016). The relationship between entrepreneurial self-efficacy and firm performance: A meta-analysis of main and moderator effects. *Journal of Small Business Management*, 55(1), 87–107. <https://doi.org/10.1111/jsbm.12240>
- Miralles, F., Giones, F., & Gozun, B. (2017). Does direct experience matter? Examining the consequences of current entrepreneurial behavior on entrepreneurial intention. *International Entrepreneurship and Management Journal*, 13(3), 881-903. <https://doi.org/10.1007/s11365-016-0430-7>
- Moriano, A., Gorgievski, M., Laguna, M., Stephan, U., & Zarafshani, K. (2012). A cross-cultural approach to understanding entrepreneurial intention. *Journal of Career Development*, 39(2), 162-185. <https://doi.org/10.1177%2F0894845310384481>
- Mumtaz, K., Munirah, S., & Halimahton, K. (2012). The relationship between educational support and entrepreneurial intentions in Malaysian higher

- learning institution. *Procedia - Social and Behavioral Sciences*, 69, (24), 2164-2173. <https://doi.org/10.1016/j.sbspro.2012.12.182>
- Neneh, B. N. (2020). Entrepreneurial passion and entrepreneurial intention: The role of social support and entrepreneurial self-efficacy. *Studies in Higher Education*, 1–17. <https://doi.org/10.1080/03075079.2020.1770716>
- Neneh, N. (2015). Entrepreneurial self-efficacy (ESE) and small business performance: The mediating effect of entrepreneurial mindset and openness to experience. *Problems and Perspectives in Management*, 13(4-1), 271-280.
- Newman, A., Obschonka, M., Schwarz, S., Cohen, M., & Nielsen, I. (2019). Entrepreneurial self-efficacy: A systematic review of the literature on its theoretical foundations, measurement, antecedents, and outcomes, and an agenda for future research. *Journal of Vocational Behavior*, 110(B), 403-419. <https://doi.org/10.1016/j.jvb.2018.05.012>
- Norman, P., Conner, M. T., & Stride, C. B. (2012). Reasons for binge drinking among undergraduate students: An application of behavioural reasoning theory. *British Journal of Health Psychology*, 17(4), 682–698. <https://doi.org/10.1111/j.2044-8287.2012.02065.x>
- Nsahlai, V. K., Zogli L. J, Lawa E., & Dlamini B. I. (2020). Factors influencing entrepreneurial intention: A case of students in a South African university. *Academy of Entrepreneurship Journal*, 26(1). <https://www.abacademies.org/articles/Factors-influencing-entrepreneurial-intention-a-case-of-students-in-a-South-African-university-1528-2686-26-1-317.pdf>
- Obschonka, S., & Rodermund, E. (2010). Entrepreneurial intention as developmental outcome. *Journal of Vocational Behavior*, 77(1), 63-72. <http://dx.doi.org/10.1016/j.jvb.2010.02.008>
- Omar, N.A., Shah, N.U., Hasan, N.A., & Ali, M.H. (2019). The influence of self-efficacy, motivation, and independence on students' entrepreneurial intentions. *Journal of Nusantara Studies*, 4(2) 1-28. <https://doi.org/10.24200/jonus.vol4iss2pp1-28>
- Paez, D., & García, J. (2011). Acercamiento a las características del universitario emprendedor en la Unidad de Emprendimiento de la Universidad Nacional de Colombia. *Revista Escuela de Administración y Negocios*, 71, 52-69. <http://journal.ean.edu.co/index.php/Revista/article/view/551>
- Pabon, R. M. (2011). Estudio de actitudes emprendedoras con profesionales que crearon empresa. *Revista Escuela de Administración de Negocios*, 71, 70-83. Retrieved from <http://journal.ean.edu.co/index.php/Revista/article/view/552>
- Peng, Z., Lu, G., & Kang, H. (2012). Entrepreneurial intentions and its influencing factors: A survey of the university students in Xi'an China. *Creative Education*, 3, 95-100. <http://dx.doi.org/10.4236/ce.2012.38B021>
- Pfeifer, S., Šarlija, N., & Zekic Sušac, M. (2014). Shaping the entrepreneurial mindset: Entrepreneurial intentions of business students in Croatia. *Journal of Small Business Management*, 54(1), 102–117. <https://doi.org/10.1111/jsbm.12133>

- Phipps, S. T., & Prieto, L. C. (2015). Women versus men in entrepreneurship: A comparison of the sexes on creativity, political skill, and entrepreneurial intentions. *Academy of Entrepreneurship Journal*, 21(1), 32-43. <https://www.abacademies.org/articles/aejvol21no12015.pdf>
- Pihie, Z., & Bagneri, A. (2013). Self-efficacy and entrepreneurial intention: The mediation effect of self-regulation. *Vocations and Learning*, 6(3), 385–401. <http://dx.doi.org/10.1007/s12186-013-9101-9>
- Podsakoff, P.M., Mackenzie, S.B., & Podsakoff, N.P. (2012) Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63(1), 539-569. <http://dx.doi.org/10.1146/annurev-psych-120710-100452>
- Prabhu, V., McGuire, S., Drost, E., & Kwong, K. (2012). Proactive personality and entrepreneurial intent: Is entrepreneurial self-efficacy a mediator or moderator? *International Journal of Entrepreneurial Behavior & Research*, 18(5), 559-586. <https://doi.org/10.1108/13552551211253937>
- Ryan, J., & Casidy, R. (2018). The role of brand reputation in organic food consumption: A behavioral reasoning perspective. *Journal of Retailing and Consumer Services*, 41, 239–247. <https://doi.org/10.1016/j.jretconser.2018.01.002>
- Saeed, S., Yousafzai, Y., Yani-De-Soriano, M., & Muffatto, M. (2015). The role of perceived university support in the formation of students' entrepreneurial intention. *Journal of Small Business Management*, 53(4), 1127-1145. <https://doi.org/10.1111/jsbm.12090>
- Sanchez, J. C. (2013). The impact of an entrepreneurship education program on entrepreneurial competencies and intention. *Journal of Small Business Management*, 51(3), 447–465. <https://doi.org/10.1111/jsbm.12025>
- Setiawan, J. L. (2013). *Examining entrepreneurial self-efficacy among students*. The 5th Indonesia International Conference on Innovation, Entrepreneurship, and Small Business (IICIES 2013), 115, 235-242. <https://doi.org/10.1016/j.sbspro.2014.02.431>
- Shahab, Y., Chengang, Y., Arbizu, A. D., & Haider, M. J. (2018). Entrepreneurial self-efficacy and intention: Do entrepreneurial creativity and education matter? *International Journal of Entrepreneurial Behavior & Research*, 25(2), 259-280. <https://doi.org/10.1108/ijeb-12-2017-0522>
- Shava, H., & Chinyamurindi, W. T., (2019). The influence of economic motivation, desire for independence and self-efficacy on willingness to become an entrepreneur. *Southern African Journal of Entrepreneurship and Small Business Management*, 11(1), 1-12. <https://doi.org/10.4102/sajesbm.v11i1.234>
- Shinnar, S., Hsu, K., & Powell, B. (2014). Self-efficacy, entrepreneurial intentions, and gender: Assessing the impact of entrepreneurship education longitudinally. *The International Journal of Management Education*, 12(3), 561-570. <http://dx.doi.org/10.1016/j.ijme.2014.09.005>
- Shmueli, G., Sarstedt, M., Hair, J.F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C.M. (2019). Predictive model assessment in PLS-SEM: Guidelines

- for using PLSpredict. *European Journal of Marketing*, 53(11), 2322-2347. <https://doi.org/10.1108/EJM-02-2019-0189>
- Singelis, T. M. (1994). The measurement of independent and interdependent self-construals. *Personality and Social Psychology Bulletin*, 20, 580-591. <https://doi.org/10.1177/0146167294205014>
- Solesvik, M., Westhead, P., Kolvereid, L., & Matlay, H. (2012). Student intentions to become self-employed: The Ukrainian context. *Journal of Small Business and Enterprise Development*, 19(3), 441-460. <http://dx.doi.org/10.1108/14626001211250153>
- Solesvik, M. Z. (2013). Entrepreneurial motivations and intentions: investigating the role of education major. *Education + Training*, 55(3), 253-271. <https://doi.org/10.1108/00400911311309314>
- Soria-Barreto, K., Zuniga-Jara, S., & Ruiz-Campo, S. (2016). Education and entrepreneurial intent in university students: A case study. *University Training*, 9(1), 25-34. <https://doi.org/10.4067/s0718-50062016000100004>
- Staniewski, M., & Awruk, K. (2015). Motivating factors and barriers in the commencement of one's own business for potential entrepreneurs. *Economic Research-Ekonomska Istraživanja*, 28(1), 583-592. <https://doi.org/10.1080/1331677x.2015.1083876>
- Torres, J., & Watson, W. (2013). An examination of the relationship between manager self-efficacy and entrepreneurial intentions and performance in Mexican small businesses. *Contaduría y Administración*, 58(3), 65-87. [https://doi.org/10.1016/S0186-1042\(13\)71222-1](https://doi.org/10.1016/S0186-1042(13)71222-1)
- Tsai, K., Chang, H., & Peng, C. (2016). Extending the link between entrepreneurial self-efficacy and intention: A moderated mediation model. *International Entrepreneurship and Management Journal*, 12, 445-463. <https://doi.org/10.1007/s11365-014-0351-2>
- Tyzka, T., Ciešlik, J., Domurat, A., & Macko, A. (2011). Motivation, self-efficacy, and risk attitudes among entrepreneurs during transition to a market economy. *The Journal of Socio-Economics*, 40(2), 124-131. <https://doi.org/10.1016/j.socec.2011.01.011>
- Urbano, D., & Aparicio, S. (2016). Entrepreneurship capital types and economic growth: International evidence. *Technological Forecasting and Social Change*, 102, 34-44. <https://doi.org/10.1016/j.techfore.2015.02.018>
- Valencia, A., Montoya, I., & Montoya, A., (2015). Factores explicativos de las intenciones emprendedoras en estudiantes universitarios. *Revista Espacios*, 36(5), 7-15. <http://www.revistaespacios.com/a15v36n05/15360507.html>
- Vanevenhoven, J., & Liguori, E. (2016). The impact of entrepreneurship education. *Journal of Small Business Management*, 51(3), 315-328. <https://doi.org/10.1111/jsbm.12026>
- Verheul, I., Thurik, R., Hessels, J., & van der Zwan, P. (2010). Factors influencing the entrepreneurial engagement of opportunity and necessity

- entrepreneurs. *Zoetermeer: Scientific Analyses Entrepreneurship and SMEs*, 1-24. <https://ondernemerschap.panteia.nl/pdf-ez/h201011.pdf>
- Walter, S. G., & Block, J. H. (2016). Outcomes of entrepreneurship education: An institutional perspective. *Journal of Business Venturing*, 31(2), 216–233. <https://doi.org/10.1016/j.jbusvent.2015.10.003>
- Wang, L. Y., & Huang, J. H. (2019). Effect of entrepreneurial self-efficacy on the entrepreneurial intentions of students at a university in Hainan province in China: Taking social support as a moderator. *International Journal of Learning, Teaching and Educational*, 18(9), 183-200. <https://doi.org/10.26803/ijlter.18.9.10>
- Westaby, J. D. (2005). Behavioral reasoning theory: Identifying new linkages underlying intentions and behavior. *Organizational Behavior and Human Decision Processes*, 98(2), 97–120. <https://doi.org/10.1016/j.obhdp.2005.07.003>
- Westaby, J. D., Probst, T. M., & Lee, B. C. (2010). Leadership decision-making: A behavioral reasoning theory analysis. *The Leadership Quarterly*, 21(3), 481–495. <https://psycnet.apa.org/doi/10.1016/j.leaqua.2010.03.011>
- Yurtkoru, E. S., Acar, P., & Teraman, B. S. (2014). Willingness to take risk and entrepreneurial intention of university students: An empirical study comparing private and state universities. *Procedia - Social and Behavioral Science*, 150, 834-840. <https://doi.org/10.1016/j.sbspro.2014.09.092>
- Zhao, H., Seibert, S. E., & Hills, G. E. (2005). The mediating role of self-efficacy in the development of entrepreneurial intentions. *Journal of Applied Psychology*, 90(6), 1265-1272. <https://doi.org/10.1037/0021-9010.90.6.1265>
- Zhao, H., Seibert, S., & Hills, G. (2005). The mediating role of self-efficacy in the development of entrepreneurial intentions. *Journal of Applied Psychology*, 90(6), 1265–1272. <https://doi.org/10.1037/0021-9010.90.6.1265>

Abstrakt

CEL: Artykuł koncentruje się na ocenie bezpośredniego wpływu przedsięwzięcia poczucia własnej skuteczności i przedsięwzięcia intencji oraz pośredniego wpływu potrzeby niezależności na relacje między konstruktami. Pomimo wzmoczonych wysiłków zmierzających do kierowania zainteresowania młodych absolwentów przedsięwzięciem przedsięwzięciem, odsetek odpowiedzi był raczej mało imponujący i niezachęcający, co wymagało uwzględnienia, jakie czynniki mogą skłaniać absolwentów w Nigerii do podjęcia decyzji o przedsięwzięciu biznesowym. **METODYKA:** W badaniu przyjęto podejście ilościowe i zestaw danych od 235 absolwentów. Dane zostały przeanalizowane przy użyciu modeli cząstkowych najmniejszych kwadratów oraz równań strukturalnych (PLS-SEM). **WYNIKI:** Stwierdzono, że poczucie własnej skuteczności nie wpływa znacząco na intencje przedsięwzięcia. Stwierdzono również, że potrzeba niezależności wpływa na intencje przedsięwzięcia. Badanie wykazało, że potrzeba niezależności w pełni pośredniczy w związku między przedsięwzięciem poczuciem własnej

skuteczności a przedsiębiorczym zamiarem. **IMPLIKACJE TEORETYCZNE I PRAKTYCZNE:** Ten artykuł zapewnia nowy wgląd w teorię rozumowania behawioralnego, poprzez jej zastosowanie w wyjaśnianiu poznawczej roli potrzeby niezależności w podejmowaniu decyzji, przy użyciu próbek z rozwijającej się gospodarki. **ORYGINALNOŚĆ I WARTOŚĆ:** Badanie rozwija nowe spojrzenie na czynniki podkreślające, które odpowiadają za intencję przedsiębiorcy, aby rozpocząć przedsięwzięcie biznesowe, zwłaszcza wśród młodych absolwentów w Nigerii, przez pryzmat teorii rozumowania behawioralnego. Ponadto popieramy zastosowanie tej teorii w literaturze dotyczącej przedsiębiorczości, biorąc pod uwagę niedostatek badań, w których przyjęto tę teorię. **Słowa kluczowe:** poczucie własnej skuteczności, intencje przedsiębiorcze, niezależność, wiara w siebie, PLS-SEM.

Biographical notes

Victor Osadolor is a lecturer at Edo State University Iyamu and seasoned scholar whose area of interest is entrepreneurship. He is currently a Ph.D. student at the University of Nigeria, Enugu Campus. He has traveled to several countries, presenting papers in both local and international conferences and has distinguished himself with scholarly works.

Dr. Emmanuel K. Agbaeze is a professor of Entrepreneurship with over twenty-seven years as an academic. He has traveled to several countries, presenting papers in both local and international conferences and has distinguished himself with scholarly works.

Ejikeme Emmanuel Isichei is a lecturer in the Department of Business Administration, Federal University Wukari, Taraba State, Nigeria. He is a doctoral candidate in the Department of Management, University of Nigeria, Enugu Campus. His research interests are entrepreneurship and strategic management.

Samuel Taiwo Olabosinde is a lecturer in the Department of Business Administration, Federal University Wukari, Taraba State, Nigeria. His research interests are supply chain management, Logistics, and transport management.

Conflicts of interest

The authors declare no conflict of interest.

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Application of knowledge management tools: Comparative analysis of small, medium, and large enterprises

Natalia Sytnik¹ , **Maryna Kravchenko²** 

Abstract

PURPOSE: The purpose of this study was to conduct a comparative analysis of knowledge management (KM) initiatives in small, medium, and large enterprises operating in Ukraine, and to highlight the specific characteristics of KM policies, as well as the scope and intensity of KM tools application in these categories. In particular, the study focused on the consistency between the awareness of knowledge/KM importance and KM policies, and the scope and intensity of the application of both human-centered tools and information communication technology (ICT) tools. **METHODOLOGY:** The concept of the study was developed on the basis of an integrative socio-technical perspective. The empirical data were obtained through a questionnaire survey among 90 managers of small, medium, and large Ukrainian enterprises and were analyzed statistically. **FINDINGS:** Both common and distinctive characteristics of these categories in terms of KM were highlighted. Although all enterprises, regardless of their size, showed a high awareness of knowledge/KM importance for their business, significant distinctions between small and large enterprises were found with regard to their KM policies, the scope of advanced KM tools application, and the intensity of some traditional and advanced KM tools application. In all cases, large enterprises showed higher levels of these characteristics compared to small enterprises, whereas medium enterprises were more similar to large enterprises. In contrast to the common view on SMEs as a homogeneous sector in terms of KM, the study shows its heterogeneity in terms of KM initiatives. According to a number of indicators studied, significant differences were observed between small and large enterprises, whereas the distinctions between medium and large enterprises were much less obvious. **IMPLICATIONS FOR THEORY AND PRACTICE:** The theoretical contribution of this study was the provision

1 Natalia Sytnik, Associate Professor, National Technical University of Ukraine, "Igor Sikorsky Kyiv Polytechnic Institute", Peremogy Street, 37, Kyiv, 030566, Ukraine, e-mail: Natalia_Sytnik@ukr.net (ORCID: <https://orcid.org/0000-0002-7670-8860>).

2 Maryna Kravchenko, Professor, National Technical University of Ukraine, "Igor Sikorsky Kyiv Polytechnic Institute", Peremogy Street, 37, Kyiv, 03056 Ukraine, e-mail: marina.kravchenko.kpi@gmail.com (ORCID: <https://orcid.org/0000-0001-5405-0159>).

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of SMEs sector heterogeneity evidence based on a number of KM characteristics. This finding allows us to deepen our knowledge of conceptual differences in KM approaches, applied by different enterprise categories. From a practical perspective, an enterprise size should be taken into account while designing specific KM policies, programs and tools to meet enterprises' needs to a greater extent. The larger the enterprise is, the more structured, deliberate, and conscious the KM approach that should be applied is. ORIGINALITY AND VALUE: No empirical research that addresses the comparative analysis of KM initiatives in small, medium, and large enterprises operating in Ukraine, as well as in other transition economies of post-Soviet states, has been previously performed, and this study fills the gap.

Keywords: *knowledge management, knowledge management awareness, knowledge management policy, human-centered tools, ICT tools, small, medium, and large enterprises*

INTRODUCTION

Nowadays, knowledge management (KM) is generally recognized as a profound factor of economic development, innovations, competitiveness, long-term organizational survival, and sustainability (Xue, 2017; Zheng, 2017; Susanty, Yuningsih, & Anggadwita, 2019; Cardoni, Zanin, Corazza, & Paradisi, 2020). The vital necessity to manage organizational knowledge in a more effective manner has been giving an impetus for rapid development of KM concepts, models, and tools. According to the knowledge-based view (KBV) of the firm, knowledge is seen as the most strategically important intangible asset of organizations and a critical source of competitive advantage (Grant, 1996; Spender, 1996).

KM is regarded as the deliberate and systematic coordination of employees, technology, processes, and organizational structure in order to add value through knowledge reuse and innovation (Dalkir, 2017). KM provides integration of some organizational processes like planning, organizing, motivating, and controlling of employees, designed and used systematically to ensure effective employment of an organization's knowledge-related assets (King, 2009). Until recently, a mainstream of the studies in the KM domain has been focused on large enterprises in which KM advantages are more visible, as compared to the sector of small and medium enterprises. Removing barriers in organizational knowledge acquisition, transfer, dissemination, and usage gives large enterprises a wide range of advantages in terms of business efficiency, vocational learning, and customer interactions (e.g., Uriarte, 2008; Becerra-Fernandez & Sabherwal, 2010). Although the SMEs sector plays a pivotal role in many world economies and represents 99% of all businesses in the EU (European Commission, 2016), only 16% of the literature devoted to KM is focused on small enterprises (Prystupa-Rządca, 2014). Some authors

(Serenko, 2013; Durst & Brunes, 2018; Centobelli, Cercione, & Esposito, 2019) argue that KM in SMEs still remains an underestimated area that has not received sufficient attention in previous KM studies. Based on an extensive literature review, Massaro, Handley, Bagnoli, and Dumay (2016, p. 281) concluded that “literature on KM in SMEs is fragmented, with few specialized authors, and is dominated by unrelated research mainly originating in other contexts (e.g., larger organizations).”

The following gaps in studying the SMEs sector, as compared to large enterprises, were found. Although specific features influencing KM adoption, benefits, and obstacles for KM implementation in SMEs are well documented (Desouza & Awazu, 2006; Hutchinson & Quintas, 2008; Edvardsson & Durst, 2013), the research contributions concerning KM tools and practices adopted by SMEs are fragmented and less systematic. Extensive research in this area with a focus on high-tech startups has only recently been launched (Evangelista, Esposito, Lauro, & Raffa, 2010; Cerchione & Esposito, 2017).

Another gap in the literature coverage deals with KM comparisons among small, medium, and large enterprises. Firstly, the quantitative comparisons between SMEs and large enterprises are quite scarce in spite of a general consensus among scholars that SMEs, in contrast to large enterprises, manage their organizational knowledge in different ways. Secondly, in a KM context, small and medium enterprises are implicitly treated as a single group, although the arguments for this view are insufficient. As Massaro, Handley, Bagnoli, and Dumay (2016, p. 281) stated, “different kinds of organizations (e.g., micro, small and medium) are sometimes treated as equivalent, making comparisons between studies hard.”

In addition, the empirical research on KM initiatives in Ukrainian enterprises is very scarce. Existing literature contributions in this area are mainly concerned with the theoretical issues of KM. (Polyakov, 2017; Ситник, 2017; Ілляшенко, Шипуліна, & Ілляшенко, 2019). To the best of our knowledge, no empirical research addressing the issues of KM in various enterprise categories has been performed in the transition economies of post-Soviet states.

The present study was initiated to conduct a comparative analysis of KM initiatives in small, medium, and large enterprises operating in Ukraine and highlight the specific characteristics of KM policies (procedures), as well as the scope and intensity of KM tools application in these categories.

The research was carried out in a sample of Ukrainian enterprises located in Kyiv city and its region. The paper is organized to contain a number of sections. Following this introduction, the literature review section outlines the main findings in the KM domain regarding organizational knowledge and KM processes, initiatives, and factors influencing their implementation and

effectiveness. The outcome of the literature review allows three research questions of this paper to be determined. The methodology section describes the main features of the sample investigated, the questionnaire survey, and the methods of statistical data analysis that have been applied. The results emerging from the questionnaire survey analysis are presented in the research results section. Both common and distinctive characteristics of KM attitudes, policies and KM tools application in various enterprise categories are highlighted. In the discussion section, the major findings of the study are discussed and compared with literature contributions. The conclusion section outlines the major findings of the study, the theoretical contribution, practical implications, limitations of the study, and suggestions for future research.

LITERATURE REVIEW

Organizational knowledge and knowledge management

During the last decades, the global economy has been facing a transformation from the era based on natural resources to the era of knowledge, in which knowledge has become a strategic asset and a dominant enabler of organizational development, performance, and competitiveness (Xue, 2017; Zheng, 2017; Susanty et al., 2019; Cardoni et al., 2020). Current definitions of knowledge reflect a wide diversity of its understanding among researchers. Some scholars consider knowledge as a source of valued organizational information and place emphasis on its informational side. Bergeron (2003) claims that knowledge incorporates information that is organized, synthesized, or summarized to enhance comprehension, awareness or understanding. According to Anand and Walsh (2016), knowledge consists of information, skills, and expertise.

Another pool of knowledge definitions is based on greater recognition of its social nature. Being socially constructed, knowledge is originated in people's minds and shaped by their values, experiences, and insights. The knowledge is recognized as "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information" (Davenport & Prusak, 1998, p. 5).

Within the frame of the firm's KBV, knowledge is recognized as the most important intangible asset of organizations and a source of sustainable competitive advantage (Grant, 1996; Spender; Zheng, 2017). The firm is viewed as the institution that integrates its members' specialist knowledge with knowledge characteristics and its production requirements

(Grant, 1996). The KBV emphasizes the social nature of organization and the role of internal organizational factors in knowledge production. To manage knowledge, the firm should manage its internal characteristics, which create a proper context for knowledge enhancing and utilization. The most valuable asset of the organization is its shared tacit knowledge (collective knowledge). Since collective knowledge exists throughout the employees' interaction process, rather than in their minds or databases, social factors such as communication and collaboration play a vital role in the utilization and coordination of knowledge resources (Spender, 1996).

The growing necessity to leverage knowledge assets and get the most benefit from their exploitation, forces companies to manage their knowledge through the development of specific KM policies, programs, procedures, and tools. It puts KM on the agenda of both academic researchers and practitioners.

The mainstream KM definitions have originated within the business-oriented KM approach. Knowledge management is recognized as "the capacity (or processes) within an organization to maintain or improve organizational performance based on experience and knowledge" (Pan & Scarbrough, 1999, p. 360). KM is seen as managing the context and conditions, under which knowledge can be created, communicated, and used to achieve organizational goals (Von Krogh, Ichijo, & Nonaka, 2000). In terms of organizational practices, KM means the integration of some organizational processes like planning, organizing, motivating, and controlling of employees, designed and used systematically to ensure the effective employment of an organization's knowledge-related assets (King, 2009).

Organizations apply KM in order to foster knowledge life cycle processes involving knowledge capturing, creation, sharing, storage, and exploitation (King, 2009; Dalkir, 2017). From a knowledge life cycle perspective, KM could be considered as a process that enhances organizational abilities in finding, selecting, organizing, disseminating, and transferring knowledge to support necessary activities such as problem solving, learning, strategic planning, and decision making within the organization (Gupta, Iyer, & Aronson, 2000). KM is also recognized as a set of activities that provide the generation, growth, application, and sustainability of intellectual capital in organizations (Marr, Gupta, Pike, & Roos, 2003; Paolini, Coluccia, Fontana, & Solimene, 2020). Drawing upon knowledge tacit-explicit dichotomy, Hansen, Nohria, and Tierney (1999) proposed a taxonomy of KM strategies that distinguishes between a people-centered "personalization" strategy and an ICT-focused "codification" strategy.

Knowledge management in SMEs and large organizations

It is well known that large organizations, as well as SMEs, can benefit from KM implementation. Large organizations can leverage KM initiatives to improve their performance, efficiency and productivity, product quality, business processes, customer satisfaction, employees' behavior, as well as to enhance market standing, promotion of innovations, and intellectual capital (e.g., Du Plessis, 2005; Greiner, Bohmann, & Krcmar, 2007; Gourova, 2010; Dalkir, 2017). The reported benefits of KM in the SMEs sector include sales and productivity growth, organizational processes improvement, better decision making and knowledge sharing, higher employee creativity and innovation, higher customer satisfaction, less work duplication, enhanced market relations, etc. (Wong & Aspinwall, 2004; Singh, Garg, & Deshmukh, 2008; Soon & Zainol, 2011, Durst & Brunes, 2018).

The managers of large enterprises demonstrate a high awareness of KM importance (e.g., Becerra-Fernandez & Sabherwal, 2008; Uriarte, 2008; Dalkir, 2017). They make deliberate efforts to design KM policies and initiate KM programs in order to achieve their organizational goals. Despite the evident benefits of KM initiatives, SMEs differ from large enterprises in terms of their attitude to KM adoption. KM development does not often belong to the priorities of SME managers. They show insufficient awareness of the organizational needs in KM initiatives and an unwillingness to invest both financial and human resources into developing KM programs (Wong & Aspinwall, 2004; Gourova, 2010).

SMEs differ from large enterprises by their constrained resources and comparatively poor managerial capabilities and practices (Pinget, Bocquet, & Mothe, 2015). They tend to focus on day-to-day operational activities and rely on short-term planning to the detriment of strategical thinking. As a result, small enterprises rarely develop an explicit KM policy (Hutchinson & Quintas, 2008), and often adopt a short-term, unstructured approach towards organizational learning (Edvardsson & Durst, 2013). SMEs are more likely to use informal procedures to manage knowledge than apply deliberate KM programs (Hutchinson & Quintas, 2008). Many scholars underline that smaller enterprises do not fully exploit KM potential and, compared to large organizations, they are much slower in introducing KM initiatives (Gourova, 2010; Evangelista et al., 2010; Durst & Edvardsson, 2012).

Since SMEs are resource constrained, they look outside the organization to capture the relevant knowledge. They are considered to be less advanced in knowledge creation (McAdam & Reid, 2001; Desouza & Awazu, 2006). Due to multiple responsibilities, SME employees often have little time to devote to knowledge codification. SME's organizational knowledge is stored

predominantly in managers' and employees' minds in tacit form (Desouza & Awazu, 2006). Due to the lack of explicit knowledge repositories, SMEs can suffer from organizational "amnesia" as they often fail to retain knowledge acquired and lessons learned in the past, and are more influenced by employee turnover (Gourova, 2010).

At the same time, some specific features of SMEs potentially make them capable of stimulating and supporting knowledge-sharing processes (Alexandru et al., 2019). Due to their structure and size, SMEs are more flexible than large firms, and these traits increase their reactivity (Pinget et al., 2015). Desouza and Awazu (2006) underline that SMEs are very social entities who rely highly on close personal relations among their employees, and have a knack for exploiting external sources of knowledge. Such SMEs' features, such as flat structures and fewer management levels, less bureaucracy, close everyday communications among employees, and rather simple business procedures, serve as prerequisites to their socialization (McAdam & Reid, 2001; Singh et al., 2008). This process of socialization allows small enterprises to form the deep common knowledge they need for organizing their work by easing knowledge transfer and application (Desouza & Awazu, 2006).

KM practices (tools) are conceptualized as the set of various management activities enabling the company to deliver value from its knowledge-based assets supporting the organizational processes of knowledge creation, storage, and transfer (Inkinen, Kianto, & Vanhala, 2015). Human-centered tools incorporate methods and techniques based on "person-to-person" communications and facilitate tacit knowledge sharing. ICT tools are the set of specific IT-based techniques supporting mainly explicit knowledge sharing.

A quantitative investigation of KM tools used by high-tech SMEs was conducted by Cerchione and Esposito (2017). Studying high-tech SMEs, the authors came to the conclusion that SMEs adopted and made more intensive use of those human-centered tools (practices) that did not exclusively focus on the knowledge management process (problem solving, learning by doing, team meetings, and work groups). KM specific, human-centered tools like knowledge elicitation interviews, knowledge modeling, knowledge office, knowledge cafes, communities of practice, and knowledge filtering were less exploited. High-tech SMEs adopted and used more intensively traditional ICT tools rather than new and more updated ones even if they were cheaper and easier to use. More advanced ICT tools (podcasting, video casting, data mining, social media, mash-up, syndication systems, collaborative filtering, crowdsourcing) were less common (Cerchione & Esposito, 2017). In contrast to large organizations, SMEs apply a more careful and leaner approach in terms of ICT tools supporting KM (Singh et al., 2008). Lately, Centobelli et al.

(2019) proposed a methodology to assess the efficiency and effectiveness of knowledge management systems adopted by SMEs.

In recent years, the strategic aspects of KM in SMEs have been the focus of a number of studies (Cerchione & Esposito, 2017; Zieba, Bolisani, & Scarso, 2016; Bolisani, Zieba, Paiola, & Scarso, 2017).

Studying SMEs in the IT sector, Zieba et al. (2016) suggested two opposite approaches to KM. The authors defined them as a deliberate (planned) and emergent approach. The essential features of these approaches were identified as follows. While applying a deliberate KM approach, organizations link their KM practices, tools and methods to the general strategic orientation: their KM procedures are deliberately designed by top management, their KM goals are based on a rational analysis of the organization's needs, objectives and resources; their KM practices are implemented and spread across the company with deliberate efforts and investments.

The emergent KM approach includes KM practices, tools, and methods that originate from the organization's employees' daily activities and learning processes. In fact, employees develop their own methods of knowledge processing in relation to their actual needs. The methods that prove to be effective, useful and/or compatible with the daily business activity are developed and become established practices, and can be recognized as "the KM approach" of the organization (Bolisani et al., 2017). Further development of ideas about the deliberate versus emergent approach was made in the Alexandru et al. (2019) study based on the data from knowledge-intensive SMEs. Three clusters of SMEs were distinguished, that differ in their attitude to KM and the use of KM practices, which the authors called "conscious adopters," "unconscious adopters," and "marginal adopters."

In contrast to SMEs, large organizations are less dependent on external sources of knowledge and make strong efforts to create their own knowledge. In large enterprises, common knowledge can be blurred or fragmented due to the interdepartmental barriers in communications. Therefore, large enterprises have to make greater efforts in order to save and distribute their organizational knowledge. One of the ways to do so leads them to the adoption of a codification strategy based on intensive use of ICT tools (Maier, 2002; Sun & Scott, 2005; Subashini, Rita, & Vivek, 2012; Merlo, 2016). Large enterprises invest generously in the implementation of sophisticated ICT tools to store explicit organizational knowledge. The ICT is proven to be a vital factor to enhance and advance their KM programs (Alavi & Leidner, 2001; Sun & Scott, 2005; Subashini et al., 2012; García-Álvarez, 2015; Dalkir, 2017). ICT tools assist in facilitating knowledge acquisition/creation, knowledge dissemination, knowledge conversion, and knowledge utilization (Cantú, Criado, & Criado, 2009; Martelo-Landroguez & Cegarra-Navarro, 2014).

To sum up, it is generally accepted that large enterprises and SMEs manage their knowledge in different ways. However, this point of view is based on logic and theoretical reasoning rather than on comparable empirical data. Our review of the literature confirms the validity of the conclusions made by Serenko (2013) and Massaro et al. (2016) on the lack of empirical data that allow quantitative comparisons among small, medium, and large enterprises.

In terms of small, medium, and large enterprise distinctions, the latest literature contributions on KM policies and KM tools application should be summarized as follows:

- a majority of the studies in the KM domain has been devoted either to large enterprises or SMEs with a strong prevalence of the studies focused on large enterprises;
- implicitly, small and medium-sized enterprises have been considered as a homogeneous group with similar KM requirements, policies, and initiatives;
- the empirical data on SMEs and large enterprises were predominantly collected on the basis of different methodological approaches and research tools;
- the latest research on KM tools application in SMEs has been conducted in knowledge-intensive SME sectors, whereas traditional business sectors (e.g., manufacturing and trade services) receive less attention from researchers;
- there is no empirical data on KM initiatives in Ukraine. Due to political, economic and cultural differences, application of KM practices and tools among Ukrainian enterprises might differ from the transitional economies of Eastern and Central Europe.

The foregoing statements are evidence that drawing comparisons between small, medium and large enterprises can be difficult and unjustified. Bearing in mind these findings, the following research questions (RQ) were formulated:

- RQ1: Do small, medium, and large Ukrainian enterprises differ in their awareness of knowledge/KM importance?*
- RQ2: Do small, medium, and large Ukrainian enterprises apply distinctive KM policies?*
- RQ3: Do small, medium, and large Ukrainian enterprises differ in the scope of KM tools application?*
- RQ4: Do small, medium, and large Ukrainian enterprises differ in the intensity of KM tools application?*

METHODOLOGY

A holistic and deep understanding of complex social phenomena like KM requires the application of a multi-paradigmatic approach to the research. The concept of the study was developed on the basis of an integrative, socio-technical perspective on KM proposed by Jelavic (2011). Taking into account a mutual explicit-tacit dependency of KM processes, a holistic approach adopted by a socio-technical perspective assumes that KM research requires exploring both human and technical factors within an organizational context (Pan & Scarbrough, 1999; Jelavic, 2011). Within the frame of this perspective, both human-centered and ICT tools were investigated as the key elements of a socio-technical system supporting KM processes in organizations. The organizational context of KM tools application was assessed through the analysis of KM attitudes and the level of formalization of KM policies.

The interpretive perspective was applied at the stage of questionnaire development, its pilot testing, and distribution. The qualitative analysis of feedback from the experts was conducted to validate the questionnaire. On the basis of intensive focus group discussions, the initial questionnaire content was reconsidered. The final version of the questionnaire was obtained through the pilot testing of the questionnaire and its discussion among the managers of four enterprises from the sample surveyed. The functionalist perspective in KM is based on the idea that knowledge is an explicit object that manifests itself in a multitude of forms and locations, including individuals and organizations, and can be detached, codified, and transmitted (Jelavic, 2011). The functionalist perspective was used at the stage of data collection and statistical analysis.

The survey was carried out in a sample of small, medium, and large Ukrainian enterprises. Given the exploratory nature of this study, a convenience sample was used. Convenience sampling is a commonly applied method in social science, and it is particularly recommended in the case of exploratory studies (Leiner, 2017). The study sample was formed from enterprises which during 2015-2019, were partners of Igor Sikorsky Kyiv Polytechnic Institute on the vocational training programs for Management and Marketing Department students. The overall list of partners includes 253 enterprises of various industries located in Kyiv city and Kyiv region. Among them, almost 80% of enterprises are medium and large. The actual data collection was conducted in two stages: 1) on the basis of the partners' list for 2015-2018 – in November-December 2018, and 2) on the basis of the partners' list for 2019 – in December 2019. All potential participants received an e-mail invitation to participate in the study. The number of enterprises that agreed to participate and, thus, included in the sample, was 90. Hence,

the response rate was 35.6%. Further contact with the participants took place at a time convenient for them in the form of a face-to-face interview. Since the respondents belonged to enterprises with which the faculty cooperated throughout different years, in fact, a “convenience pool” was used. Respondents formed two convenience samples, which allowed us to reduce one of the most substantial biases of this method – the sample’s homogeneity (Leiner, 2017).

The respondents were aged from 25 to 45 years, had a university degree in management and occupied managerial positions. Their total length of service varied from 3 to 15 years and 60% of them had been working with the respective sample enterprise for over 3 years. The enterprise category was defined according to staff headcount as proposed by the EU Commission (European Commission, 2016). The breakdown of respondents according to the enterprise category is shown in Table 1.

Table 1. Breakdown of enterprises according to the enterprise category

Category	Number of enterprises	%
Small (between 10 and 49 employees)	29	32.2
Medium (50–250)	30	33.3
Large (over 250 employees)	31	34.5
Total	90	100.0

The breakdown of enterprises according to their business sector is shown in Table 2.

Table 2. Breakdown of enterprises according to business sector

Business Sector	Number of enterprises	%
Trade	29	32.3
Financial and legal services	17	18.9
IT	15	16.8
Manufacturing	9	10.0
Construction	4	4.4
Transport	4	4.4
Household services	4	4.4
Entertainments	4	4.4
Educational services	2	2.2
Restaurants	2	2.2
Total	90	100.0

According to Table 2, trade enterprises make up almost a third of the enterprises surveyed. Financial, legal, and IT enterprises constituted roughly another third of the sample. The last third combined enterprises from seven business sectors, including manufacturing, construction, transport, household services, entertainment, educational services, and restaurants.

There were some limitations with the sampling. One clear limitation of the study is the relatively small number of respondents involved. Further, the sample was not fully representative regarding the structure of small, medium, and large enterprises in the country, and it was not random. Such sampling was made intentionally with a twofold purpose. Firstly, it allowed us to increase the representation of large enterprises in the sample, which was important in terms of the statistical analysis of the results. Secondly, it allowed us to distribute the questionnaire among owners, executives, and senior managers during face-to-face interviews. Personal communications allowed us to provide an insight into the current situation with regard to KM adoption within domestic enterprises. In the case of an online survey, senior managers would have been hardly available and the results of the study would have been compromised. Another limitation of this study is related to the geographical location of the enterprises studied. All of them were located in Kyiv city and Kyiv region. In order to investigate the above stated research questions, a method of standardized questionnaire survey was applied.

The questionnaire was designed to obtain the background characteristics of the sample enterprises and receive answers to the research questions 1-4. In order to construct the initial list of survey questions, an extensive literature review concerning quantitative measures of KM awareness and policies, human-centered tools, and ICT tools was performed (KPMG Consulting, 2000; Alavi & Leidner, 2001; Uriarte, 2001; Becerra-Fernandez & Sabherwal, 2010; Massaro et al., 2016; Cercione & Esposito, 2017).

In order to validate the questionnaire, the initial list of questions was presented to focus group for comments and discussion. The focus group involved six senior managers from small, medium, and large enterprises. They evaluated the questions in terms of their relevance to enterprise practices, ease of understanding, and clarity. As a result of the feedback received, the list of initial questions was revised. The total number of questions was decreased and some of them were reformulated to avoid ambiguity. The experts' revision allowed us to reduce the original list of human-centered tools from twenty to fifteen items and the list of ICT tools was shortened from twenty-four to fifteen items. Such ICT tools as syndication systems, podcasting, video casting, mash-up, prediction and idea markets, trust and reputation systems, product life cycle management systems, collaborative filtering and configuration management systems were excluded from the

final version of the survey as rather “exotic” for Ukrainian realities. For the final revision, the pilot testing of the questionnaire was carried out in four enterprises from the sample surveyed.

The overall structure of the questionnaire is presented in Table 3. The questions were grouped into four sections. The background information section was concerned with the general characteristics of an enterprise, section 1 included the questions on awareness of knowledge and KM importance, section 2 included the questions on KM policies. Sections 1 and 2 combined 3- or 2-choice questions, as well as Likert-scale type questions.

Table 3. Structure of questionnaire sections

Questionnaire Section	Variables	Number of Questions
Background information on enterprises and respondents surveyed	Enterprise business sector Total number of employees Respondent age Respondent education Respondent occupied position Respondent length of service	6
1. KM awareness	Awareness of knowledge importance as a factor of enterprise competitiveness Awareness of KM importance as a factor of enterprise business success	2
2. KM policies (programs)	Availability of a formal KM policy Availability of a formal staff training program in an enterprise Availability of activities that are specified as KM activities Availability of a person(s) responsible for KM activities in the company	4
3. Human-centered tools exploited by an enterprise	Staff meetings Conferences/exhibitions Brainstorming Off-site vocational training Mentoring/coaching Learning by doing Working groups Communities of practice Job rotation Collaborative problem-solving sessions (CPSS) Previous experience analysis Best practices analysis Knowledge maps Process maps Benchmarking	15

Questionnaire Section	Variables	Number of Questions
4. ICT- tools exploited by an enterprise	E-mail Social technologies (discussion forums, blogs, etc.) Skype sessions Audio/video conferences E-learning Data bases Document management systems (DMS) Customer relationship management systems (CRM systems) ERP systems Files/documents archives Groupware tools Decision-making systems Expert systems Cloud computing Data mining	15

Sections 3 and 4 combined the questions concerning the application of human-centered tools and ICT tools application accordingly. They consisted of Likert-scale type questions with a 5-point scale incorporating options varying from “Never” to “Constantly.” The questions were used to measure the scope and intensity of specific KM tool application in the company. For each enterprise category, the scope of specific KM tool application was calculated as the percentage of enterprises which exploited this KM tool “Rarely,” “Sometimes,” “Often,” and “Permanently.” The scope of specific KM tool application could range from 0, if no enterprise exploited the tool, to 100, if all enterprises exploited it.

Our questionnaire survey incorporated self-reported data from a single source. In view of this, potential risk of the common method bias (CMB) was considered. In fact, the questions from sections 2-4 provided data that could be independently verified from other sources. Such questions cause a lower risk of CMB than purely attitudinal questions (Podsakoff & Organ, 1986). Nevertheless, to minimize CMB risk, a number of remedies were applied, as suggested by Podsakoff, MacKenzie, Lee, and Podsakoff (2003). In particular, the questions were kept as simple, focused, and concise as possible, double-barreled questions were avoided, and respondent anonymity along with the exclusive research purpose of the study was reiterated. To check for CMB, correlations between variables were calculated. According to Podsakoff et al. (2003), high variable correlations indicate a high level of CMB. The highest correlation coefficient (0.605) did not exceed 0.90 which was suggested by Bagozzi, Yi, and Phillips (1991) as

the threshold for CMB assessment. So, the post-hoc test shows that CMB did not substantially confound the results obtained.

Since respondents' answers were measured on an ordinal scale, Pearson's Chi-square test was used to assess the statistical significance of differences in KM attitudes, KM policies (procedures) and the scope of KM tools application between enterprises surveyed. In all cases, the null hypothesis (H_0) stated that the differences between obtained frequencies of observable variables in small, medium, and large enterprises were statistically insignificant ($p > 0.05$). The alternative hypothesis (H_a) stated that the differences between obtained frequencies of observable variables in enterprises surveyed were statistically significant ($p \leq 0.05$).

In order to measure the intensity of KM tools application, respondents' answers were recoded as follows: Never = 0, Rarely = 1, Sometimes = 2, Often = 3, Permanently = 4. Hence the intensity of each specific tool application could range from 0, if an enterprise had never exploited the tool, to 4, if an enterprise had exploited it permanently.

One-Way ANOVA was performed with the enterprise category as an independent variable to investigate how enterprise category affects the intensity of human-centered and ICT-centered tools application. One-Way ANOVA was chosen since it is not particularly sensitive to data deviations from normal distribution. In all cases, the null hypothesis (H_0) stated that the differences between observable intensities of a specific KM tool application in small, medium, and large enterprises were statistically insignificant ($p > 0.05$). The alternative hypothesis (H_a) stated that the differences between observable intensities of a specific KM tool application in small, medium, and large enterprises were statistically significant ($p \leq 0.05$).

For significant results ($p \leq 0.05$), the Tukey-Kramer test was applied as a post-hoc test to One-Way ANOVA (Levine, Stephan, Krehbiel, & Berenson, 2008). The procedure of Tukey-Kramer test allows one to define which pairwise comparisons between enterprises' categories were significant. Importantly, the test is applicable in case of abnormal data and unequal sample sizes. According to the Tukey-Kramer test, the values $X_j - X_i$ were calculated as differences between the means of $c(c - 1)/2$ groups ($i \neq j$, $c = 3$). Obtained values were compared with Tukey-Kramer's critical range (CR):

$$CR = Q_u \sqrt{\frac{MSW}{2} \left(\frac{1}{n_i} + \frac{1}{n_j} \right)}$$

where Q_u – the upper critical value of the studentized range distribution, which has c degrees of freedom in the numerator and $n - c$ degrees of

freedom in the denominator (n – number of observations in the appropriate enterprise category), MSW – mean square within groups.

Since the quantity of enterprises in various categories was unequal, the critical range was calculated for each pair of means separately. Finally, each of the $c(c - 1)/2$ pairs of means were compared with the corresponding critical range. The elements of a pair were considered significantly different if the expression $|X_i - X_j|$ exceeded the critical range.

RESEARCH RESULTS

The study results are reported below in accordance with the research questions.

RQ1: Do small, medium, and large Ukrainian enterprises differ in their awareness of knowledge/KM importance?

The results concerning enterprise attitudes are presented in Table 4. Questions 1.1 and 1.2 reflect the awareness of knowledge importance and awareness of KM importance, respectively. As Table 4 shows, the distributions of respondents’ opinions from small, medium, and large enterprises were rather similar. For all categories studied, over 80% of respondents either strongly agree or somewhat agree that organizational knowledge is a factor of enterprise competitiveness. Nevertheless, large enterprises showed significantly higher scores on this question in comparison with medium and especially small enterprises. As far as Question 1.2 concerns, regardless of enterprise size, over 80% of respondents either strongly agree or somewhat agree that KM is a factor of business success for their enterprises. According to the Chi-square test, this finding was statistically significant.

Table 4. Awareness of knowledge and KM importance in small, medium, and large enterprises (% of respondents’ answers)

Category	Question 1.1. Managers consider knowledge as a factor of enterprise competitiveness					Level of significance, p
	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	
Small	0.0	3.4	13.8	31.0	51.8	0.00975
Medium	0.00	13.3	0	26.6	60.1	
Large	0.0	6.5	0	16.1	77.4	
Total	0.0	7.7	4.5	24.5	63.3	5.551E-17

Question 1.2. Managers consider KM as a factor of enterprise business success						
	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	
Small	0.0	6.9	10.3	31.1	51.7	0.1214
Medium	0.0	0	16.6	23.4	60.0	
Large	0.0	0	6.5	12.9	80.6	
Total	0.0	2.3	11.1	22.2	64.4	1.1941E-17

RQ2: Do small, medium, and large Ukrainian enterprises apply distinctive KM policies?

The results concerning some general characteristics of KM policies applied by various categories of enterprises are presented in Table 5. Participants' responses to question 2.1 indicate that only a few small enterprises had an explicit KM policy in the form of an official document. Almost 40% of them did not have any KM policy at all and more than a half of them had informal KM policies. Although informal KM policies prevailed in all categories of enterprises, more than a third of medium and large enterprises had explicit KM policies in the form of an official document. Only 3% of large enterprises had no KM policy. According to the Chi-square test, the differences between small, medium, and large enterprises concerning availability of KM policies were statistically significant.

As the respondents' reflections to question 2.2 indicate, all enterprises studied have staff training programs. However, 75% of small enterprises have informal training programs, in contrast to more than 50% of medium enterprises and more than 80% of large enterprises having explicit training programs in the form of an official internal document.

Statistically significant differences between the categories studied were also observed with regard to question 2.3. The question showed the level of identification of some enterprises' activities as KM activities. Respondents stated that only about 40% of small enterprises performed some organizational activities that were explicitly defined as KM activities, whereas such identification exceeded 66% in medium enterprises and 90% in large enterprises.

As for question 2.4, half of small enterprises have no person assigned to KM activities. At the same time, more than 80% of medium enterprises and 90% of large enterprises have a person(s) responsible for KM. The differences between categories studied were statistically significant.

Table 5. KM policies (procedures) in small, medium, and large enterprises (% of respondents' answers)

Category	Question 2.1. Availability of KM policies			Level of significance, <i>p</i>
	Non-available	Informal	Formal, in a form of official document	
Small	37.9	55.1	7.0	0.00337
Medium	23.4	43.3	33.3	
Large	3.3	58.0	38.7	
Question 2.2. Availability of staff training program				
	Non-Available	Informal	Formal, in a form of official document	
Small	0.0	75.9	24.1	0.00001
Medium	0.0	46.6	53.4	
Large	0.0	19.4	80.6	
Question 2.3. An enterprise conducts some activities explicitly identified as KM activities				
	No	Don't know	Yes	
Small	24.1	34.5	41.4	0.00121
Medium	20.0	13.3	66.7	
Large	0.0	9.7	90.3	
Question 2.4. Availability of a person(s) responsible for KM activities				
	No	Yes		
Small	48.2	51.7	0.00041	
Medium	16.7	83.3		
Large	6.7	93.3		

RQ3: Do small, medium, and large Ukrainian enterprises differ in the scope of KM tools application?

The descriptive statistic on the scope of human-centered tools in the categories surveyed is shown in Table 6. In all categories, the scopes exceeded 60%. The lowest average scope and the highest variation in the scope were observed in small enterprises, while the highest average scope with lowest variation was observed in large enterprises.

Table 6. Scope of human-centered tools application: Means and coefficients of variations, (%)

Category	Mean	Coefficient of Variation
Small	62.3	58.6
Medium	71.9	37.3
Large	77.3	29.9

The scope of human-centered tools application among the categories studied is presented in Figure 1. As Figure 1 depicts, staff meetings, CPSS, learning by doing, mentoring/coaching and brainstorming were the most commonly used human-centered tools in all categories. Their scope of application exceeded 90%. Such tools as off-site vocational training, communities of practice, process maps and knowledge maps were the least exploited in all categories. According to the Chi-square test, statistically significant differences between the categories were observed on benchmarking, communities of practice, process maps and knowledge maps, indicating that these tools were less common in small enterprises as compared to medium and especially large enterprises.

For small enterprises, variations in the scope of human-centered tools application were the most visible. Tools like staff meetings and collaborative problem-solving sessions showed a 100% scope of application, while knowledge maps were applied only by 7% of small enterprises. In the case of medium and especially large enterprises, variations in the scope of human-centered tools application were less noticeable.

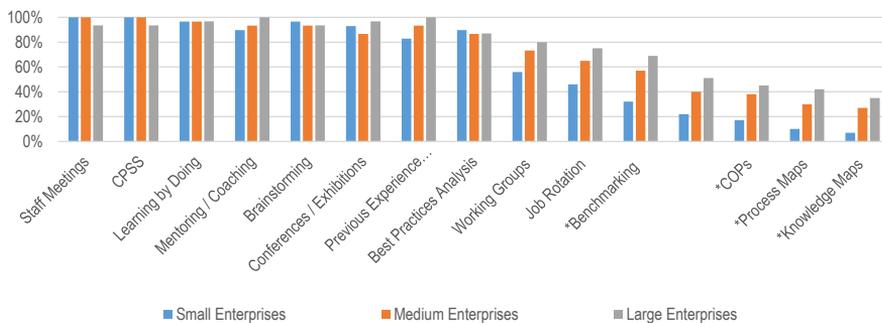


Figure 1. Scope of human-centered tools application in small, medium, and large enterprises

Note: * – statistically significant differences between the categories, $p \leq 0,05$.

Table 7 indicates that the mean values of ICT tools application were rather different in various categories of enterprises. The lowest mean was observed in small enterprises, whereas the highest mean was observed in large enterprises. On the contrary, the coefficient of variation was the highest for small enterprises and the lowest for large enterprises, indicating distinctive ranges of variations in categories means.

Table 7. Scope of ICT tools application: Means and coefficients of variations, (%)

Category	Mean	Coefficient of variation
Small	43.5	92.1
Medium	55.5	56.3
Large	63.0	42.7

Figure 2 shows that in all categories, the most exploited ICT tools were e-mail, data bases, social technologies and file archives. Their scope of application exceeded 90%. On the contrary, DMS, document management systems, ERP systems, cloud computing, expert systems, data mining, and groupware tools showed a rather low scope of application in all groups.

Even so, some distinctions between various categories were observed. For the vast majority of ICT tools studied, their scope of application was higher in large enterprises as compared to medium and especially small enterprises. According to the Chi-square test, the significant differences among the categories were found with regard to decision-making systems, ERP-systems, cloud computing, expert systems, data mining, and groupware tools ($p \leq 0.05$).

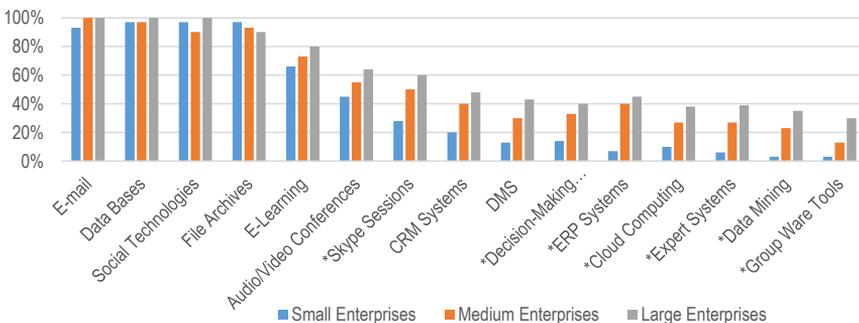


Figure 2. Scope of ICT tools application in small, medium, and large enterprises

* – statistically significant differences between the categories, $p \leq 0.05$.

RQ4: Do small, medium, and large Ukrainian enterprises differ in the intensity of KM tools application?

The distinctions in intensity of KM tools application between various categories were assessed according to ANOVA. The means of seven out of fifteen human-centered tools differed significantly between the categories studied ($p \leq 0.05$). Significant results are presented in Table 8. They indicate that small, medium, and large enterprises exploited conferences/exhibitions, previous experience analysis, mentoring/coaching, working groups, job rotation, off-site vocational training, and knowledge maps with different intensity. To conduct pairwise comparisons between enterprise categories, a post-hoc Tukey-Kramer test was applied. Its results (Table 8) show that in the vast majority of cases, the means of large and small enterprises were significantly distinctive. Small–medium enterprises pairwise comparisons, as well as medium–large enterprises comparisons, did not demonstrate many significant distinctions. Significant differences were observed for working groups in the pair of small–medium enterprises and for conferences/exhibitions in the pair of medium–large enterprises only.

Table 8. Intensity of human-centered tools application in small, medium, and large enterprises

Tools	Small (S)	Medium (M)	Large (L)	F-value	p-value (significance)	Significant differences between groups by Tukey-Kramer test
Conferences/ exhibitions	2.44	1.93	3.00	6.56	0.0022	M-L
Previous experience analysis	2.07	2.80	2.87	4.08	0.0203	S-L
Mentoring / coaching	2.37	2.80	3.32	5.59	0.0052	S-L
Working groups	0.93	1.93	2.48	10.33	9.41E-05	S-M, S-L
Job rotation	0.82	1.57	2.03	6.92	0.0016	S-L
Off-site vocational training	0.38	0.76	1.48	6.25	0.0029	S-L
Knowledge maps	0.13	0.57	0.96	4.69	0.0117	S-L

Further, One-Way ANOVA was conducted to analyze the intensity of ICT tools application. Significant One-Way ANOVA results were obtained for nine out of fifteen ICT tools studied including social technologies, audio/video conferences, e-learning, data bases, CRM systems, ERP systems, decision-making systems, expert systems, and data mining (Table 9). In all cases, large enterprises applied ICT tools more intensively. As a rule, small enterprises had the lowest intensity of ICT tools application. With some exceptions, the Tukey-Kramer test indicated that significant differences were observed between small and large enterprises. Significant differences were found for CRM systems and decision-making systems in the pair of small–medium enterprises as well as for social technologies, data bases, and data mining in the pair of medium–large enterprises.

Table 9. Intensity of ICT tools application in small, medium, and large enterprises

	Small (S)	Medium (M)	Large (L)	F- value	p-value (significance)	Significant differences between groups by Tukey-Kramer test
Social technologies	2.76	2.47	3.32	3.89	0.0242	M-L
Audio/video conferences	1.45	2.17	2.55	4.89	0.0096	S-L
E-learning	1.38	2.23	2.42	4.84	0.0102	S-L
Data bases	2.72	3.03	3.68	7.44	0.0010	S-L, M-L
CRM systems	0.13	1.37	1.87	4.09	0.0199	S-M, S-L
ERP systems	0.34	1.10	1.45	4.29	0.0167	S-L
Decision-making systems	0.27	0.96	1.42	4.77	0.0107	S-M, S-L
Expert systems	0.31	1.00	1.38	3.83	0.0255	S-L
Data mining	0.07	0.97	1.13	5.30	0.0067	S-L, M-L

As compared to small enterprises, large enterprises used more intensively audio/video conferences, e-learning, data bases, CRM systems, ERP systems, decision-making systems, expert systems, and data mining. The differences between large and medium enterprises reached significant level for a few tools (social technologies, data bases, and data mining) only.

DISCUSSION

The results concerning RQ 1-4 shed light on both similar and specific characteristics of KM initiatives in various categories of Ukrainian enterprises. The results on RQ 1-2 show that all enterprises, regardless of their size, demonstrate a rather high awareness of organizational knowledge and KM importance for their businesses. This finding is slightly different than expected. Although a high awareness is typical for managers of large enterprises, it is generally accepted that SME managers tend to underestimate the importance of knowledge and KM for their businesses (Wong & Aspinwall, 2004; Gourova, 2010). It was found that enterprises of various sizes significantly differ with regard to the development of formal KM policies (procedures) and their implementation through systematic organizational measures.

Although small and medium enterprises are traditionally treated as a homogeneous group (e.g., McAdam & Reid, 2001; Hutchinson & Quintas, 2008; Durst & Edvardsson, 2012; Cerchione & Esposito, 2017), the results on KM policies (procedures) highlight their distinctions. Medium and especially large enterprises put more systematic efforts to work out specific organizational procedures in order to support KM initiatives, whereas small enterprises tend to manage their knowledge in a less formal way, as part of their day-to-day activities, without the use of KM terminology and KM concepts (Hutchinson & Quintas, 2008). For example, they provide vocational training to their employees within the frame of informal programs and are unlikely to consider this activity as a KM activity.

Small, medium, and large enterprises demonstrate obvious distinctions in consistency between their awareness of KM importance and KM policies which they actually apply. In the case of large enterprises, high awareness of KM importance was highly consistent with the implementation of KM policies at the level of organizational procedures. On the contrary, small enterprises demonstrated obvious inconsistency between their declared attitude to KM and the actual implementation of KM policies at an organizational level.

The results concerning RQ3 indicate that all enterprises, regardless of their size, tend to rely on traditional KM tools. Widely used by all categories, core KM tools included such human-centered tools as staff meetings, collaborative problem-solving sessions, learning by doing, mentoring/coaching, brainstorming, conferences/exhibitions, and such ICT tools as e-mail, data bases, social technologies, and file archives. These KM tools can be characterized as well-known to employees, universal, easy to access, non-expensive and not exclusively constructed for KM purposes. Their scope of application exceeded 90% in all categories studied.

On the contrary, more advanced KM tools, at least for the Ukrainian market, were less spread in all categories, although the scope of their application differed in various categories. Such human-centered tools as communities of practice, process maps, knowledge maps, and such ICT tools as DMS, decision-making systems, ERP systems, cloud computing, expert systems, data mining, and groupware tools were applied by less than 45% of large enterprises, and less than 40% of medium enterprises. In small enterprises, the scope of advanced KM tools application did not exceed 10%. Cerchione and Esposito (2017) claimed that SMEs use traditional KM tools more intensively rather than new and more updated ones. Our study shows that this conclusion can be extended to the category of large enterprises (at least for those located in Ukraine).

The results also show that all enterprises, regardless of their size, are more selective in their adoption of advanced KM tools, which are rather expensive, sophisticated, and skill-demanding. Their implementation requires financial investment, staff training, and changing organizational procedures, staff habits, and models of behavior. From personal communications with managers, it occurs that, in the case of large enterprises, the implementation of more advanced ICT tool is often not a matter of cost but rather a matter of expediency of investing. Managers expect to achieve a higher efficiency of decision making, control, return on investment, and effectiveness. Large enterprises plan investments in advanced ICT tools if these tools meet their business requirements and have the potential to generate added value. Since small enterprises possess scarce human and financial resources (e.g., Desouza & Awazu, 2006; Gourova, 2010; Edvardsson & Durst, 2013), advanced ICT tools are impermissibly expensive for them. But, due to rather simple business processes and high socialization inherent to this category, the implementation of advanced ICT tools is not always of vital necessity for them.

With regard to RQ4, the significant distinctions among small, medium, and large enterprises were revealed on the intensity of KM tools application. For a number of human-centered tools (previous experience analysis, mentoring/coaching, working groups, job rotation, off-site vocational training, and knowledge maps) and ICT tools (audio/video conferences, e-learning, data bases, CRM systems, ERP systems, decision-making systems, expert systems, and data mining), large enterprises demonstrated a significantly higher intensity of their application while small enterprises had the lowest intensity of their application. There were only a few significant pairwise distinctions between medium and large enterprises. Again, this finding challenges commonly accepted view of SMEs as a homogeneous category.

The study provides some indication of distinctions in KM approaches used by various categories of enterprises. Zieba et al. (2016) and Alexandru et al.

(2019) identified two types of these approaches as deliberate and emergent. Most of large enterprises applied a deliberate approach to KM and could be characterized as “Conscious adopters.” Being highly aware of knowledge and KM importance, conscious adopters introduce formal KM policies and staff training programs, they perform activities explicitly defined as KM activities, they appoint people responsible for KM, and they demonstrate the highest scope and intensity of both traditional and advanced KM tools application.

In contrast to large enterprises, small enterprises are more likely to apply emergent approach to KM and could be characterized as “Unconscious adopters.” In spite of a rather high awareness of knowledge and KM importance, they put less deliberate efforts into creating a proper organizational context to manage knowledge. They use informal KM policies and staff training programs, they perform less activities explicitly defined as KM activities, they are less likely to appoint people responsible for KM, and they use mainly traditional KM tools. They lag far behind conscious adopters according to the scope and intensity of advanced KM tools application. Probably, small enterprises do not consider staff training and KM tools, which they actually use, as a part of KM.

To determine the predominant KM approach in the category of medium enterprises is somewhat more difficult, as according to some indicators (availability of a person(s) responsible for KM activities, the scope of advanced KM tools application, intensity of working groups, CRM systems, and decision-making systems application) they show more similarity with large enterprises, while according to other indicators (performing activities explicitly identified as KM activities, intensity of data bases and data mining application) they show more similarity with small ones. It seems that medium enterprises are rather a mixed category, which includes both conscious adopters and unconscious adopters.

In contrast to our study, Alexandru et al. (2019) did not reveal any clear relationship between an SME’s size and their KM approach. This discrepancy is likely to be explained by such differences in samplings as business sector, geographical localization and number of size categories studied. Sensibly, knowledge-intensive small enterprises located in European countries might possess a higher consciousness in terms of KM than small enterprises from mostly traditional business sectors located in a country with a transitional economy. In addition, Alexandru et al. (2019) analyzed only two categories of enterprises (small and medium), whereas our study incorporated three categories.

From the KBV perspective, natural socialization and a network of close communications among employees are crucial for the creation of shared tacit knowledge (collective knowledge), which serves as a source of sustainable growth and competitiveness (Spender, 1996). It seems that

small enterprises do not have a strong need to develop formal KM policies and apply sophisticated KM tools, even if they have the resources to invest in KM programs. Potentially, they can create collective knowledge with less management intervention than larger enterprises. On the contrary, large enterprises should put more effort into generating collective knowledge and satisfying their knowledge needs. These arguments seem to explain why small enterprises can afford to rely on an emergent approach to KM and remain unconscious adopters, whereas larger enterprises should apply a deliberate approach to KM and become conscious adopters.

The findings of the study challenge another commonly accepted view concerning the relation between enterprise category and Hansen's type of strategy (Hansen et al., 1999). Previously, it was shown that SMEs tend to rely on the personalization strategy (Becerra-Fernandez & Sabherwall, 2008) and they are most likely to apply human-centered tools based on personal communication and cooperation (Desouza & Awazu, 2006; Merono-Cerdan, Lopez-Nikolas, & Sabater-Sanchez, 2007). On the contrary, large enterprises are more likely to adopt a codification strategy based on the intensive use of ICT tools (Maier, 2002; Sun & Scott, 2005; Subashini et al., 2012; Merlo, 2016).

Our study revealed that, managing their knowledge, enterprises of various sizes did not give preference to either a personalization strategy (supported by human-centered tools) or a codification strategy (supported by ICT tools). Instead, elements of both strategies were used simultaneously and coherently, however, to varying extent. As Edwards (2009) stated, the elements of these strategies could complement each other giving a synergetic effect. Contrary to expectations, small enterprises did not follow a personalization strategy to a greater extent than other enterprises. In fact, many small enterprises applied human-centered tools less than medium and large enterprises. For all size categories, their KM policies, as well as the characteristics of human-centered tools and ICT tools applications, were interrelated with each other, demonstrating the balance between social and technical elements within an organizational context.

CONCLUSION

Although KM is an intensively studied domain, it remains, however, rather unclear in which KM aspects the small, medium, and large enterprises distinguish from each other. The comparative analysis of KM initiatives differentiating small, medium, and large organizations is hindered by the lack of empirical data and belongs to the underestimated area of KM. The purpose of this study was to conduct a comparative analysis of KM initiatives

in small, medium, and large enterprises operating in Ukraine and highlight the specific characteristics of KM policies, as well as the scope and intensity of KM tools application in these categories.

The study allows us to answer RQ1: Do small, medium, and large Ukrainian enterprises differ in their awareness of knowledge/KM importance? All enterprises surveyed, regardless of their size, demonstrate rather high awareness of knowledge/KM importance for their businesses. The study allows us to answer RQ2: Do small, medium, and large Ukrainian enterprises apply distinctive KM policies? The enterprises of various sizes showed significant distinctions regarding availability of formal KM policies and staff training programs, performance of activities explicitly defined as KM activities, and availability of person(s) assigned to KM initiatives. In all cases, large enterprises demonstrated the highest scores according to these indicators, and small enterprises demonstrated the lowest scores. Obvious distinctions among small, medium, and large enterprises were found in the consistency between their attitudes to KM and KM policies which they actually apply. In the case of large enterprises, high awareness of KM importance was highly consistent with the implementation of KM policies at the level of organizational procedures. On the contrary, small enterprises demonstrated an obvious inconsistency between the declared attitude to KM and the actual implementation of KM policies at the organizational level. Medium enterprises according to this indicator were more similar to large enterprises than to small ones. The study provides the answer to RQ3: Do small, medium, and large Ukrainian enterprises differ in the scope of KM tools application? All enterprises, regardless of their size, tend to apply traditional and not exclusively constructed for KM purposes human-centered and ICT tools. Significant differences among small, medium, and large enterprises were observed in the scope of more advanced KM tools application. The scope of advanced KM tools application among small enterprises was substantially lower as compared to medium and especially large enterprises. The study provides the answer to RQ4: Do small, medium, and large Ukrainian enterprises differ in the intensity of KM tools application? The distinctions among various categories were found in terms of the intensity of KM tools application. According to many studied KM tools, both traditional and more advanced, small enterprises lag far behind large enterprises, although the distinctions between large and medium enterprises were less visible and, in most cases, insignificant.

To sum up, the findings of the paper outlined some substantial differences among small, medium, and large enterprises in terms of their KM policies, the intensity of KM tools application, and the scope of more sophisticated KM tools application. The most consistent KM policies and the highest scope and intensity of KM tools application were found in large

enterprises, which presumably apply a deliberate KM approach and manage their knowledge consciously. Informal KM policies and the lowest scope and intensity of KM tools application were observed in small enterprises, which presumably rely on an emergent KM approach. It seems that medium enterprises rather belong to a mixed category, although the deliberate KM approach is somewhat predominant.

An important finding of this study is that, in contrast to the common view on SMEs as a homogeneous sector in terms of KM initiatives, obvious evidence of SMEs heterogeneity was obtained. According to a number of studied indicators, significant differences were observed between small and large enterprises, whereas the differences between medium and large enterprises were less obvious. Presumably, in terms of KM initiatives, medium enterprises are more similar to large enterprises than to small ones. In the scientific literature, it is generally accepted that SMEs manage their knowledge differently as compared to large enterprises. The results of the study allow us to specify this view, namely small, medium and large enterprises manage their knowledge in different ways. However, it is impossible to say that one category of enterprises is more successful in KM than another at this stage.

Regardless of their size, all enterprises operate in a highly competitive environment and understand the importance of knowledge and KM in achieving their strategic goals, organizational development, and business success. At the same time, they implement and use organizational measures (KM policies and tools) to varying degrees to meet their knowledge needs. And this is not so much due to the obvious differences in their financial resources and managerial skills, as to the different needs for knowledge and, at the same time, to the different approaches to meeting these needs. It seems that high socialization inherent in small enterprises is a natural facilitator for the formation and dissemination of collective knowledge, the most valuable resource of the organization, and requires special organizational measures to support themselves to a lesser extent than medium and large enterprises. Medium and especially large enterprises, due to departmental fragmentation and a complex network of communications, must make much more efforts to form and disseminate collective knowledge, deliberately implementing appropriate KM policies and tools. This point of view is supported by differences between the various categories of enterprises regarding the level of formalization of their KM policies, and the scale and intensity of the application of both human-centered and ICT tools.

The theoretical contribution of this study is that evidence has been provided for the heterogeneity of the SMEs sector by a number of KM characteristics, such as KM policies, and the scope and intensity of some human-centered and ICT tools application. Medium enterprises tend to apply

KM approaches in a similar way to those applied by large enterprises. This finding allows us to deepen our knowledge of the conceptual differences in KM approaches applied by different enterprise categories.

On the basis of the study, some practical implications can be formulated. In order to foster collective knowledge creation and sharing, managers should promote internal communications, tacit knowledge sharing, and encourage employees to contribute to organizational knowledge creation. However, different KM approaches can be recommended for businesses of different sizes. Enterprise size should be taken into account when designing specific KM policies, programs, and tools to meet their needs to a greater extent. The larger the enterprise is, the more structured, deliberate, and conscious the KM approach that should be applied is.

Since our study was exploratory, it had some limitations stemming from the sampling methodology. Its clear limitation is the relatively small number of respondents. Further, the convenience sample was not fully representative regarding the structure of small, medium, and large enterprises in the country. The sampling was not random in terms of geographical location of the enterprises studied. In view of these limitations, the generalizability of the results is restricted and they should be considered as indicative.

The study allows us to identify the directions for further research on the KM topic studied. Shifting from the traditional comparison format in KM area of “SMEs versus large enterprises” to the format “small enterprises versus medium enterprises versus large enterprises” will allow for a better understanding of the features of KM policies, procedures, tools, and practices among organizations of various size. Potentially, the less structured, less consistent and less conscious KM approach demonstrated by small enterprises could satisfy their knowledge needs to the same extent as the structured, consistent and conscious KM approach could satisfy the knowledge needs of larger enterprises. Further research is needed to determine how the different KM approaches used by small, medium, and large enterprises affect the efficiency of decision-making processes, organizational productivity, and, ultimately, organizational competitiveness.

References

- Alavi, M., & Leidner, D.E. (2001). Review: knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25(1), 107–136. <http://doi.org/10.2307/3250961>.
- Alexandru V. A., Bolisani E., Andrei A. G., Cegarra-Navarro J. G., Martínez Martínez A., Paiola M., Scarso E., Vătămănescu E.-M., & Zięba M. (2019). Knowledge management approaches of small and medium-

- sized firms: a cluster analysis. *Kybernetes*, 49(1), 73–87. <https://doi.org/10.1108/k-03-2019-0211>.
- Anand, A., & Walsh, I. (2016). Should knowledge be shared generously? Tracing insights from past to present and describing a model. *Journal of Knowledge Management*, 20(4), 713–730. <https://doi.org/10.1108/jkm-10-2015-0401>.
- Bagozzi, R., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organization research. *Administrative Science Quarterly*, 36, 421–458. <https://doi.org/10.2307/2393203>.
- Becerra-Fernandez, R., & Sabherwal, I. (2010). Knowledge management: Systems and processes (1st ed.). Armonk: M.E. Sharpe.
- Bergeron, B. (2003). Essentials of knowledge management (Essentials Series). New York: John Wiley & Sons.
- Bolisani, E., Zieba, M., Paiola M., & Scarso E. (2017) Knowledge management strategies in KIBS companies: A preliminary analysis. In G. Spender, G. Schiuma, & T. GavriloVA (Eds.), *Proceedings of International Forum on Knowledge Assets Dynamics* (pp. 1598–1611). St. Petersburg: St. Petersburg University.
- Cantú, L. Z., Criado, J. R., & Criado, A. R. (2009). Generation and transfer of knowledge in IT-related SMEs. *Journal of Knowledge Management*, 13(5), 243–256. <https://doi.org/10.1108/13673270910988088>.
- Cardoni, A., Zanin, F., Corazza, G., & Paradisi, A. (2020). Knowledge management and performance measurement systems for SMEs' economic sustainability. *Sustainability*, 12(7), 2594, <https://doi.org/10.3390/su12072594>.
- Centobelli, P., Cerchione, R., & Esposito, E. (2019). Efficiency and effectiveness of knowledge management systems in SMEs. *Production Planning & Control*, 30(9), 779–791, <https://doi.org/10.1080/09537287.2019.1582818>.
- Cerchione, R., & Esposito, E. (2017). Using knowledge management systems: A taxonomy of SME strategies. *International Journal of Information Management*, 37(1), 1551–1562. <https://doi.org/10.1016/j.ijinfomgt.2016.10.007>.
- Dalkir, K. (2017). Knowledge management in theory and practice (3rd ed.). Cambridge: MIT Press.
- Davenport, M., & Prusak, L. (1998). Working knowledge: How organizations manage what they know. Boston: Harvard Business School Press.
- Desouza, K. C., & Awazu, Y. (2006). Knowledge management at SMEs: Five peculiarities. *Journal of Knowledge Management*, 10(1), 32–43. <https://doi.org/10.1108/13673270610650085>.
- Du Plessis, M. (2005). Drivers of knowledge management in the corporate environment. *International Journal of Information Management*, 25(3), 193–202. <https://doi.org/10.1016/j.ijinfomgt.2004.12.001>.
- Durst, S. & Bruns, G. (2018). Knowledge management in small and medium-sized enterprises. In J. Syed, P. Murray, D. Hislop, & Y. Mouzughy (Eds.),

- The Palgrave Handbook of Knowledge Management* (pp. 495–514). London: Palgrave Macmillan.
- Durst, S., & Edvardsson, I. R. (2012). Knowledge management in SMEs: A literature review. *Journal of Knowledge Management*, 16(6), 879–903. <https://doi.org/10.1108/13673271211276173>.
- Edwards, J. S. (2009). Business processes and knowledge management. In M. Khosrow-Pour (Ed.), *Encyclopedia of Information Science and Technology* (1, pp. 471–476). Hershey: IGI Global. <https://doi.org/10.4018/978-1-60566-026-4.ch078>.
- Edvardsson, I. R., & Durst, S. (2013). The benefits of knowledge management in small and medium-sized enterprises. *Procedia – Social and Behavioral Sciences*, 81, 351–354. <https://doi.org/10.1016/j.sbspro.2013.06.441>ISI.
- Evangelista, P., Esposito, E., Lauro, V., & Raffa, M. (2010). The adoption of knowledge management systems in small firms. *Electronic Journal of Knowledge Management*, 8(1), 33–42. Retrieved from https://www.researchgate.net/publication/228951380_The_Adoption_of_Knowledge_Management_Systems_in_Small_Firms.
- European Commission. (2016). Current SMEs definition. Retrieved from <https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition>.
- Fong, P.S.W., & Lee, H. F. (2009). Acquisition, reuse and sharing of knowledge in property management firms. *Facilities*, 27(7–8), 291–314. <https://doi.org/10.1108/02632770910956148>.
- García-Alvarez, M. T. (2015). Analysis of the effects of ICTs in knowledge management and innovation: The case of Zara Group. *Computers in Human Behavior*, 51, 994–1002. <https://doi.org/10.1016/j.chb.2014.10.007>.
- Gourova, E. (2010). Knowledge management strategy for small and medium enterprises. In H. Fujita & J. Sasaki (Eds.), *Proceedings of the International Conference on Applied Computer Science* (pp. 639–648). Stevens Point: World Scientific and Engineering Academy and Society (WSEAS). Retrieved from <http://www.wseas.us/e-library/conferences/2010/Malta/ACS/ACS-105.pdf>.
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17, 109–122. <https://doi.org/10.1002/smj.4250171110>.
- Greiner, M. E., Bohmann, T., & Krcmar, H. (2007). A strategy for knowledge management. *Journal of Knowledge Management*, 11(6), 3–15. <http://doi.org/10.1108/13673270710832127>.
- Gupta, B., Iyer, L. S., & Aronson, J. E. (2000). Knowledge management: Practices and challenges. *Industrial Management & Data Systems*, 100(1), 17–21. <https://doi.org/10.1108/02635570010273018>.
- Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review*, March–April, 1–11.

- Retrieved from <https://hbr.org/1999/03/whats-your-strategy-for-managing-knowledge>.
- Hutchinson, V., & Quintas, P. (2008). Do SMEs do knowledge management? Or simply manage what they know? *International Small Business Journal*, 26(2), 131–134. <https://doi.org/10.1177/0266242607086571>.
- Ibrahim, F., Reid, V., & Edgar, D. (2009). Assessing the role of knowledge management in adding value: Moving towards a comprehensive framework. *Journal of Information and Knowledge Management*, 8(4), 275–286. <https://doi.org/10.1142/S0219649209002397>.
- Ілляшенко, С.М., Шипуліна, Ю.С., & Ілляшенко Н.С. (2019). Управління знаннями при формуванні стратегії випереджаючого інноваційного розвитку підприємства [Knowledge management in forming a strategy of innovative development of the enterprise]. *Проблеми системного підходу в економіці / Problems of Systemic Approach in the Economy*, 3(71), 215–223. Retrieved from <http://essuir.sumdu.edu.ua/handle/123456789/7396>.
- Inkinen, H., Kianto, A., & Vanhala, M. (2015). Knowledge management practices and innovation performance in Finland. *Baltic Journal of Management*, 10(4), 432–455. <https://doi.org/10.1108/bjm-10-2014-0178>.
- Jelavic, M. (2011). Socio-technical knowledge management and epistemological paradigms: Theoretical connections at the individual and organisational level. *Interdisciplinary Journal of Information, Knowledge, and Management*, 6(1), 1–16. <https://doi.org/10.28945/1337>.
- King, W. R. (2009). Knowledge management and organizational learning. *Annals of Information Systems*, 4, 3–13. https://doi.org/10.1007/978-1-4419-0011-1_1.
- KPMG Consulting. (2000). Knowledge management research report. London: KPMG Consulting. Retrieved from http://www.providersedge.com/docs/km_articles/KPMG_KM_Research_Report_2000.pdf.
- Leiner, D. J. (2017). Our research's breadth lives on convenience samples. A case study of the online respondent pool SoSci Panel. *Studies in Communication and Media (SCM)*, 5(4), 367–396. <https://doi.org/10.5771/2192-4007-2016-4-36769-134>.
- Levine, D. M., Stephan, D. F., Krehbiel, T. C., & Berenson, M. L. (2008). *Statistics for managers: Using Microsoft Excel* (5th ed.). Boston: Pearson Custom Publishing.
- Maier, R. (2002). *Knowledge Management Systems: Information and Communication Technologies for Knowledge Management*. Berlin: Springer-Verlag.
- Marr, B., Gupta, O., Pike, S., & Roos, G. (2003). Intellectual capital and knowledge management effectiveness. *Management Decision*, 41(8), 771–781. <https://doi.org/10.1108/00251740310496288>.
- Martelo-Landroguez, S., & Cegarra-Navarro, J. G. (2014). Linking knowledge corridors to customer value through knowledge processes. *Journal of*

- Knowledge Management*, 18(2), 342–365. <https://doi.org/10.1108/jkm-07-2013-0284>.
- Massaro, M., Handley, K., Bagnoli, C., & Dumay, J. (2016). Knowledge management in small and medium enterprises: A structured literature review. *Journal of Knowledge Management*, 20(2), 258–291. <https://doi.org/10.1108/jkm-08-2015-0320>
- McAdam, R., & Reid, R. (2001). SME and large organization perceptions of knowledge management: Comparisons and contrasts. *Journal of Knowledge Management*, 5(3), 231–241. <https://doi.org/10.1108/13673270110400870>.
- Merlo, T. R. (2016). Factors influencing knowledge management use in technology enterprises in the Southern United States. *Procedia Computer Science*, 99, 15–35. <https://doi.org/10.1016/j.procs.2016.09.098>.
- Merono-Cerdan, A. L., Lopez-Nicolas, C., & Sabater-Sanchez, R. (2007). Knowledge management strategy diagnosis from KM instruments use. *Journal of Knowledge Management*, 11(2), 60–72. <https://doi.org/10.1108/13673270710738915>.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37. <https://doi.org/10.1287/orsc.5.1.14>.
- Pan, S. L., & Scarbrough, H. (1999). Knowledge management in practice: An exploratory case study. *Technology Analysis and Strategic Management*, 11(3), 359–374. <https://doi.org/10.1080/095373299107401>.
- Paolini, M., Coluccia, D., Fontana, S., & Solimene, S. (2020). Knowledge management, intellectual capital and entrepreneurship: A structured literature review. *Journal of Knowledge Management*, 24 (8), 1797–1818. <https://doi.org/10.1108/JKM-01-2020-0052>
- Pinget, A., Bocquet, R. & Mothe, C. (2015). Barriers to environmental innovation in SMEs: empirical evidence from French firms. *M@nagement*, 18(2), 132–155. <https://doi.org/10.3917/mana.182.0132>.
- Podsakoff, P. M. & Organ, D. (1986). Self-report in organizational research. *Journal of Management*, 12(4), 531–544. <https://doi.org/10.1177/014920638601200408>.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>.
- Polyakov, M. V. (2017). Positive impact of international companies on development of knowledge economy. *Problems and Perspectives in Management*, 15(2), 81–89. [http://doi.org/10.21511/ppm.15\(2\).2017.08](http://doi.org/10.21511/ppm.15(2).2017.08).
- Поляков, М. В. (2017). Особливості розвитку міжнародного бізнесу в умовах становлення глобальної економіки знань [Features of international business development in the conditions of global knowledge economy]. *Економічний простір / Economic Environment*, 121, 47–57. Retrieved from http://nbuv.gov.ua/ujrn/ecpros_2017_121_6.

- Prystupa-Rządca, K. (2014). Zarządzanie wiedzą w organizacjach born global. Warsaw: Sedno.
- Serenko, A. (2013). Meta-analysis of scientometric research of knowledge management: Discovering the identity of the discipline. *Journal of Knowledge Management*, 17(5), 773–812. <https://doi.org/10.1108/jkm-05-2013-0166>.
- Singh, R. K., Garg, S. K. & Deshmukh, S. G. (2008). Strategy development by SMEs for competitiveness: A review. *Benchmarking: An International Journal*, 15(5), 525–547. <https://doi.org/10.1108/14635770810903132>.
- Ситник Н. І. (2017). Організаційне навчання як складова менеджменту знань [Organizational knowledge and knowledge management]. Менеджмент і маркетинг інновацій / *Management and Marketing of Innovations*, 3, 346–354. <http://doi.org/10.21272/mmi.2017.3-32>.
- Soon, T. T., & Zainol, F. A. (2011). Knowledge management enablers, process and organizational performance: Evidence from Malaysian enterprises. *Asian Social Science*, 7(8), 186–192. <https://doi.org/10.5539/ass.v7n8p186>.
- Spender, J.-C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17, 45–62. <https://doi.org/10.1002/smj.4250171106>.
- Subashini, R., Rita, S., & Vivek, M. (2012). The role of ICTs in knowledge management (KM) for organizational effectiveness. In P. V. Krishna, M. R. Babu, & E. Ariwa (Eds.), *Global Trends in Information Systems and Software Applications. ObCom 2011. Communications in Computer and Information Science* (pp. 542–549). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-29216-3_59.
- Sun, P. Y.-T., & Scott, J. L. (2005). An investigation of barriers to knowledge transfer. *Journal of Knowledge Management*, 9(2), 75–90. <https://doi.org/10.1108/13673270510590236>.
- Susanty, A., Yuningsih, Y., & Anggadwita, G., (2019). Knowledge management practices and innovation performance: A study at Indonesian Government apparatus research and training center. *Journal of Science and Technology Policy Management*. 10(2). 301-318. <https://doi.org/10.1108/jstpm-03-2018-0030>.
- Uriarte, F. (2008). Introduction to knowledge management. Jakarta: ASEAN Foundation. <https://doi.org/10.4236/jsea.2012.51006> 5,032.
- Von Krogh, G., Ichijo, K., & Nonaka, I. O. (2000). *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*. Oxford: Oxford University Press.
- Wong, K. Y., & Aspinwall, E. (2004). Characterizing knowledge management in the small business environment. *Journal of Knowledge Management*, 8(3), 44–61. <https://doi.org/10.1108/13673270410541033>.
- Xue, C. T. S. (2017). A literature review on knowledge management in organizations. *Research in Business and Management*, 4(1), 30–41. <https://doi.org/10.5296/rbm.v4i1.10786>.

- Zheng, T. (2017). A literature review on knowledge sharing. *Open Journal of Social Sciences*, 5(3), 51–58. <https://doi.org/10.4236/jss.2017.53006>.
- Zieba, M., Bolisani, E., & Scarso, E. (2016). Emergent approach to knowledge management by small companies: Multiple case-study research. *Journal of Knowledge Management*, 20(2), 292–307. <https://doi.org/10.1108/jkm-07-2015-0271>.

Abstrakt

CEL: Celem niniejszego opracowania było przeprowadzenie analizy porównawczej inicjatyw zarządzania wiedzą (KM) w małych, średnich i dużych przedsiębiorstwach działających na Ukrainie oraz podkreślenie specyfiki polityk KM, a także zakresu i intensywności aplikacyjnych narzędzi KM w tych kategoriach. W szczególności badanie koncentrowało się na spójności między świadomością znaczenia wiedzy/KM i polityki KM, a zakresem i intensywnością stosowania zarówno narzędzi skoncentrowanych na człowieku, jak i narzędzi technologii komunikacji informacyjnej (ICT). **METODYKA:** Koncepcja badania została opracowana w oparciu o integracyjną perspektywę społeczno-techniczną. Dane empiryczne uzyskano poprzez badanie ankietowe wśród 90 menedżerów małych, średnich i dużych przedsiębiorstw ukraińskich, których wyniki poddano analizie statystycznej. **WYNIKI:** Podkreślono zarówno wspólne, jak i wyróżniające cechy tych kategorii pod względem KM. Chociaż wszystkie przedsiębiorstwa, niezależnie od wielkości, wykazywały wysoką świadomość znaczenia wiedzy/KM dla prowadzonej przez nich działalności, to jednak stwierdzono istotne różnice pomiędzy małymi i dużymi przedsiębiorstwami w odniesieniu do ich polityki KM, zakresu stosowania zaawansowanych narzędzi KM oraz intensywności niektórych z nich, tradycyjne i zaawansowane aplikacje narzędzi KM. We wszystkich przypadkach przedsiębiorstwa duże wykazywały wyższy poziom tych cech w porównaniu z przedsiębiorstwami małymi, natomiast przedsiębiorstwa średnie były bardziej zbliżone do przedsiębiorstw dużych. W przeciwieństwie do powszechnego poglądu na MŚP jako sektor jednorodny pod względem KM, badanie pokazuje jego niejednorodność pod względem inicjatyw KM. Według szeregu badanych wskaźników zaobserwowano istotne różnice między małymi i dużymi przedsiębiorstwami, natomiast różnice między średnimi i dużymi przedsiębiorstwami były znacznie mniej oczywiste. **IMPLIKACJE DLA TEORII I PRAKTYKI:** Teoretycznym wkładem tego badania było dostarczenie dowodów na heterogeniczność sektora MŚP w oparciu o szereg cech KM. To odkrycie pozwala nam pogłębić naszą wiedzę na temat różnic pojęciowych w podejściach KM, stosowanych przez różne kategorie przedsiębiorstw. Z praktycznego punktu widzenia, przy projektowaniu konkretnych polityk, programów i narzędzi KM, które w większym stopniu zaspokajają potrzeby przedsiębiorstw, należy wziąć pod uwagę wielkość przedsiębiorstwa. Im większe przedsiębiorstwo, tym bardziej ustrukturyzowane, celowe i świadome podejście do KM, które należy zastosować. **ORYGINALNOŚĆ I WARTOŚĆ:** Nie przeprowadzono wcześniej żadnych badań empirycznych, które dotyczyłyby analizy porównawczej inicjatyw KM w małych, średnich i dużych przedsiębiorstwach działających na Ukrainie, a także w innych transformujących się gospodarkach państw postsowieckich.

Słowa kluczowe: zarządzanie wiedzą, świadomość zarządzania wiedzą, polityka zarządzania wiedzą, narzędzia zorientowane na człowieka, narzędzia ICT, małe, średnie i duże przedsiębiorstwa

Biographical notes

Natalia Sytnik is an associate professor at the Management Department of the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Ukraine. Her research interests are related to the “human” side of knowledge management and organizational creativity. She is the author of numerous publications on knowledge management, organizational learning, human resources and startup management.

Maryna Kravchenko is a Doctor of Science in economics, specializing in management sciences. She is a Professor at the Management Department of the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute,” Ukraine. She is the Head of the Bachelor’s and Master’s Programs “Management of Investment and Innovation.” Her research areas include innovation management, startup management, and enterprise sustainable development management. She is the editor-in-chief of the academic journal “Economic Bulletin of the National Technical University of Ukraine “Kyiv Polytechnic Institute” and a member of the editorial board of the economic scientific journal “Entrepreneurship and Innovation.” Since 2015, she has been a member of a working group of World Data Center for Geoinformatics and Sustainable Development to develop a Foresight of the Ukrainian Economy for mid-term and long-term time horizons. She is the author or co-author of more than 200 publications, including three monographs and four textbooks for university students.

Conflicts of interest

The authors declare no conflict of interest.

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Innovation among SMEs in Finland: The impact of stakeholder engagement and firm-level characteristics

Hannu Littunen¹ , Timo Tohmo² ,
Esa Storhammar³ 

Abstract

PURPOSE: The aim of the paper is to analyse the importance of both internal capabilities (resources) and external information sources in implementing product, process, marketing and organizational innovations aiming to maximize firm competitive advantage and create value for stakeholders. Furthermore, in particular, we examine the role of public organizations, business networks, firm size, and the industry sector, in the emergence of different types of product, process, marketing, and organizational innovations. The research was based on the typology of innovation (product, process, marketing, and organizational) adopted by the OECD. **METHODOLOGY:** The paper is based on data from 389 SMEs located in Finland and describes the development of a model for testing the factors that increase the innovativeness of SMEs. The logistic regression model is used as a methodology. **Findings:** The results show that the creation of novel products, processes and marketing innovation is connected to various external sources of information, such as fairs, the media and the internet. Moreover, the relationship between internal capabilities such as the firm's know-how increases the marketing and organizational innovativeness of SMEs. Our results demonstrated that the creation of product innovation is positively connected to manufacturing. Furthermore, we find that the creation of novel processes and organizational innovation is related to firm size, such that firms with fewer than 20 employees (smallest firms) were concentrated among non-innovators and companies with more than 20 employees were concentrated among innovators. **IMPLICATIONS FOR THEORY AND PRACTICE:** The contribution of our study is to analyse to what extent various types of innovation rely on specific information sources. This study

1 Hannu Littunen, Ph.D., University of Eastern Finland, Department of Health and Social Management, P.O. Box 1627, 70211, Finland, email: hannu.littunen@uef.fi (ORCID: <https://orcid.org/0000-0001-7740-5194>).

2 Timo Tohmo, Ph.D, Jyväskylä University School of Business and Economics, P.O. BOX 35, 40100, Finland, email: timo.tohmo@jyu.fi (ORCID: <https://orcid.org/0000-0002-1189-2257>).

3 Esa Storhammar, Ph.D., Jyväskylä University School of Business and Economics, P.O. Box 35, 40100, Finland, email: esa.t.storhammar@jyu.fi (ORCID: <https://orcid.org/0000-0002-4153-9761>).

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also provides suggestions for practice and policymakers. Contrary to expectations regarding our findings, public support organizations were not statistically significant in any innovation model. Therefore, public support organizations should develop better mechanisms to find SMEs with strong motivations to develop new products and market opportunities. **ORIGINALITY AND VALUE:** This paper provides a new and topical viewpoint for the literature by examining the possible factors explaining the increase in SMEs' likelihood of implementing product, process, marketing, and organizational innovations. Our study provides comprehensive information on how different stakeholders contribute to the emergence of SME innovation.

Keywords: SMEs, innovation, internal capabilities, external information sources, stakeholders, industry sector, firm size

INTRODUCTION

In the last few years, much attention has been given to the innovation activity of small and medium-sized enterprises (SMEs) (Jones-Evans et al., 2018; Lukovszki et al., 2020; Lecerf & Omrani, 2020). Innovation activity can be seen as a prerequisite for SMEs' performance (Freel & Robson, 2004; Keskin, 2006; Lööf & Heshmati, 2006). As employers and producers of innovations, SMEs' performance has a significant impact on economic growth (Storey, 1994; Audretsch, 2002; Wong, et al., 2005; Rigtering et al., 2014; Ipinaiye et al., 2017). Companies with fewer than five employees account for almost 90% of the number of Finnish companies (369 940 in 2019), contribute almost 12% of turnover (430 246 485 thousand €) and provide approximately 15% of employment (1 530 726) of Finnish firms in 2019 (OSF, 2021). Furthermore, all SMEs accounted for over half of turnover and approximately 64% of employment in Finnish firms in 2019. According to the Official Statistics of Finland (OSF, 2020), in Finland, over 60% of firms employing at least ten employees engaged in innovation activities between 2016 and 2018⁴. Approximately 40% of industrial firms and 34% of service sector firms made product innovations or launched new or improved products in 2016-2018.

Howells and Roberts (2000) argue that, especially for advanced industrialized countries, knowledge is one of the resources that helps companies gain a competitive advantage and creates growth and wealth. In a knowledge-based economy, increased competitiveness and innovation go hand in hand. According to Asheim et al. (2003), therefore, measures to improve the competitiveness of SMEs must focus primarily on their innovation and innovation performance.

⁴ Firm size classes used in the Eurostat Community Innovation Survey (CIS) are 10-49 employees (small firms), 50-249 employees (medium-sized firms) and more than 250 employees (large firms). OSF (2020) is part of the European-wide CIS survey.

Harrison et al. (2010) found that firms that manage stakeholders devote more resources to meet the requirements of their legitimate stakeholders than would be necessary to maintain deliberate participation in the productive activities of a firm. Thus, such behaviour may disrupt the processes of value creation. However, the utility of stakeholders may also lead to firm innovativeness (see Harrison et al., 2010). In this paper, stakeholders are broadly defined as individuals or groups that may influence a firm's competitive advantage (Freeman, 1984; Jones & Wicks, 1999; Phillips, 2003; Freeman et al., 2007; Harrison et al., 2010; Pollack et al., 2017; Jones et al., 2018; Leonidou et al., 2020).

Chang et al. (2011) argue that the innovation strategies of SMEs and large firms differ because SMEs have limited leadership skills and different internal and external operating environments. Although many studies have noted that the company must have strong internal capabilities and an advanced knowledge base to create innovation (e.g., Cohen & Levinthal, 1990), studies to date have paid little attention to variables and indicators that can measure these internal effects. As described by Walsh and Linton (2001), industry-wide competencies are needed for the success of a firm. According to this core competence perspective, obtaining a competitive advantage depends on a firm's ability to identify its managerial capabilities as well as specific technological expertise and competencies and to match these strengths with the resources necessary to gain a competitive advantage in the firm's chosen markets. Thus, if firms do not have sufficient internal capabilities, they are unlikely to identify important competencies in their environment (see, e.g., Kang & Park, 2012; Voudouris et al., 2012).

The resource-based view (RBV) emphasizes the firm's internal factors, as the firm's strategies are considered through its internal strengths and weaknesses. Penrose (1959) argues that a firm's success is based on its ability to utilize and combine existing resources. Then, it is important both how original the resources are and how difficult it is to emulate similar resources. Furthermore, according to RBV, innovation can be seen as a valuable internal resource that can lead to firm success (Barney, 1991; Khairuddin et al., 2019). Therefore, it is important to develop and test measures of internal capabilities, especially during turbulent economic times. The question of whether different measures and indicators of internal capabilities are related to the creation of different types of innovations is also addressed in this article.

It is commonly accepted that economic development is highly dependent on the accumulation and diffusion of knowledge. However, Tödtling et al. (2009) argue that "It is unclear to what extent different kinds of innovation rely on specific knowledge sources and links." On the other hand, Amara et al. (2016) argue that four categories of knowledge assets are considered important

in the literature to explain the firm's propensity for innovation: 1) diversity of knowledge sources; 2) knowledge creation; 3) knowledge embodied in management practices and advanced technologies and 4) knowledge embodied in the strength of ties. However, as Cassiman and Veugelers (2006) state, firms cannot rely solely on internal knowledge sourcing in their innovation activities. Thus, firms require knowledge (internal) not existing in the firm, i.e., external knowledge acquisition. Furthermore, Cohen and Levinthal (1990) state that a prior stock of knowledge, internal knowledge, plays an important role when firms scrutinize and embrace external knowledge.

Our data also consist of knowledge-intensive business service (KIBS) firms. KIBS knowledge sources can be classified as internal sources, market source information, research source information, and generally available information sources (see, e.g., Amara & Landry, 2005; Amara et al., 2016; Rodriguez et al., 2017). Internal sources refer to knowledge from the firm, market sources refer to market-based knowledge, research sources refer to research-based knowledge and general sources refer to generally available knowledge such as scientific journal, conferences and exhibitions that are important to firms' innovation activity.

Studies analysing the relation between variety in knowledge sourcing and innovation novelty concerning manufacturing are, for example, Amara and Landry (2005), Nieto and Santamaría (2007), and Zeng et al. (2010). Rodriguez et al. (2017) studied the importance of different types of knowledge sources (information sources) for the novelty of KIBS innovation. They found evidence of a positive relation between a variety of market sources and the introduction of innovations for the firm and a negative relation between a variety of research sources and innovations for firms.

Furthermore, the OECD (2005) argues that certain types of innovation⁵ (product, process, marketing, and organizational) greatly affect firm performance. This evidence includes case studies using data for Finland (Varis & Littunen, 2010), Cambodia (O'Cass et al., 2014), Greece (Kafetzopoulos et al., 2015), Brazil (Bruhn et al., 2016), Italy (Landoni et al., 2016), Spain (Hervas-Oliver et al., 2016), Nigeria (Ilori et al., 2017), Colombia (Mejia & Arias-Perez, 2017), Italy (De Martino et al., 2018), Portugal (Carvalho et al., 2013) and Mexico (Maldonado-Guzmán et al., 2019). Saunila (2020) suggests that the most analysed type of innovation is product innovation. She also notes that less research has been done on process innovation.

Varis and Littunen (2010) found that the emergence of product and marketing innovation is most closely linked to freely available information sources (e.g., exhibitions and fairs, the internet, the media) on SMEs in Northern Savonia. Our study augments Varis and Littunen's (2010) sample

⁵ OECD (2005) give full definitions of types of innovation.

by assessing all regions in Finland. The data used in the study include 389 Finnish SMEs, of which 299 are industrial firms, 73 are KIBS firms, and 17 are firms in other sectors. The enquiry was collected through a survey and was conducted in autumn 2017 and spring 2018 through telephone interviews.

In sum, our study provides comprehensive information on how different stakeholders (various information sources) contribute to the emergence of different types of product, process, marketing, and organizational innovations in SMEs. First, we analyse the importance of internal capabilities (resources) on the adoption of new things in the firm. Second, the role of various external information sources, such as exhibitions and fairs, the internet and the media, as sources of information on reform will be examined. The extent to which different types of innovations do depend on certain data sources and links has remained largely unanswered in the innovation literature (Tödtling et al., 2009). Third, we also explore other possible information sources by analysing the weight of public organizations and other organizations in the emergence of innovations. Fourth, the focus is on the effects of different groups of firms, such as competitors, sales and distribution organizations, on the innovation process.

Thus, we believe that this paper provides a new and topical viewpoint for the literature by examining the possible factors explaining the increase in SMEs' likelihood of implementing product, process, marketing, and organizational innovations.

To delve into these matters empirically, an analysis was conducted by utilizing data collected from 389 SMEs located in Finland. Based on the sample, we employ logistic regression analysis to determine the stakeholders (various information sources) and firm-level characteristics that distinguish noninnovative and innovative companies.

The paper is organized as follows. The following chapter provides a condensed overview of the SME innovation literature, which is relevant for the current study. This section also presents the research hypotheses. The following chapter provides an introduction to the methodology used in the study, including the data and variables used. The results of the analysis are then presented and interpreted. Finally, the discussion, conclusions, and potential implications of this study are presented.

LITERATURE REVIEW

In the context of firms' innovation activities, it is important to define "innovation". Schumpeter (1939) defined innovation as a setting up of a new production function. Hagedoorn (1996) found this definition broad

and rather vague. For example, Trott (2002) indicated that innovation is a process that involves new ideas, inventing new solutions to particular problems, and developing new markets. This study accepts the definition of innovation proposed by the OECD (2005). The widely accepted definition of technological innovation by the OECD (2005) is that innovation is, from the company's point of view, a completely new or significantly improved product, process, marketing, or organizational improvement in business practices or external relations.

The question of how to approach the stakeholders of SMEs can be considered from the viewpoint of the company's objectives and how they are achieved. A firm's objectives are formed by its stakeholders, such like the entrepreneur or another proprietor, the firm's employees and its financiers (Freeman, 1984; Carroll, 1993; Freeman et al., 2007). Carroll (1993) stated that an increasing number of groups belong to this category. Together with proprietors and other priority interest groups, the management of the firm is linked to the firm's next phase, competitors, local community and representatives of the government (Carroll, 1995). The task of management is thus to coordinate the expectations and requirements of the various interest groups (e.g., Eesley & Lenox, 2006; Harrison et al., 2010). The idea from stakeholder theory is that various groups that have mutual inputs to a firm interact with each other and make its operations possible. We adopt in our study the view used by Freeman (1984) and Tang and Tang (2012) that all individuals or groups are defined as stakeholders who can influence the achievement of the firm's goals or who are affected by it. Thus, stakeholders may be crucial sources in innovation processes (Vrontis et al., 2017; Santoro et al., 2018).

Grama-Vigouroux et al. (2020) argue that stakeholder engagement strengthens organizational competencies in knowledge retrieval, retention, and utilization. According to Harrison et al. (2010), activities with the firm's interest groups increase a firm's knowledge and thus increase its ability to innovate. Similarly, Sawang and Unsworth (2011) found that the weight of external stakeholders is pushed to the innovativeness of SMEs. According to the study of Bridoux and Stoelhorst (2014), primary stakeholders, i.e., customers and owners, create value and competitive advantage and make it easier to manage core competencies and innovation orientation in firm operations (see also Prahalad & Hamel, 1990; Walsh & Linton, 2001).

Llerena and Oltra (2002) distinguished between internal and external learning to characterize the innovation strategies of firms (e.g., Malerba 1992; Peeters & van Pottelsberghe de la Potterie, 2006). Internal learning is related mainly to formalized activities, i.e., knowledge is generated through formalized internal sources such as R&D. In turn, external learning is related to

information from external sources such as public research and dissemination. Numerous studies have provided strong theoretical support for the utility of a firm's internal capabilities (Zahra & Covin, 1993; Lumpkin & Dess, 2001; Kreiser et al., 2002; Tang et al., 2008; Saunila 2016, 2020). Hervas-Oliver et al. (2011) studied Spanish low- and medium-low-tech firms in 2015 and 2016, which were mainly SMEs, and found that firms with more internal resources had better possibilities for cooperating and accessing external knowledge flows. Thus, internal capabilities, networking capabilities, and the use of external information sources may be interconnected in complex ways.

In contrast, the role of external information sources in companies' ability to innovate has been less studied, especially in Finland. Leiponen (2012) found with Finnish CIS data that manufacturing and service firms benefit from the scope of external knowledge acquisition strategies. Furthermore, Leiponen and Helfat (2010) argue that by using a larger number of complementary knowledge sources, firms may increase their probability of obtaining useful knowledge that leads to innovation.

Sources of useful information are supposed to vary between different types (process, product, marketing, and organizational) of innovation (Freel & de Jong, 2009; Varis & Littunen, 2010). Thus, SMEs' innovation performance is supposed to be shaped along with internal capabilities and the use of external information sources. From the theoretical starting point mentioned above, we formulate the following research hypotheses:

H1: *Higher internal capabilities of a firm increase SMEs' likelihood of implementing product, process, marketing and organizational innovations.*

H2: *Companies using various types of external information sources in their innovation process have an increased likelihood of innovating through product, process, marketing and organizational innovations.*

The resources and networking opportunities of SMEs are often limited. According to Freel (2003), supplementing and complementing SMEs with limited resources on innovation processes and business cooperation have been of interest since the late 1980s and 1990s. Freel (2003) provides a detailed discussion on the importance of extending the knowledge base and risk-sharing offered by, e.g. universities and public agencies, on firms' innovation capacity. He concludes that innovative small firms are more likely to be associated with public sector support, ministries, or trade support organizations than noninnovative firms. Furthermore, the role of universities and public research institutes as sources of new knowledge is

also emphasized, e.g., by Cassiman et al. (2009), Belderbos et al. (2016), and Caloghirou et al. (2021). However, universities and public research institutions are not the only public organizations offering innovation policy instruments to SMEs' innovation processes.

Policy instrument systems can generally be considered complex due to a large number of support instruments. Public policy instruments are defined as a set of techniques that authorities use to support and implement social change (Vedung, 1998). Thus, policy instruments concerning innovation policy are supposed to foster innovation, including instruments offered by universities and public research institutions. Borrás and Edquist (2013) categorize policy instruments into three groups: regulatory instruments (legal tools, rules, directives), economic and financial instruments (subsidies, loan guarantees, promotions, etc.) and soft instruments (recommendations, agreements, relations, partnerships). Soft instruments have become more popular over the years, which means that, according to Borrás and Edquist (2013), the role of governments has changed from providers and regulators towards coordinators or facilitators.

To meet the limited resources of companies, regional developers and the public sector have developed innovation-related services for SME innovation processes. Boter and Lundström (2005) analysed how Swedish SMEs use existing support services and found low participation rates on available support services. Olmos-Penuela et al. (2017) found that Spanish SME firms with formal plans for innovation benefit from cooperation with public research organizations. Cravo and Piza (2019) found in their meta-analysis that in low- and middle-income countries, business support interventions relating to formalization, business environment, exports, clusters, training, access to credit, technical assistance and innovation, improve SME performance. Furthermore, Mole et al. (2017) found that firms with more than nine employees in the UK were more likely to access business support than microfirms. Moreover, Mole et al. (2017) found sectoral differences in accessing support and intention to growth to be related to support-seeking behaviour. Thus, the evidence on the business-support seeking behaviour of SMEs is not deterministic or consistent. The purpose of our study is to determine whether SMEs benefit from the knowledge offered by public support organizations in innovation processes. Derived from the above discussion, the third research hypothesis is proposed:

H3: SMEs that use services from public support organizations are more likely to implement product, process, marketing and organizational innovations.

The importance of networks in firms' innovation processes has grown during the last few decades (Hagedoorn, 2002; Zeng, Xie & Tan, 2010; Belderbos et al., 2018). Along with the growing importance of networks, research into them has also increased. As a consequence, a vast number of studies have analysed the relation between networks or cooperation and a firm's innovation performance (Kaufmann & Tödtling, 2002; Tether, 2002; Becker & Dietz, 2004; Doloreux, 2004; Dickson et al., 2006; Nieto & Santamaría, 2007; Zeng et al., 2010). Nieto and Santamaria (2007) studied Spanish manufacturing firms and found that technological networks are crucial to achieving product innovations with a higher degree of novelty value. Suppliers, clients and research organizations had a positive impact on innovation novelty. Contrary, competitors' influence was negative. Furthermore, Zeng et al. (2010) studied 137 Chinese manufacturing SMEs and found a positive relation between innovation performance and interfirm cooperation, intermediary institutions and research organizations. Suppliers, customers and other firms seem to be more important organizations in innovation processes than governments, universities, or research institutes. Thus, networks could be seen as a way to complement a firm's internal resource base to achieve more successful innovation processes.

Rosenzweig (2017) argues that innovation networks enable firms to access external information sources. Saastamoinen et al. (2018) state that networks with other firms is related to the innovation performance of SMEs. They conclude that while developing new products for the public sector, SMEs should emphasize networks with other firms and place less emphasis on networks with public or private R&D actors. Hossain and Kauranen (2016) state that SMEs are forced to keep several networks manageable because they have limitations on various resources, in addition to which the time available for networking is limited. As a consequence, combining different knowledge in innovation processes may be related to the emergence of innovation. The fourth research hypothesis is formulated as follows:

H4: *Companies with denser networks are more likely to implement product, process, marketing and organizational innovations.*

Innovation and firm-level characteristics

According to the OECD (1997, 2005, 2018), innovation activity varies significantly between companies of different sizes. Moreover, Kirchhoff et al. (2013) argue that only a slight proportion of small firms will grow into medium-sized firms. The most prominent job creators are technology firms with a high degree of innovation and rapid growth at the same time. Several

studies on innovation processes have noted that firm size may affect SMEs' innovation activities (Rogers, 2004; Vaona & Pianta, 2008; Park et al., 2010; Demirel & Mazzucato, 2012; Deschryvere, 2014; Antonelli & Scellato, 2015; Littunen & Huovinen, 2020).

SME resources are typically scarce, which may influence their innovation activities. Woschke et al. (2017) reviewed 17 studies to determine the relation between resource scarcity and innovation. Firms were found to need resources to seek new opportunities. In contrast, for some firms, constraints were found to affect positively. As a consequence, the relation between the scarcity of resources and innovations is contradictory. Thus, firm size is supposed to affect the availability of scarce resources. However, our data do not address issues related to the scarcity of firm resources, and we are not able to distinguish the relationship between different innovation types and SME resource scarcity.

The relationship between firm size and innovation activity has proven to be contradictory. Among others, Pavitt (1984), Vaona and Pianta (2008), Park et al. (2010), and Deschryvere (2014) suggest that the size of a firm can be linked to its innovation processes. In contrast, Arvanitis (1997) argues that there is no link between innovation and firm size. The relationship between firm size and innovation orientation is examined by Laforet⁶ (2008), who discovered that firm size and strategic orientation are associated with innovation performance. Laforet (2008) found that the firms that had adopted a prospector strategy were more innovative and market-oriented than those pursuing a defender strategy (see also Ghosh et al., 2001). However, Arvanitis (1997) received contradictory results to some extent, as, according to him, the size of a firm does not affect the innovativeness of the firm. No final consensus has been reached, despite the number of studies on the subject, but more research is needed on the nature of the links between firm size and innovation. Based on the abovementioned theoretical starting points, we formulate the following fifth research hypothesis:

H5: A larger firm size increases the likelihood of implementing product, process, marketing and organizational innovations.

There exists a great deal of research that connects the industry sector of SMEs, which is crucial for the innovativeness and performance of a firm (e.g., Tether, 2005; Howells, 2005; Prajogo, 2006; Mansury & Love, 2008; Jiménez-Jiménez & Sanz-Valle, 2011; Segarra & Teruel, 2014; Littunen & Huovinen, 2020). Negassi et al. (2019) argue that firms in different industries differ considerably

⁶ According to her, within the SME population, medium-sized firms are proactive 'prospectors' that habitually search for opportunities and utilize analysis in the formulation of their competitive strategy, whereas the smaller firms are reactive 'defenders' whose activities are more short-term and reactive to the observations made of the environment

from the point of view of innovation strategies, as industries offer different opportunities as well as constraints for the organization of innovation activities by firms. Earlier studies have found a relation between the industry sector and innovation activity and firm performance (Beaudry & Swann, 2009; Antonelli & Scellato, 2015). Despite the importance of innovations, very little is known about their origins, development mechanisms and diffusion in different operating environments, which are shaped by the specifics of the industry.

For instance, Littunen and Huovinen (2020) pointed out that the creation of product and process innovation is positively related to the manufacturing industry, but then the creation of marketing innovations is linked to the field of trade. In turn, Vega-Jurado et al. (2008) stated that innovation factors vary in the industry and the novelty of newly developed products. Similarly, Segarra and Teruel (2014, p. 819) found that R&D intensity has a positive and statistically significant sign for manufacturing firms. In contrast, R&D intensity does not affect the growth of service firms. Similar results were also obtained by Beaudry and Swann (2009), who analysed industrial cluster effects in the UK; they found the strongest cluster effects on growth in manufacturing, manufacturing-related (agriculture; mining; construction; extraction of crude petroleum and natural gas, and related services) and infrastructure (electricity, gas, steam and hot water supply; air transport, water transport; education) sectors. However, cluster effects on firm growth were weaker in services (retail trade; insurance and pension funding; activities auxiliary to financial intermediation; other business activities). On the other hand, according to Cainelli et al. (2004) and Leiponen (2005), innovation activity is strongly linked in service firms (see also Henrekson & Johansson, 2010).

Our data consist also of KIBS firms. The KIBS sector is commonly regarded as one of the most important drivers of economic growth and technological change. KIBS can be seen as playing two distinct roles (Shearmur & Doloreux, 2019): 1) they act as providers of intermediation services to innovators that drive innovation in their client companies, and 2) KIBS act as innovators introducing internal innovations, providing mostly highly qualified workplaces and contributing to economic growth (see also Muller & Zenker, 2001).

However, Weerawardena et al. (2006, p. 43) argue that industry does not have a uniform relation to a firm's strategies of knowledge acquisition. They also call for more study of the internal factors that guide a firm's acquisition of information through internal sources. Therefore, derived from the above discussion, the sixth research hypothesis is proposed:

H6: Operating in the manufacturing sector increases the likelihood of SMEs implementing product, process, marketing and organizational innovations.

METHODOLOGY

Data and sample

The data used in the study were collected through a survey of Finnish SMEs. Samples from SMEs of different sizes and regions were purchased from Statistics Finland. The survey was conducted through telephone interviews with industrial SMEs and KIBS-based companies. Although the firms in Statistics Finland data were classified as industrial or KIBS firms, some of the enterprises interviewed still turned out to be other types of firms (e.g., service firms other than KIBS). The telephone interviews were conducted by a surveying company that specializes in this method, and interviewers were trained in interview techniques. In addition, the completed questionnaire was pretested as a telephone interview with firms. The data consisted of 389 SMEs, 299 industrial enterprises and 73 KIBS enterprises, and 17 firms in other sectors. Data were collected by a telephone survey in autumn 2017 and spring 2018.

The OECD (2018) argues that the innovation activities of firms differ by size. As a consequence, we used firm size to construct strata. The size categories are determined by the number of employees in the SMEs as follows: less than 5 employees, 5-9 employees, 10-49 employees, and 50 or more employees. For the firm interviews, the sample was also stratified by firm location. Regionally, the companies were located in six regions: 1) the Helsinki region, 2) the Oulu, Vaasa and Seinäjoki regions, 3) the Tampere and Turku regions, 4) the Jyväskylä, Kuopio and Joensuu regions, 5) the Lahti, Kouvola, Kotka and Lappeenranta regions, and 8) other than the abovementioned regions. The companies replied to the telephone interviews very well, and there were only a few refusals. In the stratified sample, a company that refused was replaced by a new company. According to the OECD (2018), there are no clear boundaries for high, moderate, or low response rates. However, the response rate of our enquiry exceeded 70%, which could be used as a rule of thumb as a high response rate (OECD, 2018). Thus, we believe that our sample describes the target population, SMEs in Finland, well, and the results are generalized to the target population.

Respondents of the inquiry were entrepreneurs and professionals (SMEs usually do not have employees, such as R&D managers, who are responsible for developing innovation). Our study used a structured questionnaire that included questions that were operationalized from the theoretical literature, utilized in previous innovation research, and new questions related to the theme. Thus, items and questions are based on a wide range of literature, including the OECD (1997, 2005). We strove to make a logically constructed questionnaire with clear definitions and instructions so that respondents

understood exactly what had been asked. We used questions that dealt with issues such as the business environment, networks, innovation strategies, and innovation activities. As a result, the data cover the broad scope of SME growth, performance, and innovation. The dependent variable has a binary outcome, so probability models and binary logistic regression are well suited for analysis. However, logistic regression is not the right method for measurements with continuous outcomes. Tansey et al. (1996) demonstrate the advantages and disadvantages of logistic regression analysis. In logistic regression analysis, data points should be independent of other data points. As a result of the dependence of different data points, the model will overweight those observations. One example of such a study is matched pairs design which matches a drug-taker with a similar individual who is taking a placebo. Perhaps the major limitation of the model is the linearity assumption between the independent and dependent variables. However, the advantages of the logistic regression model are remarkable: 1) it does not need distribution assumptions in feature space, 2) it is relatively easy to implement, 3) the results are well interpreted, and 4) as a result, it gives the size of the coefficients and their direction, i.e., how appropriate an independent variable is and is the sign of the coefficient positive or negative; 5) it can be extended to outcomes with three or more categories, 6) overfitting is not a big problem, and 7) it can be regarded as a model of good accuracy.

Innovation activity is suggested to vary considerably between firms of different sizes (OECD, 1997, 2005). Furthermore, the OECD has defined the types of innovation in four categories: 1) production, 2) process, 3) marketing, and 4) organization as innovation. In the survey, we followed the OECD guidelines, and the sample was stratified according to the size of the enterprises. The innovations were also typed according to the OECD specification. Overall, it can be argued that the surveyed firms represent rather well the typical small companies that make up the majority of companies in Finland (Statistics Finland, 2014). Over 77% of the companies were small enterprises with fewer than twenty employees (Table 1).

The European Union (2020) defines small firms as having fewer than 50 employees and medium-sized firms as firms with fewer than 250 employees. Microenterprises, on the other hand, employ fewer than 10 people. However, the majority of innovation surveys tend to underrepresent or completely ignore the population of the smallest enterprises, especially microenterprises. Furthermore, Kirchhoff et al. (2013) argue that only a slight proportion of small firms will grow into medium-sized firms. Based on the abovementioned starting points, our study highlights the innovation performance of the smallest firms with fewer than 5 employees relative to larger firms.

The size distribution in our study is based on Statistics Finland firm size distribution: 1) Fewer than 5 employees, 2) 5-9 employees, 3) 10-19 employees, 4) 20-49 employees, 5) 50-99 employees and 6) 100-249 employees. This enables us to compare the smallest firms, which have been largely overlooked in innovation studies, with larger SMEs. For the analyses, we have combined the categories so that the categories to be analyzed are 1) Less than 5 employees, 2) 5-19 employees, 3) 20 employees or more. The size distribution of the sample firms provides an interesting starting point for the current study.

Finnish industry is dominant in the sample (76.9%). Almost one-fifth of the enterprises were KIBS firms. Typically, KIBS firms require highly skilled employees. Miles et al. (1995) divided the KIBS industry into two parts: 1) I-KIBS, which are traditional expert services, and 2) II-KIBS, which are based on new technologies. In our study, we do not divide KIBS companies into two main groups because of the size of the sample. Table 1 presents the sample size and industry distribution, and in Appendix 1, sectors included in the KIBS sector are shown.

Table 1. Distribution of the sample by industry and company size

Industry	Less than 5 employees	5-19 employees	20 employees or more	Total no. of firms
Manufacturing	127	94	78	299 (76.9%)
KIBS firms	52	15	6	73 (18.8%)
Other industry	5	7	5	17 (4.3%)
Total	184 (47.3%)	116 (29.8%)	89 (22.9%)	389 (100.0%)

Variables and measures

The OECD (2005) gives full definitions of types of innovation. Product innovations relate to entirely new products or services as well as significant improvements of existing products. Process innovation is the case when a company makes significant changes in production and delivery methods. Changes in the organization's internal business practices or business practices in the company's external relations refer to organizational innovations. Marketing innovations, in turn, include the introduction of new marketing methods as well as changes in product promotion and placement.

Our study uses the above OECD typology and analyses how various information sources (individuals or groups that may influence firms' competitive advantage, stakeholders) and firm-level characteristics (size and industrial sector) are connected to SMEs' likelihood of implementing the product, process, marketing and organizational innovations. Our main interests are in internal capabilities, use of external information sources, use

of services of public support companies, business network density, firm size, and the industrial sector. Definitions of variables are shown in Table 2.

Table 2. Variable definitions

Dependent variables	Definition	Scale of measurement
Product/ process/ marketing/ organizational innovation	Variable indicating whether a firm has introduced a completely new or significantly improved innovation(s) within three years before the inquiry. Dummy variable	1=Innovation 0=Otherwise
Independent variables		
Internal	The importance of a firm's internal capabilities (sum-variable) <ul style="list-style-type: none"> • Company expertise (know-how) • The ability of the firm to change its operations • Training and education for employees • Employee initiatives • How work is organized (e.g., teamwork, job rotation) • Organizational communication within the company • Spontaneous communication within the company • Shared leisure activities and social events 	All sub-variables were measured on the scale 1-5 (Likert scale) and then summed up.
Diffext	The importance of various external information sources (sum-variable) <ul style="list-style-type: none"> • Fairs and exhibitions • Internet • Patent databases • Media • Professional literature • Educational meetings • Friends of the entrepreneur • Participation in development projects 	All sub-variables were measured on the scale 1-5 (Likert scale) and then summed up.
<i>Pubsupp</i>	The importance of using services of public support organization (sum-variable) <ul style="list-style-type: none"> • The local offices of government located in regions (Centre for Economic Development, Transport and the Environment) • The Federation of Finnish Enterprises/The Confederation of Finnish Industries • Industry organization • University • Other educational institution • Research institutes • Technology centre 	All sub-variables were measured on the scale 1-5 (Likert scale) and then summed up.

Dependent variables	Definition	Scale of measurement
Network	The importance of business network relations (sum-variable) <ul style="list-style-type: none"> • Clients (customers) • Rival (competitors) • Sales and delivery organization • Subcontractors and suppliers • Business service companies (and consultants) • Accounting firms 	All sub-variables were measured on the scale 1-5 (Likert scale) and then summed up.
	The size of the firm (employees; categorical variable)	
Size (1)		1= <5, 0= >4
Size (2)		1=5-19, 0= <5 and >19
Size		0= <5, 1= 5-19, 2= >19
	The industry of the firm (categorical variable)	
Industry (1)		0=KIBS firms and others, 1=manufacturing,
Industry (2)		0=manufacturing and KIBS firms, 1=others
Industry		0=manufacturing, 1=others, 2= KIBS firms

It is expected that firms' various information sources connected to the creation of innovations may vary depending on the type of innovation. Therefore, separate models have been created for different types of innovation. The dependent variable used in this study is the introduction of product, process, marketing, and organizational innovations in the firm. In the models, we look at a total of six explanatory variables to analyse different aspects of various information sources (stakeholders). On a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), respondents were asked to give their opinions on a number of statements concerning the company's various information sources. We combine several different variables into sum variables to improve the validity and reliability of the study. Four sum variables were identified (see also Varis & Littunen, 2010): internal capability factor (eight items), external information sources (eight items), public support organizations (seven items), and business network relations (six items). Regarding firm-level characteristics, two categorical variables were employed to measure firm size as well as the industry of a firm.

In the present study, a dummy variable, *Size* (1), equals one if a firm employs fewer than 5 employees and zero if there are more than 4 employees. Additionally, a dummy variable for “middle-sized” firms, *Size* (2), was used, which equals one if a firm has 5-19 employees and a value of zero otherwise. Variable *Size* indicates whether the overall variable is statistically significant. However, *Size* is not a variable in the model, which is why there is no coefficient listed. Thus, variables that code for *Size* are included in the regressions (*Size* (1) and *Size* (2))

A dummy variable, *Industry* (1), equals one if a firm operates in the manufacturing sector and zero otherwise (KIBS firms and others). Additionally, a dummy variable, *Industry* (2), was used, which equals zero if a firm operates in manufacturing or KIBS sectors and a value of one otherwise. *Industry* is not a variable in the model, which is why there is no coefficient listed. See Table 2 for a description of the variables used.

RESULTS

In our data, 331 firms engage in innovation activities (Table 3). Fifty-six firms were non-innovative firms without any product, process, marketing or organizational innovations. Most common innovations related to product innovations. In contrast, organizational innovations were less common since approximately 37% of all firms had made changes to the organization that could be regarded as organizational innovations.

Table 3. Distribution of the sample by industry and company size

Distribution of firms	n	Product innovations n (%)	Process innovations n (%)	Marketing innovations n (%)	Organizational innovations n (%)
Number of firms that <u>has not</u> made innovations		120 (31%)	135 (34.9%)	205 (52.7%)	241 (62.4%)
Number of firms that has made innovations		267 (69%)	252 (65.1%)	180 (46.8%)	145 (37.6%)
Has made all types of innovations	76 of 331 firms				
Total	387(100%)	387	387	385	386

Notes: 56 of 387 firms have not made innovations at all (non-innovative firms). 331 firms have made product, process, marketing or organizational innovations.

Descriptive statistics for each of four continuous explanatory sum variables are shown in Table 4. Additionally, the reliability values of the sum variables (continuous) are shown. The descriptive statistics in Table 4 are presented for all firms. However, all firms (N=389) did not answer all questions, which is why n varies by sum variable.

Table 4. Descriptive statistics of continuous independent variables and reliability coefficients (Cronbach’s alphas) of the independent sum-variables

Independent variables	Number of firms	Mean	Std. dev.	Alpha
Internal	324	2.8021	0.7801	0.865
Diffext	374	2.5866	0.7211	0.790
Pubsupp	372	1.6897	0.6706	0.831
Network	365	2.5543	0.6525	0.663

The descriptive evidence in Table 4 suggests that the introduction of innovation may be strongly emphasized by internal capabilities (Internal). This suggestion is in line with the previous RBV literature and encourages us to further analyse the factors that contribute to the creation of products, processes, marketing, and organizational innovation. On the other hand, the least importance is given to the creation of innovation by public organizations (Pubsupp). Standard deviations are quite low regarding all the variables; thus, these variables are not on the skew distribution. In addition, the normal distribution of explanatory variables is not expected, unlike in linear regression analysis (see, e.g., Hosmer & Lemeshow, 2000). The reliabilities of the variables describing firms’ various information sources range from 0.663 to 0.865 (see Cronbach, 1951). Nunally (1978) considered 0.5 to be the lower limit of acceptability (see also Tavakol & Dennick, 2011). According to the results of Cronbach’s alpha, all scales were completely internally consistent (ibid), i.e., confidence values were significantly higher than 0.5.

Correlations of variables are shown in Appendix 2. Correlations are mainly statistically significant, showing that explanatory variables are connected to different types (product, process, marketing, and organizational) of innovation.

Multivariate analysis

The results relating to SME product innovations are presented in Table 5. The estimated model was highly significant (model Chi-square=0.000). Our model classifies observed observations into two groups extremely well. As a consequence, 75.7% of the total number of observations was correctly classified using a logistic regression model.

Table 5. The importance of stakeholders and firm-level characteristics related to product innovation in SMEs. Logistic regression model

Explanatory variable	Coefficient	Standard error	Significance
Internal	0.110	0.239	0.646
Diffext	1.109	0.303	0.000***
Pubsupp	-0.270	0.307	0.380
Network	-0.167	0.307	0.587
Size			0.226
Size (1)	-0.601	0.411	0.143
Size (2)	-0.100	0.411	0.808
Industry			0.015**
Industry (1)	0.892	0.359	0.013*
Industry (2)	2.284	1.104	0.039**
Constant	-1.643	0.931	0.078*

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%.

Partial classification rates (%): firms with new product innovation (%) = 94.8; other firms (%) = 24.1

Model Chi-square = 0.000; n = 292; df = 8, total classification rates (%) = 75.7

Dependent variable: introduction of an innovation by a firm: 0 = no innovation, 1 = innovation

The logistic regression model shows that Diffext, Industry (1) and Industry (2) were statistically significant variables. Various external information sources, such as fairs, the media and the internet, increase SMEs' likelihood of creating product innovation (*H2* supported). A strong motivation to develop new products and to seek new opportunities broadly from various external sources is linked to the innovativeness of SMEs, and there are differences between innovative and noninnovative SMEs (see, e.g., March, 1991; Eesley & Lenox, 2006; Varis & Littunen, 2010; Harrison et al. 2010; Littunen & Rissanen, 2015). This finding suggests that the entrepreneurs who develop products in their small firms do not think of their firms strategically but are flexible to changes in the environment (see, e.g., Vos, 2005). However, in contrast to previous studies, the introduction of product innovation related to the internal capabilities of a firm was not found to be significant (e.g., Vega-Jurado et al., 2008; Kang & Park, 2012; Voudouris et al., 2012; Landoni et al., 2016), and *H1* cannot be accepted.

The results confirm that the creation of product innovation is positively connected with manufacturing (*H6* supported). This result is similar to many other studies (e.g., Prajogo, 2006; Beaudry & Swann, 2009; Jiménez-Jiménez & Sanz-Valle, 2011; Ilori & Lamal, 2017).

Regarding firms' process-related innovative activity, the logistic regression model (Table 6) was highly significant (model Chi-square=0.000).

Our model classifies observed observations into two groups extremely well. As a consequence, 73.5% of the total number of observations was correctly classified using a logistic regression model.

Table 6. The importance of stakeholders and firm-level characteristics related to process innovation in SMEs. Logistic regression model

Explanatory variables	Coefficient	Standard error	Significance
Internal	0.266	0.223	0.232
Diffext	0.540	0.267	0.043**
Pubsupp	0.215	0.295	0.465
Network	-0.049	0.294	0.868
Size			0.053*
Size (1)	-0.959	0.412	0.020**
Size (2)	-0.845	0.404	0.036**
Industry			0.261
Industry (1)	0.571	0.350	0.102
Industry (2)	0.365	0.706	0.606
Constant	-1.281	0.896	0.153

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%.
 Partial classification rates (%): firms with new process innovation (%) = 92.5; other firms (%) = 32.3
 Model Chi-square = 0.000; n = 294; df = 8, total classification rates (%) = 73.5
 Dependent variable: introduction of an innovation by a firm: 0 = no innovation, 1 = innovation
Note: Negative value means that with a dummy value = 1, the coefficient is negative, i.e., a value of zero has a greater effect. Size (1) obtains the value 1 when there are fewer than 5 employees, and size (2) = 1 when there are 5-9 employees.

The logistic regression model showed that the statistically significant variables were Diffext, Size (1), and Size (2). In line with the results of the product innovation model, the results of the process innovation model showed that various external information sources contribute positively to the creation of process innovation in SMEs (*H2* supported). This finding supports several studies in which an entrepreneur utilizes a variety of sources in the creation of process innovation (e.g., Freel, 2003; Amara & Landry, 2005). The results tie well with previous studies wherein the creation of process innovation was linked to the size of firms (see, e.g., Van Dijk et al., 1997; Laforet, 2008; Damanpour, 2010). According to the results, process innovation was stronger in large (=over 20 employees) firms than in small (=less than 20 employees) firms (*H5* supported). This result is partly similar to Abel-Koch et al. (2015), who found in Germany that manufacturing SMEs with more than 10 employees introduced more process innovations between 2010 and 2012 than smaller firms in the construction, wholesale and retail or services sectors.

In addition, a logistic regression analysis was performed to compare various information sources (stakeholders) and firm-level characteristics associated with the creation of marketing innovations (Table 7). The estimated model was highly significant (model Chi-square= 0.000). Our model classifies observed observations into two groups fairly well. As a consequence, 63.0% of the total number of observations was correctly classified using a logistic regression model.

The logistic regression model shows that the Internal and Diffext variables were statistically significant (H1 and H2 supported). The findings are directly in line with previous findings (e.g., Cohen & Levinthal, 1990; Kreiser et al. 2002; Tang et al., 2008; Petrou & Daskalopoulou, 2013) that internal capabilities, such as a firm's know-how, have an effect on the firm's innovativeness, that is, in this case, on the creation of marketing innovation. In the context of the stakeholder framework, primary stakeholders as entrepreneurs themselves, firm owners and employees are, according to the results, most important in the marketing innovation process (see, e.g., Freeman et al., 2007; Harrison et al., 2010). In line with the product and process innovation model, the results for marketing innovation showed that various external information sources, such as the internet, entrepreneurs' friends and participation in development projects, have a positive relation to the creation of marketing innovation in SMEs.

Table 7. The importance of stakeholders and firm-level characteristics related to marketing innovation in SMEs. Logistic regression model

Explanatory variables	Coefficient	Standard error	Significance
Internal	0.429	0.208	0.039**
Diffext	0.498	0.240	0.038**
Pubsupp	-0.153	0.252	0.545
Network	0.312	0.267	0.243
Size			0.619
Size (1)	-0.166	0.346	0.632
Size (2)	-0.320	0.329	0.330
Industry			0.803
Industry (1)	-0.037	0.340	0.914
Industry (2)	-0.422	0.660	0.523
Constant	-2.751	0.854	0.001***

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%.

Partial classification rates (%): firms with new marketing innovation (%) = 58.0; other firms (%) = 67.8

Model Chi-square = 0.000; n = 292; df = 8, total classification rates (%) = 63.0

Dependent variable: introduction of an innovation by a firm: 0 = no innovation, 1 = innovation

The logistic regression model regarding the organizational-related activities (Table 8) of companies was highly significant (model Chi-square=0.000). Our model classifies observed observations into two groups extremely well. As a consequence, 75.8% of the total number of observations was correctly classified using a logistic regression model. The high classification rate of the model was based on a successful grouping of the other firms (companies without new organizational innovation, 84.6%). In addition, the other group (innovators) was classified quite well.

The statistically significant variables were Internal, Size (1), and Size (2). A firm’s know-how increases SMEs’ opportunities to innovate when firms aggressively interact with their environment (see Cohen & Levinthal, 1990; Lumpkin & Dess, 2001; Beaver & Prince, 2004). Moreover, stakeholders’ utilization of management resources adds value to the firm’s operations and increases the environmental management and innovativeness of the firm (see, e.g., Freeman et al., 2007; Harrison et al., 2010; Eesley & Lenox, 2016) (*H1* supported).

Table 8. The importance of stakeholders and firm-level characteristics related to organizational innovation in SMEs. Logistic regression model.

Explanatory variables	Coefficient	Standard error	Significance
Internal	0.935	0.255	0.000***
Diffext	0.011	0.285	0.970
Pubsupp	0.211	0.295	0.474
Network	-0.116	0.323	0.718
Size			0.000***
Size (1)	-2.961	0.431	0.000***
Size (2)	-2.194	0.397	0.000***
Industry			0.538
Industry (1)	-0.432	0.400	0.281
Industry (2)	-0.551	0.801	0.492
Constant	-0.787	0.974	0.419

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%.
 Partial classification rates (%): firms with new organizational innovation (%) = 63.7; other firms (%) = 84.6
 Model of Chi-square = 0.000; n = 293; df = 8, total classification rates (%) = 75.8
 Dependent variable: introduction of an innovation by a firm: 0 = no innovation, 1 = innovation

In line with the results of the process innovation model and earlier studies (e.g., Van Dijk et al., 1997; Laforet, 2008), our results showed that organizational innovation was more focused in large (=over 20 employees) firms than in small (=less than 20 employees) firms (*H5* supported). This result

is partly in line with Bruhn et al. (2016), who found that firms with more than 70 employees in Brazil more frequently have organizational innovations. Furthermore, Abel-Koch et al. (2015) found that the share of firms that introduced organizational innovations in Germany was larger among firms with 50-249 employees than among firms with 10-49 employees.

DISCUSSION

It has been widely acknowledged that innovation in SMEs is far from an unequivocal phenomenon but rather is contingent on several factors. The aim of our study was to acquire knowledge of information sources (stakeholders) and characteristics of the company that potentially differentiate between the different types of innovation introduced in SMEs. In this study, innovative SMEs were compared to their noninnovative counterparts. By focusing on themes associated with the importance of internal capabilities, public support organizations, business network relations and various external information sources together with a firm's industry sector and size, the results at least partially tie well to the criteria made in previous studies. There were also unexpected findings that contradicted the existing evidence. Overall, the present study revealed a number of issues worthy of consideration by further research on SME innovation activities.

Our findings on product, process and marketing innovation showed that firms use various external sources of information in the innovation process (hypothesis 2). These various sources, such as fairs and educational meetings, may provide information that encourages firm innovativeness that is not otherwise available in the industry (see, e.g., Zahra, 1991; Shane, 2003; Freeman, et al., 2007; Harrison, et al., 2010). As Vaona and Pianta (2008, p. 283) noted, "product, process and marketing innovations are related to different innovative inputs and strategies pursued by firms." However, although a lack of strategic orientation may potentially emasculate the success of innovative endeavours in SMEs, from the results, it would also suggest that small firms striving for product, process and marketing innovations should adopt flexible strategies rather than ones that are "carved in stone." The present study confirmed the findings of Beaver and Prince's (2004) study, which argued that "the notion of strategic awareness as a specific capability and planning as an embedded process is much more critical than the written business plan for shaping the competitive posture of many small enterprises." However, these findings are somewhat contradictory to most studies in this area (see, e.g., Cohen & Levinthal, 1990), as a firm's innovation process generally requires strong internal capabilities (hypothesis 1).

CONCLUSION

Regarding the findings for marketing and organizational innovation, a positive relation was found between the internal capabilities of a firm and the creation of marketing and organizational innovation processes (hypothesis 1). These findings regarding SMEs' internal capabilities related to marketing and organizational innovation are consistent with research showing that innovation frequently needs special know-how by a firm's primary stakeholders (see, e.g., March, 1991; Eesley & Lenox, 2006; Freeman et al., 2007). The utility of a firm's internal capabilities in innovation processes has also been found among Finnish SMEs (Saunila, 2016, 2020). As Cohen and Levinthal (1990) stated, the ease of learning and the uptake of technology are related to the extent to which innovation relates to the existing knowledge base. On the other hand, perhaps the most unexpected findings, which contradicted several older studies (see, e.g., Tödtling & Kaufmann, 2001; Lechner & Dowling, 2003; Tödtling et al., 2009), were that a firm's business network and use of public support organization were not related to the processes for the different types of innovation (hypothesis 3 and 4).

Considering the relation between innovation and the size of the firm, our results demonstrated that the introduction of a novel process and organizational innovation was associated with firm size, such that firms with more than 20 employees were concentrated in the group of innovators (hypothesis 5). This result is somewhat in line with most studies, which have found that innovativeness is stronger in larger firms, including Van Dijk et al. (1997), Laforet (2008), Damanpour (2010), Abel-Koch et al. (2015), and Bruhn et al. (2016). Furthermore, structuring the industry sector, competition and size can influence the creation of innovations. As Laforet (2008, p. 754) stated, "large firms in low-tech industries have an advantage over small firms, but no difference exists in high-tech industries."

Regarding our findings, it was found that the introduction of product innovation was connected to the firm's industry; therefore, firms in manufacturing and other industries were concentrated in the group of innovators, but KIBS firms were concentrated in the group of non-innovators (hypothesis 6). This result supported those of previous studies that indicated that innovation activity is more frequent in manufacturing firms than in services firms (e.g., see Beaudry & Swann, 2009; Jiménez-Jiménez & Sanz-Valle, 2011; Segarra & Teruel, 2014; Littunen & Huovinen, 2020).

This study also provides suggestions for practice and policymakers. Our study found that public support organizations were not related to SME innovativeness (hypothesis 3). This finding is in line with Zeng et al. (2010), who found that suppliers, customers and other firms seem to be

more important organizations in innovation processes than governments, universities, or research institutes. Furthermore, Saastamoinen et al. (2018) state that while developing new products for the public sector, SMEs should emphasize networks with other firms and place less emphasis on networks with public or private R&D actors. In contrast, Huang et al. (2010) found that firms engaging in product innovations found universities and research institutions to be important information sources for innovation. However, our findings that public support organizations were not statistically significant in any innovation model are contrary to our expectations. Therefore, public support organizations should develop better mechanisms to find SMEs with strong motivations to develop new products and market opportunities. Thus, appropriate support mechanisms for innovative SMEs with growth endeavours would lower the threshold for taking the first critical steps, which are often characterized by the development of innovation and often the funding of innovation. Further, motivating entrepreneurs to interact with different stakeholders in innovation development is most important (Amara et al., 2016; Leiponen & Helfat, 2010). Thus, a larger number of complementary knowledge sources may increase the probability of obtaining useful knowledge that leads to innovation. Our study found that firms using various types of external information sources, such as fairs, the media and the internet, increase SMEs' likelihood of creating product, process and marketing innovations (hypothesis 2).

Mole et al. (2017) state that SMEs may make suboptimal use of services and that because of imperfect information, they may have doubts about the value and reliability of the services, they may lack the time to wait for the benefits of services to accrue, there might be power imbalances or different world views between the owner and service advisers, and there might be uncertainty as to whether those advisers can be trusted or are fully aware of the needs of business managers. As a consequence, various relationships between firms and public support organizations increase trust and may lower the threshold of use of public services.

In regard to further research on the issues covered here, the primary stakeholders of SMEs related to the introduction of different types of innovations will be examined in more detail in other studies with a variety of data. Surprisingly, according to the findings of this study, networks with some primary stakeholders, such as customers, competitors and suppliers, were not linked to the introduction of different types of innovation.

Finally, it is appropriate to pay attention to some potential caveats regarding the study design and interpretations made on the grounds of empirical analysis. One could criticize the sample that includes firms from various industries, since, as argued by De Jong and Vermeulen (2006), it

could diminish the value of the study regarding the implications for practice that could be made based on findings. Although it cannot be denied that differences do exist between industries with respect to their innovation practices (Pavitt, 1984), it has also been shown that small firms' innovation activities share many common features across both manufacturing and service sectors (see, e.g., Drejer, 2004; De Jong & Marsili, 2006), suggesting that some general patterns of SME innovation do exist, although they are certainly not applicable to every firm in every industry. Furthermore, as De Jong and Vermuelen (2006) and Knoblen (2009) noted, studies focusing on a single industry are also problematic, as the findings from these studies are difficult to generalize.

Moreover, the distinctive features of the country studied may have an impact on the research findings. Further studies in other countries are welcomed, and we encourage researchers in other countries to conduct a similar study for comparison in different countries. Although it is not easy to generalize the results of the study to other geographical contexts, we believe that parallel findings could be obtained when conducting the study in an economically and technologically advanced country. It is also important to remember that this study data were collected only from entrepreneurs and professionals. Because of their dominant position, entrepreneurs can be biased in their views of the business situation in their firms. Hence, somewhat different results might have been obtained if multiple informants had been used. Conversely, it is the opinions of entrepreneurs that are of interest because, after all, they are arguably the most important people in their respective firms in regard to strategy formulation and innovation orientation. However, our study has shed a little light on the subject for those interested in studying the innovativeness of SMEs, despite the potential limitations identified.

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References

- Abel-Koch, J., Del Bufalo, G., Fernandez, M., Gerstenberer, J., Lo, V., Navarro, B., & Thornary, B. (2015). Investment and innovation. France, Germany, Italy and Spain. Retrieved from <https://www.ico.es/documents/19/14629/SME+Investment+and+Innovation+2015.pdf/1fa1ff45-66c6-4463-9ea0-61297e3ad630>
- Amara, N., D'Este, P., Landry, R., & Doloreux, D. (2016). Impacts of obstacles on innovation patterns in KIBS firms. *Journal of Business Research*, 69(10), 4065-4073. <http://dx.doi.org/10.1016/j.jbusres.2016.03.045>.
- Amara, N., & Landry, R. (2005). Sources of information as determinants of novelty of innovation in manufacturing firms: Evidence from the 1999 statistics Canada innovation survey. *Technovation*, 25(3), 245-259. [http://dx.doi.org/10.1016/S0166-4972\(03\)00113-5](http://dx.doi.org/10.1016/S0166-4972(03)00113-5).
- Antonelli, C., & Scellato, G. (2015). Firms size and directed technological change. *Small Business Economics*, 44(1), 207–218. <http://dx.doi.org/10.1007/s11187-014-9593-1>.
- Arvanitis, S. (1997). The impact of firm size on innovative activity – an empirical analysis based on Swiss firm data. *Small Business Economics*, 9(6), 473–490.
- Asheim, B. T., Coenen, L., & Svensson-Henning, M. (2003). *Nordic SMEs Regional Innovation Systems: Final Report*. Oslo: Nordic Innovation Center.
- Audretsch, D. B. (2002). The dynamic role of small firms: Evidence from the US. *Small Business Economics*, 18(1–3), 13–40.
- Barney, J. B. (1991). Firm resources and competitive advantage. *Journal of Management*, 17(1), 99-120.
- Beaudry, C., & Swann, G. M. P. (2009). Firm growth in industrial clusters of the United Kingdom. *Small Business Economics*, 32(4), 409–424. <http://dx.doi.org/10.1007/s11187-007-9083-9>.
- Beaver, G., & Prince, C. (2004). Management, strategy and policy in the UK small business sector: A critical review. *Journal of Small Business and Enterprise Development*, 11(6), 34–49. <http://dx.doi.org/10.1108/14626000410519083>.
- Becker, W., & Dietz, J. (2004). R&D cooperation and innovation activities of firms evidence for the German manufacturing industry. *Research Policy*, 33(2), 209-223. <http://dx.doi.org/10.1016/j.respol.2003.07.003>.
- Belderbos, R., Gilsing, V. A., & Suzuki, S. (2016). Direct and mediated ties to universities: “Scientific” absorptive capacity and innovation performance of pharmaceutical firms. *Strategic Organization*, 14(1), 32-52. <http://dx.doi.org/10.1177/1476127015604734>.
- Belderbos, R., Gilsing, V., Lokshin, B., Carree, M., & Sastre, J. F. (2018). The antecedents of new R&D collaborations with different partner types: On the dynamics of past R&D collaboration and innovative

- performance. *Long Range Planning*, 51(2), 285-302. <http://dx.doi.org/10.1016/j.lrp.2017.10.002>.
- Borrás, S., & Edquist, C. (2013). The choice of innovation policy instruments. *Technological Forecasting and Social Change*, 80(8), 1513-1522. <http://dx.doi.org/10.1016/j.techfore.2013.03.002>.
- Boter, H., & Lundström, A. (2005). SME perspectives on business support services: The role of company size, industry and location. *Journal of Small Business and Enterprise Development*, 12(2), 244-258. <http://dx.doi.org/10.1108/14626000510594638>.
- Bridoux, F., & Stoelhorst, J. W. (2014). Microfoundations for stakeholder theory: Managing stakeholders with heterogeneous motives. *Strategic Management Journal*, 35(1), 107-125. <http://dx.doi.org/10.1002/smj.2089>.
- Bruhn, N. C. P., Alcantara, J. N., & Calegario, C. L. L. (2016). Multinational enterprises and spillover effects: A study on the factors associated with the innovation capacity of SMEs in Brazil. *Revista ESPACIOS*, 37(10), 1-12.
- Cainelli, G., Evangelista, R., & Savona, M. (2004). The impact of innovation on economic performance in services. *The Service Industries Journal*, 24(1), 116-130. <http://dx.doi.org/10.1080/02642060412331301162>.
- Caloghirou, Y., Giotopoulos, I., Kontolaimou, A., Korra, E., & Tsakanikas, A. (2021). Industry-university knowledge flows and product innovation: How do knowledge stocks and crisis matter?. *Research Policy*, 50(3), 104195.
- Carroll, A. (1993). *Business and Society, Business Ethics, and Stakeholder Management*. Dallas: South-Western Publishing.
- Carroll, A. (1995). Stakeholder thinking in three models of management morality: A perspective with strategic implications. In J. Näsi (Ed.), *Understanding Stakeholder Thinking* (pp. 44-47). Jyväskylä, Finland: LSR Publications.
- Carvalho, L., Costa, T., & Caiado, J. (2013). Determinants of innovation in a small open economy: A multidimensional perspective. *Journal of Business Economics and Management*, 14(3), 583-600. <http://dx.doi.org/10.3846/16111699.2012.701225>.
- Cassiman, B., & Veugelers, R. (2006). In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management Science*, 52(1), 68-82. <http://dx.doi.org/10.1287/mnsc.1050.0470>.
- Cassiman, B., Di Guardo, M. C., & Valentini, G. (2009). Organizing R&D projects to profit from innovation: Insights from co-opetition. *Long Range Planning*, 42(2), 216-233.
- Chang, Y. Y., Hughes, M., & Hotho, S. (2011). Internal and external antecedents of SMEs' innovation ambidexterity outcomes. *Management Decision*, 49(10), 1658-1676. <http://dx.doi.org/10.1108/00251741111183816>.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152. <http://dx.doi.org/10.2307/2393553>.

- Cravo, T. A., & Piza, C. (2019). The impact of business-support services on firm performance: A meta-analysis. *Small Business Economics*, 53(3), 753–770. <http://dx.doi.org/10.1007/s11187-018-0065-x>.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika* 16(3), 297–334. <http://dx.doi.org/10.1007/BF02310555>.
- Damanpour, D. (2010). An integration of research findings of effects of firm size and market competition on product and process innovations. *British Journal of Management*, 21(4), 996–1010. <http://dx.doi.org/10.1111/j.1467-8551.2009.00628.x>.
- De Jong, J. P. J., & Marsili, O. (2006). The fruit flies of innovations: A taxonomy of innovative small firms. *Research Policy*, 35(2), 213–229. <http://dx.doi.org/10.1016/j.respol.2005.09.007>.
- De Jong, J. P. J., & Vermeulen, P. A. M. (2006). Determinants of product innovation in small firms: A comparison across industries. *International Small Business Journal*, 24(6), 587–609. <http://dx.doi.org/10.1177/0266242606069268>.
- Demirel, P., & Mazzucato, M. (2012). Innovation and firm growth: Is R & D worth it?. *Industry and Innovation*, 19(1), 45–62. <http://dx.doi.org/10.1080/13662716.2012.649057>.
- Deschryvere, M. (2014). R&D, firm growth and the role of innovation persistence: An analysis of Finnish SMEs and large firms. *Small Business Economics*, 43(4), pp.767–785. <http://dx.doi.org/10.1007/s11187-014-9559-3>.
- Dickson, P. H., Weaver, K. M., & Hoy, F. (2006). Opportunism in the R&D alliances of SMEs: The roles of the institutional environment and SME size. *Journal of Business Venturing*, 21(4), 487–513. <http://dx.doi.org/10.1016/j.jbusvent.2005.02.003>.
- Doloreux, D. (2004). Regional networks of small and medium sized enterprises: Evidence from the metropolitan area of Ottawa in Canada. *European Planning Studies*, 12(2), 173–189. <http://dx.doi.org/10.1080/0965431042000183923>.
- Drejer, I. (2004). Identifying innovation in surveys of services: A Schumpeterian perspective. *Research Policy*, 33(3), 551–562. <http://dx.doi.org/10.1016/j.respol.2003.07.004>.
- Eesley, C., & Lenox, M. J. (2006). Firm responses to secondary stakeholder action. *Strategic Management Journal*, 27(8), 765–781. <http://dx.doi.org/10.1002/smj.536>.
- European Union. (2020). The revised user guide to the SME definition. SME definition | Internal Market, Industry, Entrepreneurship and SMEs. Retrieved from https://ec.europa.eu/growth/smes/sme-definition_en
- Freel, M. (2003). Sectoral patterns of small firm innovation, networking and proximity. *Research Policy*, 32(5), 751–770. [http://dx.doi.org/10.1016/S0048-7333\(02\)00084-7](http://dx.doi.org/10.1016/S0048-7333(02)00084-7).
- Freel, M. S., & Robson, P. J. A. (2004). Small firm innovation, growth and performance. *International Small Business Journal*, 22(6), 561–575.

- Freel, M., & De Jong, J. P. (2009). Market novelty, competence-seeking and innovation networking. *Technovation*, 29(12), 873-884. <http://dx.doi.org/10.1016/j.technovation.2009.07.005>.
- Freeman, R. E. (1984). *Strategic Management— A Stakeholder Approach*. Boston: Pitman.
- Freeman R. E., Harrison J. S., & Wicks A. C. (2007). *Managing for Stakeholders: Survival, Reputation and Success*. New Haven, CT: Yale University Press.
- Ghosh, B. C., Liang, T. W., Meng, T. T., & Chan, B. (2001). The key success factors, distinctive capabilities and strategic thrusts of top SMEs in Singapore. *Journal of Business Research*, 51(3), 209–221. [http://dx.doi.org/10.1016/S0148-2963\(99\)00047-8](http://dx.doi.org/10.1016/S0148-2963(99)00047-8).
- Gramma-Vigouroux, S., Saidi, S., Berthinier-Poncet, A., Vanhaverbeke, W., & Madanamoothoo, A. (2020). From closed to open: A comparative stakeholder approach for developing open innovation activities in SMEs. *Journal of Business Research*, 119, 230-244. <http://dx.doi.org/10.1016/j.jbusres.2019.08.016>.
- Hagedoorn, J. (1996). Innovation and entrepreneurship: Schumpeter revisited. *Industrial and Corporate Change*, 5(3), 883-896. <http://dx.doi.org/10.1093/icc/5.3.883>.
- Hagedoorn, J. (2002). Inter-firm R&D partnerships: An overview of major trends and patterns since 1960. *Research Policy*, 31(4), 477-492. [http://dx.doi.org/10.1016/S0048-7333\(01\)00120-2](http://dx.doi.org/10.1016/S0048-7333(01)00120-2).
- Harrison, J. S., Bosse, D. A., & Phillips, R. A. (2010). Managing for stakeholders, stakeholder utility functions, and competitive advantage. *Strategic Management Journal*, 31(1), 58-74. <http://dx.doi.org/10.1002/smj.801>.
- Henrekson, M., & Johansson, D. (2010). Gazelles as job creators: A survey and interpretation of the evidence. *Small Business Economics*, 35(2), 227–244. <http://dx.doi.org/10.1007/s11187-009-9172-z>.
- Hervas-Oliver, J. L., Garrigos, J. A., & Gil-Pechuan, I. (2011). Making sense of innovation by R&D and non-R&D innovators in low technology contexts: A forgotten lesson for policymakers. *Technovation*, 31(9), 427-446. <http://dx.doi.org/10.1016/j.technovation.2011.06.006>.
- Hervas-Oliver, J. L., Boronat-Moll, C., & Sempere-Ripoll, F. (2016). On process innovation capabilities in SMEs: A taxonomy of process-oriented innovative SMEs. *Journal of Small Business Management*, 54, 113-134. <http://dx.doi.org/10.1111/jsbm.12293>.
- Hosmer, D. W., & Lemeshow, S. (2000). *Applied Logistic Regression*, 2nd edition. New York: Wiley.
- Hossain, M., & Kauranen, I. (2016). Open innovation in SMEs: A systematic literature review. *Journal of Strategy and Management*, 9(1), 58-73. <http://dx.doi.org/10.1108/JSMA-08-2014-0072>.
- Howells, J. (2005). Innovation and regional economic development: A matter of perspective?. *Research Policy*, 34(8), 1220–1234. <http://dx.doi.org/10.1016/j.respol.2005.03.014>.

- Howells, J., & Roberts, J. (2000). From innovation systems to knowledge systems. *Prometheus: Critical Studies in Innovation*, 18(1), 17-31. <http://dx.doi.org/10.1080/08109020050000636>.
- Huang, C., Arundel, A., & Hollanders, H. (2010). How firms innovate: R&D, non-R&D, and technology adoption. Retrieved from <http://collections.unu.edu/view/UNU:405#viewAttachments>
- Ilori, A. B., Lawal, A., & Simeon-Oke, O. O. (2017). Innovations and innovation capability in palm kernel processing industry in southwestern Nigeria. *International Journal of Innovation Science*, 9(1), 102-114. <http://dx.doi.org/10.1108/IJIS-10-2016-0045>.
- Ipinaiye, O., Dineen, D., & Lenihan, H. (2017). Drivers of SME performance: A holistic and multivariate approach. *Small Business Economics*, 48(4), 883-911. <http://dx.doi.org/10.1007/s11187-016-9819-5>.
- Jiménez-Jiménez, D., & Sanz-Valle, R. (2011). Innovation, organizational learning, and performance. *Journal of Business Research*, 64(4), 408-417. <http://dx.doi.org/10.1016/j.jbusres.2010.09.010>.
- Jones T. M., & Wicks A. C. (1999). Convergent stakeholder theory. *Academy of Management Review*, 24(2), 206–221. <http://dx.doi.org/10.5465/amr.1999.1893929>.
- Jones, T. M., Harrison, J. S., & Felps, W. (2018). How applying instrumental stakeholder theory can provide sustainable competitive advantage. *Academy of Management Review*, 43(3), 371-391. <http://dx.doi.org/10.5465/amr.2016.0111>.
- Jones-Evans, D., Gkikas, A., Rhisiart, M., & MacKenzie, N. G. (2018). Measuring open innovation in SMEs. In F.F. W. Vanhaverbeke, F. Frattini, N. Roijakkers, M. Usman (Eds.), *Researching Open Innovation in SMEs* (pp. 399-427). New Jersey: https://doi.org/10.1142/9789813230972_0013
- Kafetzopoulos, D., & Psomas, E. (2015). The impact of innovation capability on the performance of manufacturing companies: The Greek case. *Journal of Manufacturing Technology Management*, 26(1), 104-130. <http://dx.doi.org/10.1108/JMTM-12-2012-0117>.
- Kang, K., & Park, H. (2012). Influence of government R&D support and inter-firm collaborations on innovation in Korea biotechnology SMEs. *Technovation*, 32(1), 400-414.
- Kaufmann, A., & Tödtling, F. (2002). How effective is innovation support for SMEs? An analysis of the region of Upper Austria. *Technovation*, 22(3), 147-159. [http://dx.doi.org/10.1016/S0166-4972\(00\)00081-X](http://dx.doi.org/10.1016/S0166-4972(00)00081-X).
- Keskin, H. (2006). Market orientation, learning orientation, and innovation capabilities in SMEs: An extended model. *European Journal of Innovation Management*, 9(4), 396-417. <http://dx.doi.org/10.1108/14601060610707849>.
- Khairuddin, S., Qureshi, Z. H., Wahid, R. A., Tehseen, S., Pathan, Z. H., & Khan, M. R. K. (2019). A conceptual study on contingent impact of external integration on innovation SME business success relationship. *International*

- Journal of Financial Research*, 10(5), 370. <http://dx.doi.org/10.5430/ijfr.v10n5p370>.
- Kirchhoff, B. A., Linton, J. D., & Walsh, S. T. (2013). Neo-Marshallian equilibrium versus Scumpeterian creative destruction: Its impact on Business research and economic policy. *Journal of Small Business Management*, 51(2), 159-166.
- Knoben, J. (2009). Localized inter-organizational linkages, agglomeration effects, and the innovative performance of firms. *The Annals of Regional Science*, 43(30), 757–779. <http://dx.doi.org/10.1007/s00168-008-0229-8>.
- Kreiser, P. M., Marino, L. D., & Weaver, K.M. (2002). Assessing the psychometric properties of the entrepreneurial orientation scale: A Multi-Country Analysis. *Entrepreneurship Theory and Practice*, 26(4), 71-94. <http://dx.doi.org/10.1177/104225870202600405>.
- Laforet, S. (2008). Size, strategic, and market orientation affects on innovation. *Journal of Business Research*, 61(7), 753–764. <http://dx.doi.org/10.1016/j.jbusres.2007.08.002>.
- Landoni, P., Dell’Era, C., Ferraloro, G., Peradotto, M., Karlsson, H., & Verganti, R. (2016). Design contribution to the competitive performance of SMEs: The role of design innovation capabilities. *Creativity and Innovation Management*, 25(4), 484-499. <http://dx.doi.org/10.1111/caim.12165>.
- Lecerf, M., & Omrani, N. (2020). SME internationalization: The impact of information technology and innovation. *Journal of the Knowledge Economy*, 11(2), 805-824. <http://dx.doi.org/10.1007/s13132-018-0576-3>.
- Lechner, C., & Dowling, M. (2003). Firm networks: external relationships as sources for the growth and competitiveness of entrepreneurial firms. *Entrepreneurship & Regional Development*, 15(1), 1-26. <http://dx.doi.org/10.1080/08985620210159220>.
- Leiponen, A. (2005). Organization of knowledge and innovation: the case of Finnish business services. *Industry and Innovation*, 12(2), 185–203. <http://dx.doi.org/10.1080/13662710500087925>.
- Leiponen, A. (2012). The benefits of R&D and breadth in innovation strategies: A comparison of Finnish service and manufacturing firms. *Industrial and Corporate Change*, 21(5), 1255-1281. <http://dx.doi.org/10.1093/icc/dts022>.
- Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, 31(2), 224-236. <http://dx.doi.org/10.1002/smj.807>.
- Leonidou, E., Christofi, M., Vrontis, D., & Thrassou, A. (2020). An integrative framework of stakeholder engagement for innovation management and entrepreneurship development. *Journal of Business Research*, 119, 245-258. <http://dx.doi.org/10.1016/j.jbusres.2018.11.054>.
- Littunen, H., & Huovinen, J. (2020). Innovation and performance among firms in Finland: The impact of firm-level characteristics. *International Journal*

- of Innovation and Regional Development*, 9(2), 102-120. <http://dx.doi.org/10.1504/IJIRD.2020.110505>.
- Littunen, H., & Rissanen, S. (2015). Information sources and innovation linked networking: Relations to health and social service enterprises' performance in Finland. *Innovation and Development*, 5(1), 93-111. <http://dx.doi.org/10.1080/2157930X.2014.994261>.
- Llerena, P., & Oltra, V. (2002). Diversity of innovative strategy as a source of technological performance. *Structural Change and Economic Dynamics*, 13(2), 179–201. [http://dx.doi.org/10.1016/S0954-349X\(01\)00036-4](http://dx.doi.org/10.1016/S0954-349X(01)00036-4).
- Lukovszki, L., Rideg, A., & Sipos, N. (2020). Resource-based view of innovation activity in SMEs: An empirical analysis based on the global competitiveness project. *Competitiveness Review: An International Business Journal*, 31(3), 513-541. <http://dx.doi.org/10.1108/CR-01-2020-0018>.
- Lumpkin, G. T., & Dess, G. G. (2001). Linking two dimensions of entrepreneurial orientation to firm performance: The moderating role of environment and industry life cycle. *Journal of Business Venturing*, 16(5), 429-451.
- Lööf, H., & Heshmati, A. (2006). On the relationship between innovation and performance: A sensitivity analysis. *Economics of Innovation and New Technology*, 15(4-5), 317-344. <http://dx.doi.org/10.1080/10438590500512810>.
- Maldonado-Guzmán, G., Garza-Reyes, J. A., Pinzón-Castro, S. Y., & Kumar, V. (2019). Innovation capabilities and performance: Are they truly linked in SMEs?. *International Journal of Innovation Science*, 11(1), 1757-2223. <http://dx.doi.org/10.1108/IJIS-12-2017-0139>.
- Malerba, F. (1992). Learning by firms and incremental technical change. *The Economic Journal*, 102(413), 845–859. <http://dx.doi.org/10.2307/2234581>.
- Mansury, M. A., & Love, J. H. (2008). Innovation, productivity and growth in US business services: A firm-level analysis. *Technovation*, 28(1–2), 52–62. <http://dx.doi.org/10.1016/j.technovation.2007.06.002>.
- March J.G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71–87. <http://dx.doi.org/10.1287/orsc.2.1.71>.
- De Martino, M., & Magnotti, F. (2018). The innovation capacity of small food firms in Italy. *European Journal of Innovation Management*. 21(3), 362-383. <http://dx.doi.org/10.1108/EJIM-04-2017-0041>.
- Mejia, A., & Arias-Perez, J. (2017). Approach to differences in product and process innovation capabilities and financial performance in manufacturing companies. *Revista ESPACIOS*, 38(04). <https://www.revistaespacios.com/a17v38n04/17380412.html>
- Miles, I., Kastrinos, N., Flanagan, K., Bilderbeek, R., Den Hertog, P., Huntink, W., & Bouman, M. (1995). Knowledge-intensive business services: Their role as users, carriers and sources of innovation. Retrieved from https://www.research.manchester.ac.uk/portal/files/32800224/FULL_TEXT.PDF

- Mole, K., North, D., & Baldock, R. (2017). Which SMEs seek external support? Business characteristics, management behaviour and external influences in a contingency approach. *Environment and Planning C: Politics and Space*, 35(3), 476-499. <http://dx.doi.org/10.1177/0263774X16665362>.
- Muller, E., & Zenker, A. (2001). Business services as actors of knowledge transformation: The role of KIBS in regional and national innovation systems. *Research Policy*, 30(9), 1501-1516. [http://dx.doi.org/10.1016/S0048-7333\(01\)00164-0](http://dx.doi.org/10.1016/S0048-7333(01)00164-0).
- Negassi, S., Lhuillery, S., Sattin, J. F., Hung, T. Y., & Pratlong, F. (2019). Does the relationship between innovation and competition vary across industries? Comparison of public and private research enterprises. *Economics of Innovation and New Technology*, 28(5), 465-482. <http://dx.doi.org/10.1080/10438599.2018.1527552>.
- Nieto, M. J., & Santamaría, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation*, 27(6-7), 367-377. <http://dx.doi.org/10.1016/j.technovation.2006.10.001>.
- Nunally, J. (1978). *Psychometric Theory*. New York, NY: McGraw-Hill.
- O' Cass, A., & Sok, P. (2014). The role of intellectual resources, product innovation capability, reputational resources and marketing capability combinations in firm growth. *International Small Business Journal*, 32(8), 996-1018. <http://dx.doi.org/10.1177/0266242613480225>.
- OECD. (1997). *Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*. 2nd edition. Paris: OECD.
- OECD. (2005). *The Measurement of Scientific and Technological Activities: Guidelines for Collecting and Interpreting Innovation Data, Oslo Manual*, 3rd ed. Paris: OECD.
- OECD/Eurostat. (2018). The measurement of scientific, technological and innovation activities: Guidelines for collecting, reporting and using data for innovation, Oslo Manual 2018, 4th ed. Paris/Eurostat, Luxembourg: OECD Publishing. <https://doi.org/10.1787/9789264304604-en>.
- Official Statistics of Finland (OSF). (2020). Innovaatiotoiminta 2018. Innovation. Helsinki: Statistics Finland. Tiede, teknologia ja tietoyhteiskunta 2020. Part of Eurostat Community Innovation Survey (CIS). Retrieved from http://www.stat.fi/til/inn/index_en.html.
- Official Statistics of Finland (OSF). (2021). Structural business and financial statement statistics. Helsinki: Statistics Finland. Retrieved from http://www.stat.fi/til/yrti/meta_en.html.
- Olmos-Peñuela, J., García-Granero, A., Castro-Martínez, E., & D'Este, P. (2017). Strengthening SMEs' innovation culture through collaborations with public research organizations. Do all firms benefit equally?. *European Planning Studies*, 25(11), 2001-2020. <http://dx.doi.org/10.1080/09654313.2017.1279592>.
- Park, Y., Shin, J., & Kim, T. (2010). Firm size, age, industrial networking, and growth: A case of the Korean manufacturing industry. *Small Business*

- Economics*, 35(2), 153–168. <http://dx.doi.org/10.1007/s11187-009-9177-7>.
- Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, 13(6), 343–373. [http://dx.doi.org/10.1016/0048-7333\(84\)90018-0](http://dx.doi.org/10.1016/0048-7333(84)90018-0)
- Peeters, C., & van Pottelsberghe de la Potterie, B. (2006). Innovation strategy and the patenting behaviour of firms. *Journal of Evolutionary Economics*, 16(1-2), 109–135.
- Penrose, E. (1959). *The Theory of the Growth of the Firm*. New York, NY: John Wiley.
- Petrou, A., & Daskalopoulou (2013). Social capital and innovation in service sector. *European Journal of Innovation Management*, 16(1), 50-69. <http://dx.doi.org/10.1108/14601061311292850>.
- Phillips R. A. (2003). *Stakeholder Theory and Organizational Ethics*. San Francisco, CA.: Berrett-Koehler.
- Pollack, J. M., Barr, S., & Hanson, S. (2017). New venture creation as establishing stakeholder relationships: A trust-based perspective. *Journal of Business Venturing Insights*, 7, 15-20. <http://dx.doi.org/10.1016/j.jbvi.2016.12.003>.
- Prahalad, C. K., & Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 68(May-June), 79-91.
- Prajogo, D. I. (2006). The relationship between innovation and business performance—a comparative study between manufacturing and service firms. *Knowledge and Process Management, special issue: Continuous Innovation, Performance and Knowledge Management*, 13(3), 218–225. <http://dx.doi.org/10.1002/kpm.259>.
- Rigtering, J. C., Kraus, S., Eggers, F., & Jensen, S. H. (2014). A comparative analysis of the entrepreneurial orientation/growth relationship in service firms and manufacturing firms. *The Service Industries Journal*, 34(4), 275-294. <http://dx.doi.org/10.1080/02642069.2013.778978>.
- Rodriguez, M., Doloreux, D. & Shearmur, R. (2017). Variety in external knowledge sourcing and innovation novelty: Evidence from the KIBS sector in Spain. *Technovation*, 68(December), 35-43. <http://dx.doi.org/10.1016/j.technovation.2017.06.003>.
- Rogers, M. (2004). Networks, firm size and innovation. *Small Business Economics*, 22(2), 141–153. <http://dx.doi.org/10.1023/B:SBEJ.0000014451.99047.69>.
- Rosenzweig, S. (2017). The effects of diversified technology and country knowledge on the impact of technological innovation. *The Journal of Technology Transfer*, 42(3), 564-584. <http://dx.doi.org/10.1007/s10961-016-9492-5>.
- Saastamoinen, J., Reijonen, H., & Tammi, T. (2018). Should SMEs pursue public procurement to improve innovative performance?. *Technovation*, 69, 2-14. <http://dx.doi.org/10.1016/j.technovation.2017.10.003>.

- Santoro, G., Vrontis, D., Thrassou, A., & Dezi, L. (2018). The Internet of Things: Building a knowledge management system for open innovation and knowledge management capacity. *Technological Forecasting and Social Change, 136*, 347-354. <http://dx.doi.org/10.1016/j.techfore.2017.02.034>.
- Saunila, M. (2016). Performance measurement approach for innovation capability in SMEs. *International Journal of Productivity and Performance Management, 65*(2), 162-176. <http://dx.doi.org/10.1108/IJPPM-08-2014-0123>.
- Saunila, M. (2020). Innovation capability in SMEs: A systematic review of the literature. *Journal of Innovation & Knowledge, 5*(4), 260-265. <http://dx.doi.org/10.1016/j.jik.2019.11.002>.
- Sawang, S., & Unsworth, K. (2011). Why adopt now? Multiple case studies and survey studies comparing small, medium and large firms. *Technovation, 31*(10), 554-559. <http://dx.doi.org/10.1016/j.technovation.2011.06.002>.
- Schumpeter, J.A. (1939) *Business Cycles*. Philadelphia: Porcupine Press.
- Segarra, A., & Teruel, M. (2014). High-growth firms and innovation: An empirical analysis for Spanish firms. *Small Business Economics, 43*(4), 805–821. <http://dx.doi.org/10.1007/s11187-014-9563-7>.
- Shane, S. (2003). *A General Theory of Entrepreneurship, the Individual-Opportunity Nexus*. Massachusetts: Edward Elgar Publishing, Inc.
- Shearmur, R., & Doloreux, D. (2019). KIBS as both innovators and knowledge intermediaries in the innovation process: Intermediation as a contingent role. *Papers in Regional Science, 98*(December), 191-209. <http://dx.doi.org/10.1111/pirs.12354>.
- Statistics Finland. (2014). *Structural Business and Financial Statement Statistics*. Helsinki. Retrieved from https://www.stat.fi/til/yrti/tup_en.html
- Storey, D. (1994). *Understanding the Small Business Sector*. London: Routledge.
- Tang, Z., & Tang, J. (2012). Stakeholder–firm power difference, stakeholders' CSR orientation, and SMEs' environmental performance in China. *Journal of Business Venturing, 27*(4), 436-455. <http://dx.doi.org/10.1016/j.jbusvent.2011.11.007>.
- Tang, J., Tang, Z., Marino, L. D., Zhang, Y., & Li Q. (2008). Exploring an inverted u-shape relationship between entrepreneurial orientation and performance in Chinese Ventures. *Entrepreneurship Theory and Practice, 32*(1), 219-239. <http://dx.doi.org/10.1111/j.1540-6520.2007.00223.x>.
- Tansey, R., White, M., Long, R. G., & Smith, M. (1996). A comparison of loglinear modeling and logistic regression in management research. *Journal of Management, 22*(2), 339-358. <http://dx.doi.org/10.1177/014920639602200207>.
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2*, 53-55. <http://dx.doi.org/10.5116/ijme.4dfb.8dfd>.

- Tether, B. S. (2002). Who co-operates for innovation, and why: An empirical analysis. *Research Policy*, 31(6), 947-967.
- Tether, B. S. (2005). Do services innovate (differently)? Insights from the European Innobarometer Survey. *Industry and Innovation*, 12(2), 153–184. <http://dx.doi.org/10.1080/13662710500087891>.
- Trott, P. (2002). *Innovation Management and New Product Development*, 2nd ed. Essex: Pearson Education.
- Tödtling, F., & Kaufmann, A. (2001). The role of the region for innovation activities of SMEs. *European Urban and Regional Studies*, 8(3), 203-15. <http://dx.doi.org/10.1177/096977640100800303>.
- Tödtling, F., Lehner, P., & Kaufmann, A. (2009). Do different types of innovation rely on specific kinds of knowledge interactions?. *Technovation*, 29(1), 59-71. <http://dx.doi.org/10.1016/j.technovation.2008.05.002>.
- Van Dijk, B., Hertog, R., Menkveld, B., & Thurik, R. (1997). Some new evidence on the determinants of large and small-firm innovation. *Small Business Economics*, 9(4), 335–343.
- Vaona, A., & Pianta, M. (2008). Firm size and innovation in European manufacturing. *Small Business Economics*, 30(3), 283–299. <http://dx.doi.org/10.1007/s11187-006-9043-9>.
- Varis, M., & Littunen H. (2010). Types of innovation, sources of information and performance in entrepreneurial SMEs. *European Journal of Innovation Management*, 13(2), 128-154. <http://dx.doi.org/10.1108/14601061011040221>.
- Vedung, E. (1998). Policy instruments: typologies and theories. In M.L. Bemelmans-Videc, R.C. Rist, & E. Vedung (Eds.), *Carrots, Sticks, and Sermons: Policy Instruments and Their Evaluation* (pp. 21-58). London: Routledge.
- Vega-Jurado, J., Gutiérrez-Gracia A., Fernández-de-Lucio, I., & Manjarrés-Henríquez, L. (2008). The effect of external and internal factors on firms' product innovation. *Research Policy*, 37(4), 616–632. <http://dx.doi.org/10.1016/j.respol.2008.01.001>.
- Vos, J-P. (2005). Developing strategic self-descriptions of SMEs. *Technovation*, 25(9), 989–999. <http://dx.doi.org/10.1016/j.technovation.2004.02.014>.
- Voudouris, I., Lioukas, S., Iatrelli, M., & Caloghirou, Y. (2012). Effectiveness of technology investment: Impact of internal technological capability, networking and investment's strategic importance. *Technovation*, 32(6), 400-414. <http://dx.doi.org/10.1016/j.technovation.2012.04.001>.
- Vrontis, D., Thrassou, A., Santoro, G., & Papa, A. (2017). Ambidexterity, external knowledge and performance in knowledge-intensive firms. *The Journal of Technology Transfer*, 42(2), 374-388. <http://dx.doi.org/10.1007/s10961-016-9502-7>.
- Walsh, S. T., & Linton, J. D. (2001). The competence pyramid: A framework for identifying and analysing firm and industry competence. *Technology Analysis & Strategic Management*, 13(2), 165-177. <http://dx.doi.org/10.1080/09537320124246>.

- Weerawardena, J., O’Cass, A., & Julian, C. (2006). Does industry matter? Examining the role of industry structure and organizational learning in innovation and brand performance. *Journal of Business Research*, 59(1), 37-45. <http://dx.doi.org/10.1016/j.jbusres.2005.02.004>.
- Wong, P. K., Ho, T.P., & Autio, E. (2005). Entrepreneurship, innovation and economic growth: Evidence from GEM data. *Small Business Economics*, 24(3), 335–350. <http://dx.doi.org/10.1007/s11187-005-2000-1>.
- Woschke, T. & Haase, H., & Kratzer, J. (2017). Resource scarcity in SMEs: Effects on incremental and radical innovations. *Management Research Review*, 40(2), 195-217. <http://dx.doi.org/10.1108/MRR-10-2015-0239>.
- Zahra, S. A. (1991). Predictors and financial outcomes of corporate entrepreneurship: An exploratory study. *Journal of Business Venturing*, 6(4), 259-285. [http://dx.doi.org/10.1016/0883-9026\(91\)90019-A](http://dx.doi.org/10.1016/0883-9026(91)90019-A).
- Zahra, S. A., & Covin, J. G., (1993). Business strategy, technology policy and firm performance. *Strategic Management Journal*, 14(6), 451-478. <http://dx.doi.org/10.1002/smj.4250140605>.
- Zeng, S. X., Xie, X. M., & Tam, C. M. (2010). Relationship between cooperation networks and innovation performance of SMEs. *Technovation*, 30(3), 181-194. <http://dx.doi.org/10.1016/j.technovation.2009.08.003>.

Appendices

Appendix 1. KIBS sector includes

- Computer and related activities
- Research and development
- Legal, accounting, book-keeping and auditing activities; tax consultancy; debt collecting
- Market research and public opinion polling; advertising; trade fair and product demonstration activities
- Architectural and engineering activities and related technical consultancy; technical testing and analysis; industrial design
- Business and management consultancy activities; labour recruitment and provision of personnel

Appendix 2. Correlations

	Internal	Diffext	Pubsupp	Network	Size	Product	Process	Marketing
Internal	1							
Diffext	0.521**	1						
Pubsupp	0.426**	0.562**	1					
Network	0.492**	0.572**	0.516**	1				
Size	0.371**	0.220**	0.330**	0.224**	1			
Product	0.214**	0.277**	0.153**	0.159**	0.189**	1		

	Internal	Diffext	Pubsupp	Network	Size	Product	Process	Marketing
Process	0.228**	0.285**	0.221**	0.177**	0.254**	0.425**	1	
Marketing	0.243**	0.283**	0.209**	0.208**	0.178**	0.337**	0.154**	1
Organizational	0.369**	0.250**	0.283**	0.200**	0.550**	0.251**	0.272**	0.336**

Note: Correlation is significant at the 0.01 level (2-tailed). **, Correlation is significant at the 0.05 level (2-tailed).

Abstrakt

CEL: Celem artykułu jest analiza znaczenia zarówno wewnętrznych zdolności (zasobów), jak i zewnętrznych źródeł informacji we wdrażaniu innowacji produktowych, procesowych, marketingowych i organizacyjnych mających na celu maksymalizację przewagi konkurencyjnej firmy oraz tworzenie wartości dla interesariuszy. Ponadto w szczególności badamy rolę organizacji publicznych, sieci biznesowych, wielkości firmy i sektora przemysłu w pojawianiu się różnego rodzaju innowacji produktowych, procesowych, marketingowych i organizacyjnych. Badania oparto na typologii innowacji (produktowej, procesowej, marketingowej i organizacyjnej) przyjętej przez OECD. **METODYKA:** Artykuł opiera się na danych z 389 MŚP zlokalizowanych w Finlandii i opisuje opracowanie modelu do testowania czynników zwiększających innowacyjność MŚP. Jako metodologię zastosowano model regresji logistycznej. **WYNIKI:** Wyniki pokazują, że tworzenie nowych produktów, procesów i innowacji marketingowych jest powiązane z różnymi zewnętrznymi źródłami informacji, takimi jak targi, media i internet. Ponadto związek między wewnętrznymi zdolnościami, takimi jak know-how firmy, zwiększa innowacyjność marketingową i organizacyjną MŚP. Nasze wyniki wykazały, że tworzenie innowacji produktowych jest pozytywnie powiązane z produkcją. Ponadto stwierdzamy, że tworzenie nowych procesów i innowacji organizacyjnych jest związane z wielkością firmy, tak iż firmy zatrudniające mniej niż 20 pracowników (firmy najmniejsze) były skoncentrowane wśród nieinnowatorów, a firmy zatrudniające więcej niż 20 pracowników były skoncentrowane wśród innowatorów. **IMPLIKACJE DLA TEORII I PRAKTYKI:** Wkładem naszego badania jest przeanalizowanie, w jakim stopniu różne rodzaje innowacji opierają się na konkretnych źródłach informacji. Niniejsze badanie zawiera również sugestie dla praktyków i decydentów. Wbrew oczekiwaniom dotyczącym naszych wyników organizacje wsparcia publicznego nie były statystycznie istotne w żadnym modelu innowacji. Dlatego organizacje wsparcia publicznego powinny opracować lepsze mechanizmy znajdowania MŚP z silną motywacją do opracowywania nowych produktów i możliwości rynkowych. **ORYGINALNOŚĆ I WARTOŚĆ:** Ten artykuł przedstawia nowy i aktualny punkt widzenia dla literatury, badając możliwe czynniki wyjaśniające wzrost prawdopodobieństwa wdrożenia przez MŚP innowacji produktowych, procesowych, marketingowych i organizacyjnych. Nasze badanie dostarcza wyczerpujących informacji na temat tego, w jaki sposób różni interesariusze przyczyniają się do powstawania innowacji w MŚP. **Słowa kluczowe:** MŚP, innowacyjność, możliwości wewnętrzne, zewnętrzne źródła informacji, interesariusze, sektor przemysłu, wielkość firmy

Biographical notes

Hannu Littunen, Ph.D., is an Emeritus Professor of entrepreneurship and regional development. After graduating from the University of Jyväskylä, he has been a Researcher at the University of Jyväskylä, School of Business and Economics, Centre for Economic Research, Finland (1981-2002), and a Professor of entrepreneurship and regional development at the University of Eastern Finland (2003-2015). Research conducted by Hannu Littunen has mainly focused on factors relating to new firms' innovation and success, entrepreneurship and regional development. He has published in journals such as *European Journal of Innovation Management*, *Innovation and Development*, *International Journal of Entrepreneurial Behaviour and Research*, *Small Business Economics*, *Entrepreneurship and Regional Development*, *Family Business Review* and others.

Timo Tohmo, Ph.D., is a Senior Researcher in Economics at the Jyväskylä University School of Business and Economics, JSBE, Finland. His research includes factors relating to firms' innovation and success, regional economics, cultural economics, tourism economics, and economic impact studies. He has also been interested in the intersectoral mobility of Finnish academics.

Esa Storhammar, Ph.D., is a Senior Researcher in Management and Leadership at the Jyväskylä University School of Business and Economics, Finland. His research interests are innovation management, SMEs, entrepreneurship, and economic impact studies.

Conflicts of interest

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Tritschler, Jonas – VICTORIA | International University of Applied Sciences, Germany

Ujwary-Gil, Anna – Institute of Economics, Polish Academy of Sciences, Poland

Varela Vazquez, Pedro - University of Santiago de Compostela, Spain.

van der Linden, Rene W.H – The Hague University of Applied Sciences, Hague, The Netherlands

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