



Entrepreneurs as strategic transformation managers: Exploring micro-foundations of digital transformation in small and medium internationalisers

Vahid Jafari-Sadeghi^{a,*}, Hannan Amoozad Mahdiraji^b, Gazi Mahabubul Alam^c, Alberto Mazzoleni^d

^a Aston Business School, Aston University, Birmingham, United Kingdom

^b Leicester School of Business, University of Leicester, Leicester, United Kingdom

^c Department of Foundation of Education, Faculty of Educational Studies, University of Putra Malaysia, Selangor, Malaysia

^d Department of Economic and Management, University of Brescia, Brescia, Italy

ARTICLE INFO

Keywords:

Digital transformation
International entrepreneurs
Micro-foundations
Small internationalisers
Theory of Planned Behaviour
SMEs

ABSTRACT

This paper is set to explore the role of individual-level behaviours and actions in the digital transformation of international SMEs. This is particularly important since little is known regarding the extent to which entrepreneurs and decision-makers manage the digitalisation process. Thus, building on the theory of planned behaviour, this research focuses on individual-level micro-foundations in the digital transformation of small and medium internationalisers. The paper benefits from a mixed-method synthesis. First, through a systematic review of literature, we identified twenty-seven factors in four inclusive categories. Then, they have been narrowed down to the top seven individual-level micro-foundations, using Intuitionistic Fuzzy Delphi based on Normalised Hamming Distance. Subsequently, Intuitionistic Fuzzy Decision-Making Trial and Evaluation Laboratory analysis is applied to disentangle the causality and effectuality as well as conceptual framework to depict their interrelationships. Our findings contribute to the digital transformation research by developing six prepositions that explore the relationships between SMEs' micro-foundations at the individual level.

1. Introduction

The wave of digitalisation and emergence of game-changing technologies such as artificial intelligence, big data, 3D printing, the internet of things, and nanotechnology has been transforming the competitive landscape of all industries (Denicolai et al., 2021; Strange & Zucchella, 2017). Indeed, the technological revolution (so-called the fourth industrial revolution or industry 4.0) has challenged firms from two perspectives. First, the disruptive digital business offerings by new entrants (e.g., new streaming subscriptions against traditional media providers) have changed the behaviour and the expectations of customers (Lähteenmäki et al., 2022; Wrede et al., 2020). Second, advanced technologies and innovative initiatives significantly challenged firms to not only change the way they formulate their offerings but also manage how their employees work in and react to the new digital-oriented workplace (Favoretto et al., 2022; Selimović et al., 2021). This led to

a dramatic wave of shifting from traditional to technology-centred business models over the last two decades (Hinterhuber & Nilles, 2021; Kotarba, 2018). In this vein, Verhoef et al. (2021, pp. 1) define firms' digital transformation as 'a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm'. That is, literature (e.g., Li, 2020; Nambisan & Luo, 2021) highlights that digital transformation is crucial for firms to gain a competitive advantage and remain successful in national and international markets.

Researchers have explored digital transformation from different perspectives. For instance, Dittes and Smolnik (2019) explain the extent to which firms take advantage of social media platforms to transform into the digital work environment and increase the performance of their employees. In another vein, Nasiri et al. (2020) highlight that supply chain firms enhance their digital transformation journey with smart technologies to achieve performance. However, digital transformation

* Corresponding author.

E-mail addresses: v.jafari-sadeghi@aston.ac.uk (V. Jafari-Sadeghi), ham26@leicester.ac.uk (H. Amoozad Mahdiraji), gazi.mahabubul@upm.edu.my (G.M. Alam), alberto.mazzoleni@unibs.it (A. Mazzoleni).

<https://doi.org/10.1016/j.jbusres.2022.08.051>

Received 13 January 2022; Received in revised form 22 August 2022; Accepted 25 August 2022

Available online 12 September 2022

0148-2963/© 2022 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

research suffers from various gaps and shortcomings. Accordingly, [Cenamor et al. \(2019\)](#) argue that prior studies have predominantly disentangled the extent to which large firms adopt digital technologies. When it comes to small and medium enterprises (SMEs), literature has an extensive focus on high-tech or digital start-ups irrespective of the scope of their operations (e.g., [Ghezzi & Cavallo, 2020](#)). However, there is limited research that explores the antecedents of digital transformation in non-digital and international SMEs. Although the adaptation of digital-oriented strategies is an intricate process, this investigation is particularly crucial for small and medium internationalisers since they can overcome their liability of newness and smallness and compete with larger counterparts ([Hagen et al., 2019](#)). Digital transformation has been also considered a strategic decision of de-internationalised SMEs which can assist them to develop new digital capabilities and renew their business models as necessary for their subsequent re-internationalisation ([Yu et al., 2022](#)).

Nonetheless, extant research has disentangled the dimensions of digital transformation at different levels: some studies build on country level characteristics to explore the role of country infrastructure and technological readiness (e.g., [Jafari-Sadeghi et al., 2021](#)) while others focused on firm-specific capabilities (e.g., [Warner & Wäger, 2019](#)). However, there is scant research that sheds light on the role of micro-foundations in the digital transformation of international SMEs. Defined as ‘the underlying actions on individual and group levels that shape strategy and organisation’ ([Bojesson & Fundin, 2021](#)), digital transformation literature has employed micro-foundations to underly the role of the human dimensions ([Manfreda & Štemberger, 2018](#); [Tabrizi et al., 2019](#)). Indeed, it has been argued that the development of human resource management and change management capabilities is determinantal ([Sousa & Rocha, 2019](#); [Thite, 2022](#)) since managers and employees can accept or reject new digital strategies depending on their impact on their working circumstances ([Van Steenberghe et al., 2018](#); [Yeow et al., 2018](#)). When it comes to small and medium internationalisers, micro-foundations are highly linked to the actions and behaviour of senior managers (e.g., CEO/entrepreneur) who are often the central decision-makers at the individual level ([Jafari-Sadeghi, Amoozad Mahdiraji, et al., 2021](#)). Notwithstanding the decisive role of senior managers in international SMEs, there has been limited empirical understanding of behaviours and actions toward the digital transformation process.

Accordingly, this research builds on the underpins of the theory of planned behaviour ([Ajzen, 1991](#)) and aims to explore and examine the key managerial micro-foundations that constitute the successful digital transformation of small and medium internationalisers. The relative research questions are: “RQ₁. what are the most pertinent managerial behaviours and actions towards for digital transformation of international SMEs?” and “RQ₂. what are the (cause vs effect) nature and the interrelationship among identified micro-foundations?” To address these research questions, this paper employs a mixed method consisting of a systematic literature review (SLR) and a multi-layer decision-making approach by considering intuitionistic fuzzy sets (IFs). Initially, the list of key managerial behaviours toward successful digital transformation mentioned by other scholars has been extracted from the SLR. Then, a Delphi method has been performed amongst SME entrepreneurs to screen the prominent factors. To consider the uncertainty of the environment in the Delphi stage, IFs have been used in this regard. After, the causal relationship amongst the screened key managerial behaviours toward successful digital transformation has been analysed and designed via an intuitionistic fuzzy DEMATEL approach. Eventually, an initial conceptual model revealing the relationship amongst the critical factors has been illustrated.

This paper provides various contributions to the literature. First, we address largely ignored individual-level exploration of digital transformation. We discuss that international entrepreneurs play the role of strategic transformation managers who can drive SMEs towards successful digitalisation. Second, the contribution of this research offers

novel measures that expand the antecedents of the theory of planned behaviour by the development of seven individual-level micro-foundations pertinent to digital transformation. Third, our findings contribute to the conceptualisation of digital transformation in international entrepreneurship research by developing six prepositions and proposing a conceptual model that reveals the relationship between behaviours and actions of international entrepreneurs during the transformation process.

The rest of the paper is structured as follows. The next section explores the micro-foundations that contribute to the digital transformation of international SMEs. This is followed by a discussion regarding the details of the employed method for the data collection and analysis. Further, we discuss the main findings of this research and argue our subsequent theoretical contributions and practical implications. Eventually, the concluding section summarises the research, discusses the research limitation and proposes future lines of studies.

1.1. Micro-foundations toward digital transformation

In the business literature, the concept of digital transformation has been used to highlight the disruptive and transformational impacts of digitalisation and advanced technologies on human life, and business activities in particular ([Matt et al., 2016](#); [Nambisan, 2017](#)). In this vein, [Warner and Wäger \(2019\)](#) argue that the term digital transformation is not necessarily dedicated to high tech and innovative companies, but rather includes firms of any size and operating in any industry. For instance, small and entrepreneurial firms can rely on advanced technologies to explore and exploit novel opportunities either within or outside of national boundaries. In the service sector, [Mimoun et al. \(2017\)](#) highlight that although it is risky and expensive, technological innovation can significantly contribute to market expansion. It is particularly pertinent to international operations of firms as digitalisation and internet-based platforms transform the labour divisions and work patterns to optimise the cross-border value creation processes. That is, [Castellani et al. \(2013\)](#) argue that ‘digital and global transformations tend to overlap and to reinforce one another, significantly changing the geography of innovation compared to the past’.

Extant research highlights that digital transformation strategies have been undertaken by firms due to several reasons (e.g., [Matt et al., 2015](#); [Vial, 2019](#)). They include firm-level factors including dynamic capabilities and the ability of firms to adopt new technologies in their operations ([Rezaei, Jafari-Sadeghi, Cao, & Amoozad Mahdiraji, 2021](#); [Hamburg, 2019](#)) to the corporate-level external determinants such as the intensity of competition in the market ([Scott, 2007](#)) or even country-level factors like the availability of required infrastructures ([Jafari-Sadeghi, Garcia-Perez, et al., 2021](#)). However, literature has shown an increasing interest among scholars to explore micro-level studies on technological innovation and digitalisation ([Albats et al., 2018](#); [Felin et al., 2012](#)). Studies on micro-foundations are then designed to explore the role of cultural differences among individuals ([Ferraris et al., 2022](#); [Lin & Berg, 2001](#)), their collaborations ([Albats et al., 2018](#); [O’Kane et al., 2017](#)) as well as communications and motivations ([Barnes et al., 2002](#); [Plewa et al., 2013](#)). Notwithstanding, the micro perspectives of digital transformation and technological innovation in small and medium internationalisers yet remained under-explored.

According to [Scuotto et al. \(2020\)](#), micro-foundations strive to understand the crucial role of collective and individual behaviour of actors involved in the process of digitalisation and technology transfer. In this regard, [Tabrizi et al. \(2019\)](#) shed the light on human factors and highlight that the reaction of employees can be determinantal. Whether consciously or not, they might resist the technological changes if they feel that digitalisation will threaten their jobs, hence digital transformation can be an ineffective strategy (*idem*). On the other hand, managers can translate the transformation process as an opportunity to develop the capabilities and skills of human resources alongside with the needs of highly competitive international markets. Therefore, we build

on the wealth of theory of planned behaviour to predict and explain the micro-foundations digital transformation in international SMEs.

The theory of planned behaviour is introduced by Ajzen (1991) to explain the psychological and social dimensions of an individual's behaviour. Stressing the role of cognitive capacity, the theory highlights that individuals decide to engage in behaviour based on their positive or negative perceptions (Ajzen, 1991; Armitage & Conner, 2001). Indeed, the theory of planned behaviour leads to a comprehensive framework that constitutes the formation of intention toward a particular behaviour (Mohammed et al., 2021; Verma & Chandra, 2018). It consists of three elements including perceived behavioural control by individuals, their attitude towards the behaviour as well as subjective norms (Ajzen, 2015; M. Wu et al., 2020). As such, this theory has been chosen as the theoretical background of this research since it provides a pertinent behavioural perspective of digital transformation. Therefore, we explore the impact of entrepreneurs' behaviour in four different dimensions, each refers to a particular capability of international entrepreneurs which impacts the successful digital transformation of small and medium internationalisers.

To begin with, one of the most important factors that drive small firms to transform to digital-centred operations is the technology management capacities of their decision-makers. Referring to the role of technological capabilities, Bergek et al. (2008) highlight that firms can leverage heterogeneous but a wide range of technical resources related to information and knowledge, design, process and product to make positive changes and gain higher performance. However, Zawislak et al. (2012) argue that technological capabilities are not limited to technical mastery capabilities only, rather they refer to the broader firms' capacities to deploy and expand their core capabilities so that they can effectively adapt and combine various technological resources and mobilise them throughout the firm. In small firms, technological capacities are often tailored to the managerial attitude and capabilities toward the employment of the technologies (Camilleri, 2018; Elbeltagi et al., 2013). They can include the level of digital literacy among employees (and managers), providing transparent access to all digital platforms throughout the firm, or commitment towards connecting all remote, branch, and mobile offices to the central office for analytics, etc (e.g., Ferraris et al., 2019; Heavin & Power, 2018). That is, well developed technological capabilities among central decision-makers will lead SMEs to transform their business environment toward more technology-based operations, regardless of their size (micro vs small) or the age of business life (baby business, start-up, or established) (Jafari-Sadeghi, Amoozad Mahdiraji, Bresciani, & Pellicelli, 2021; Salisu & Abu Bakar, 2019; Wang, Lo, Zhang, & Xue, 2006).

Another crucial dimension for the SMEs' digital transformation at the individual level is associated with the knowledge management capabilities of central decision-makers. Knowledge management refers to the methodical practices that influence the creation, acquisition, sharing and managing the data, information, and knowledge to meet the organisational and individual objectives within the firms (Abubakar et al., 2019; Schumann & Tittmann, 2015; Rezaei et al., 2022). In this vein, the literature highlights that firms' ability to explore and exploit knowledge makes them more likely to become innovative and adopt new technologies (e.g., Asim & Sorooshian, 2019; Hervás-Oliver et al., 2021). Further, the transformation of the knowledge into specialised and valuable knowledge can assist firms to employ novel technologies and convert/expanding their processes and offerings (Choy et al., 2006; Mardani et al., 2018). From the technological perspective, knowledge management capabilities are associated with the practices, processes, and systems employed to store, maintain and analyse knowledge (Hock-Doepgen et al., 2021; Lee & Choi, 2003), which are necessary to gain competitive advantages (Crupi et al., 2020; Del Giudice et al., 2015). At SMEs, knowledge management can be significantly linked with the behaviour of managers such as their attitude towards the information about technological changes in the marketplace, the tendency on working in partnership with international stakeholders towards

technical knowledge acquisition, etc (Biancone et al., 2022; Darroch, 2005; Ferraris et al., 2019).

The other two individual-level micro-foundations of the digital transformation in SMEs refer to capabilities in regards to 'entrepreneurial and innovation' as well as 'leadership and management' skills. The former explains the extent to which entrepreneurial orientation encourages SME managers to develop various capabilities such as innovativeness, risk-taking and proactiveness (Covin & Miller, 2014; Wales et al., 2021) and gain competitive advantages from the digital transformation journey (Sousa & Rocha, 2019; Weber et al., 2022). For instance, innovative tendencies promote practices that constitute a significant change in the workplace as well as responsibilities (Croonen et al., 2016; Hughes et al., 2018). Similarly, the risk-taking characteristic of SMEs' top managers favours the digital transformation process by allowing the exchange of novel ideas and initiatives (Jiang et al., 2019; Porfirio et al., 2021) and reducing uncertainty in case of ambiguous digital strategy goals (Ritala et al., 2021). On the other hand, digital transformation processes are deemed to be an increasing challenge that requires high levels of leadership and management capabilities (Zeike et al., 2019). In this regard, Westerman et al. (2014) highlight that firms need to build high levels of leadership and management capabilities to successfully drive the process of digital transformation. In the context of digitalisation, leadership capabilities can be described as "leaders' ability to create a clear and meaningful vision for the digitalisation process and the capability to execute strategies to actualise it" (Larjo-vuori et al., 2016, pp. 1144). Such capabilities include (but are not limited to) techniques towards potentiating the employees' performance (Hosseinzadeh et al., 2022) by leveraging digitalisation, analytical skills and change management capabilities towards workforce optimisation, etc.

Therefore, this research builds on four inclusive dimensions of micro-foundations to explore digital transformation in small and medium internationalisers. They include 'technology management capacities', 'knowledge management capabilities', 'entrepreneurial and innovation capabilities' and 'leadership and management capabilities'.

2. Methodology

To analyse the key managerial micro-foundations nurturing digital transformation from the perspective of SMEs entrepreneurs, three research objectives were considered including (i) extracting the most relevant managerial micro-foundations, (ii) identifying the critical micro-foundations resulting in digital transformation in SMEs, and eventually, (iii) analysing the relationship amongst the micro-foundations and presenting a basic conceptual model from the entrepreneurs' point of view. To achieve these research objectives, several research methodologies are applied. However, considering (i) the qualitative type of key managerial micro-foundations, and (ii) the limitation to access numerical data, statistical-oriented methods are not applicable. Consequently, Multi-Criteria Decision-Making (MCDM) methods should be performed (Razavi Hajiagha et al., 2022). MCDM methods and models are usually employed to (i) identify and determine the importance/weights (e.g. Delphi Fuzzy, Best-Worst Method (BWM), etc.), (ii) analyse the relationship amongst the elements (e.g. DEMATEL, ISM, etc.), and (iii) evaluate the alternatives and determine their score (e.g. TOPSIS, SAW, etc.), (iv) satisfy multiple objectives in decision-making (MODM) (Jafari-Sadeghi et al., 2022). As the research objectives indicate, extracting the most relevant managerial micro-foundations, identifying the critical micro-foundations, and comprehending the relationship amongst the micro-foundations are investigated in this research. To this aim, a mixed methodology has been designed and scheduled including a systematic literature review (SLR), Delphi approach, and Decision-Making Trial and Evaluation Laboratory (DEMATEL) for each objective, relatively. On the other hand, as the managerial micro-foundations are mainly qualitative and difficult to measure via precise values and numbers, uncertainty approaches have

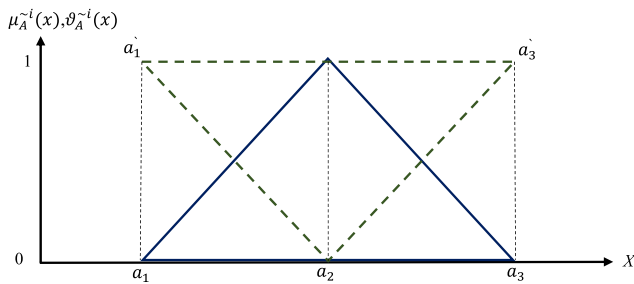


Fig. 1. Membership and non-membership functions for a TIFN.

been included in this research by the authors. As a result, instead of applying the Delphi method, a modified Intuitionistic Fuzzy Delphi (IFD) has been developed and instead of employing deterministic DEMATEL, an Intuitionistic Fuzzy version (IFDEMATEL) has been

designed. Before exploring the details of the designed methodology, some basics, definitions, and operators of IFs are presented. It is notable that, there are many approaches to uncertainty while using MCDM methods including Pythagorean Fuzzy, Fermatean Fuzzy, Hesitant Fuzzy, Intuitionistic Fuzzy, etc. Nonetheless, as in this research, the experience, knowledge, skills, etc. of the entrepreneurs were employed as the most valuable input, and IFs were applied by the authors to reflect the expert's opinion in a more realistic fashion.

Definition 1. Atanassov in 1988 coined a new format for fuzzy set known as intuitionistic fuzzy presented as $A = \{x, \mu_A(x), \theta_A(x)\}$. Where, (A) was an intuitionistic fuzzy set (IFS), x was a member, and $\mu_A(x)$ was the membership function of x (membership probability of x), and $\theta_A(x)$ was the non-membership function of x (non-membership degree of element x). Note that $\mu_A(x)$ and $\theta_A(x) \rightarrow [0,1]$ and $\mu_A(x) + \theta_A(x) \leq 1$. Furthermore, $\pi_A(x)$ presents the degree of hesitation or intuitionistic index of x where $\pi_A(x) = 1 - \mu_A(x) - \theta_A(x)$ (Hashemi et al., 2016).

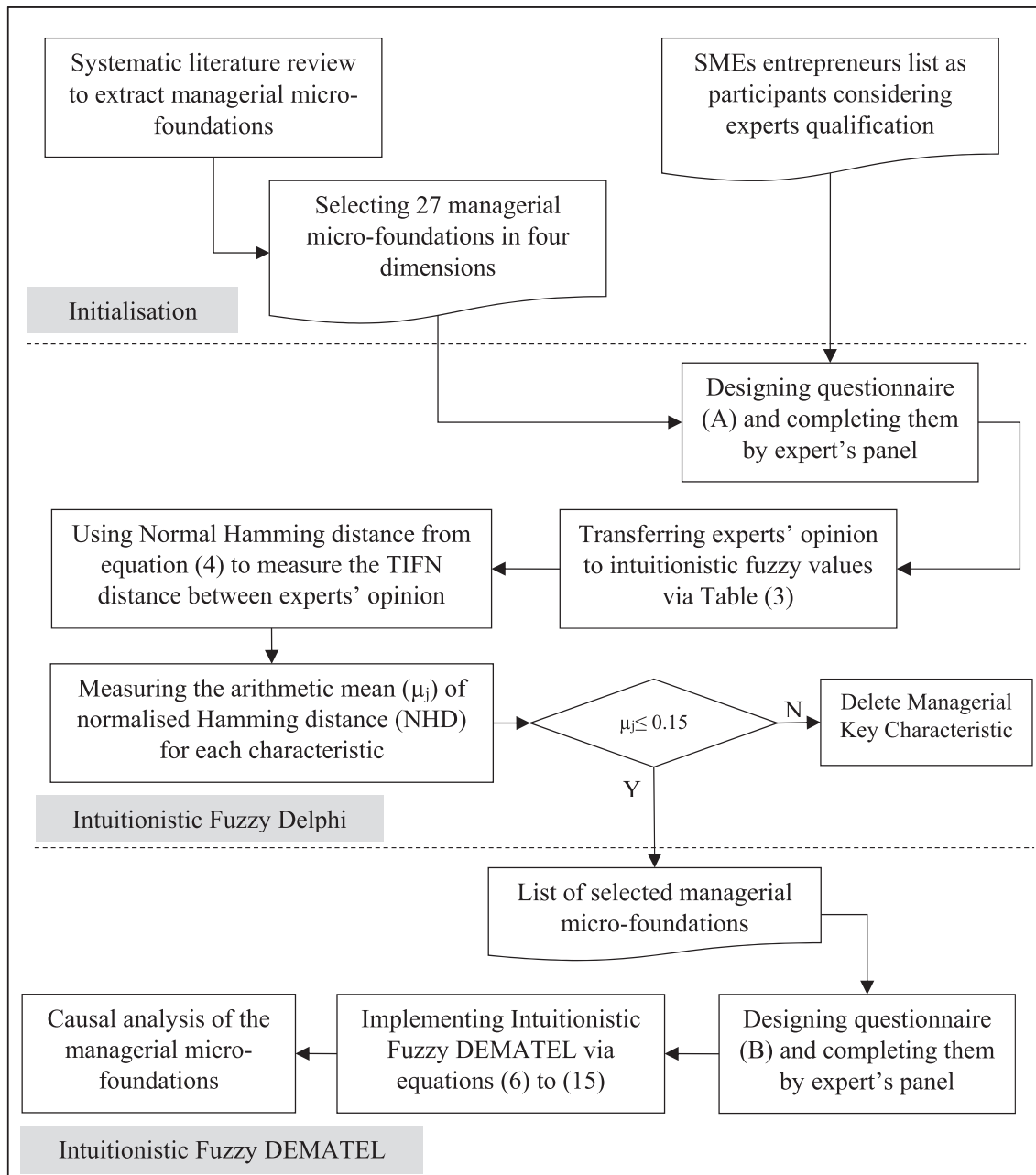


Fig. 2. Summary of the research procedure.

Table 1
Identified managerial micro-foundations toward digital transformation.

Category	Code	Managerial characteristic	Reference
Technology Management Capabilities	TMC ₁	Developing digital literacy to create their analytics	Ferraris et al. (2019)Byrd and Turner (2000) Salisu and Abu Bakar (2019)
	TMC ₂	Adapting technology at the workplace to meet a variety of needs during analytics tasks	
	TMC ₃	Commitment towards connecting all remote, branch, and mobile offices to the central office for analytics	
	TMC ₄	Utilising open system network mechanisms to boost analytics connectivity	
	TMC ₅	Providing transparent access to all digital platforms and applications	
Knowledge Management Capabilities	KMC ₁	Commitment towards well-developed financial reporting systems	Ferraris et al. (2019)Darroch (2005)
	KMC ₂	Being sensitive to information about technological changes in the marketplace	
	KMC ₃	Being sensitive to the science and technology profile of human capital	
	KMC ₄	Working in partnership with international stakeholders towards technical knowledge acquisition	
	KMC ₅	Obtaining information from specialised market surveys	
	KMC ₆	Using of specific techniques or technology to disseminate knowledge	
	KMC ₇	Commitment towards disseminating the latest (digital) knowledge at the workplace	
	KMC ₈	Capacity towards being responsive towards knowledge	
Entrepreneurial and Innovation Capabilities	EIC ₁	Willingness and capability to undertake risk	Sousa and Rocha (2019)Covin and Miller (2014)Ritala et al. (2021)
	EIC ₂	Capacity toward creativity and innovativeness	
	EIC ₃	Ability to explore and exploit new business opportunities	
	EIC ₄	Capacity toward resource management to address opportunities	
	EIC ₅	Ability to develop and/or create national and international network ties	
	EIC ₆	Capacity to develop novel opportunities for the colleagues through leveraging coaching and mentoring skills and other techniques	
Leadership and Management Capabilities	LMC ₁	Skills and ability for developing the employees' performance	Sousa and Rocha (2019)Zeike et al. (2019)
	LMC ₂	Capabilities and techniques towards potentiating the employees' performance	
	LMC ₃	Capacity to Integrate and manage the employees' cultural differences	
	LMC ₄	Decision-making and responsibility skills	
	LMC ₅	Analytical skills and change management capabilities towards workforce optimisation	
	LMC ₆	Communication capacities towards boosting the employees' commitment	
	LMC ₇	Ability to develop and manage strategic deals and alliances	
	LMC ₈	Ability to manage projects with high performance	

Definition 2. Intuitionistic fuzzy numbers (IFN) are classified into different versions, including triangular, trapezoidal, etc. (Hajiagha et al., 2015). Here, the authors have employed triangular intuitionistic fuzzy numbers (TIFN) for further process. A TIFN is an IFS in the set of real numbers (\mathbb{R}), with the membership and non-membership functions of $\mu_A^i(x)$ and $\vartheta_A^i(x)$, respectively and demonstrated as follows (Garg & Rani, 2021).

$$\mu_A^i(x) = \begin{cases} \frac{x - a_1}{a_2 - a_1} & a_1 \leq x \leq a_2 \\ \frac{a_3 - x}{a_3 - a_2} & a_2 \leq x \leq a_3 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

both less than 0.5 when $\mu_A^i(x) = \vartheta_A^i(x)$ for all \times elements of (\mathbb{R}) (Pathade et al., 2020). Consequently, a TIFN for A is presented as TIFN(A) = ($a_1, a_2, a_3; a_1^i, a_2^i, a_3^i$), where the first three values reveal the membership, and the later three illustrate the non-membership degrees. The schematic version of a TIFN has been designed as in Fig. 1 (Mahdiraji, Zavadskas, et al., 2020).

Definition 3. Assume two TIFNs as A and B with the membership and non-membership functions of TIFN(A) = ($[(a_1, a_2, a_3); \mu_A], [(a_1^i, a_2^i, a_3^i)]; \vartheta_A$) and TIFN(B) = ($[(b_1, b_2, b_3); \mu_B], [(b_1^i, b_2^i, b_3^i)]; \vartheta_B$). Considering the abovementioned definitions, the main four mathematical operators for TIFNs, are presented in equation (3) (Hashemi et al., 2016; Mahdiraji et al., 2021).

$$\begin{aligned} A + B &= ([[(a_1, a_2, a_3); \mu_A], [(a_1^i, a_2^i, a_3^i)]; \vartheta_A] + [[(b_1, b_2, b_3); \mu_B], [(b_1^i, b_2^i, b_3^i)]; \vartheta_B]) = [(a_1 + b_1, a_2 + b_2, a_3 + b_3); \min(\mu_A, \mu_B)], [([(a_1^i + b_1^i, a_2^i + b_2^i, a_3^i + b_3^i)]; \max(\vartheta_A, \vartheta_B))] \\ A - B &= ([[(a_1, a_2, a_3); \mu_A], [(a_1^i, a_2^i, a_3^i)]; \vartheta_A] - [[(b_1, b_2, b_3); \mu_B], [(b_1^i, b_2^i, b_3^i)]; \vartheta_B]) = [(a_1 - b_1, a_2 - b_2, a_3 + b_1); \min(\mu_A, \mu_B)], [([(a_1^i - b_1^i, a_2^i - b_2^i, a_3^i - b_1^i)]; \max(\vartheta_A, \vartheta_B))] \\ A \times B &= ([[(a_1, a_2, a_3); \mu_A], [(a_1^i, a_2^i, a_3^i)]; \vartheta_A] \times [[(b_1, b_2, b_3); \mu_B], [(b_1^i, b_2^i, b_3^i)]; \vartheta_B]) = [(a_1 \times b_1, a_2 \times b_2, a_3 \times b_3); \min(\mu_A, \mu_B)], [([(a_1^i \times b_1^i, a_2^i \times b_2^i, a_3^i \times b_3^i)]; \max(\vartheta_A, \vartheta_B))] \\ A \tilde{\wedge} B &= ([[(a_1, a_2, a_3); \mu_A], [(a_1^i, a_2^i, a_3^i)]; \vartheta_A] \tilde{\wedge} [[(b_1, b_2, b_3); \mu_B], [(b_1^i, b_2^i, b_3^i)]; \vartheta_B]) = [(a_1 \tilde{\wedge} b_1, a_2 \tilde{\wedge} b_2, a_3 \tilde{\wedge} b_1); \min(\mu_A, \mu_B)], [([(a_1^i \tilde{\wedge} b_1^i, a_2^i \tilde{\wedge} b_2^i, a_3^i \tilde{\wedge} b_1^i)]; \max(\vartheta_A, \vartheta_B))] \end{aligned} \quad (3)$$

$$\vartheta_A^i(x) = \begin{cases} \frac{a_2 - x}{a_2 - a_1} & a_1^i \leq x \leq a_2^i \\ \frac{x - a_2}{a_3 - a_2} & a_2^i \leq x \leq a_3^i \\ 1 & \text{otherwise} \end{cases} \quad (2)$$

Note that $a_1^i \leq a_1 \leq a_2 \leq a_3 \leq a_3^i$, and obviously $\mu_A^i(x)$ and $\vartheta_A^i(x)$ are

Considering the basics, definitions, and main operators of intuitionistic fuzzy numbers and specially TIFNs, the research methodology has been illustrated in Fig. 2. The details of each step have been elaborated after the figure.

Table 2
Experts' profile.

Expert No.	Gender	Age groups	Education	Area	Experience (yrs)
E01	M	30 s	PG	Industry Expert	5+
E02	M	30 s	PG	Industry Expert	10+
E03	M	40 s	DBA	Officials	15+
E04	M	50 s	DBA	Officials	30+
E05	F	30 s	MBA	Officials	5+
E06	F	50 s	PHD	Academician	20+
E07	M	40 s	MBA	Industry Expert	15+
E08	F	30 s	PG	Industry Expert	5+
E09	F	50 s	PHD	Academician	25+
E10	M	30 s	MBA	Officials	10+

2.1. Phase 1. Initialisation

To extract the most relevant managerial key micro-foundations, we have searched relevant keywords in popular databases including ScienceDirect, Scopus, Proquest, etc. As discussed in the literature review section, the most frequent and most cited key micro-foundations nurturing digital transformation were selected for further investigation in this manuscript. These micro-foundations (27) were classified into four categories/capabilities as previously discussed in Section 2. Table 1 presents micro-foundations toward SMEs' digital transformation.

After, the SME entrepreneurs based on their education, age, experience, accessibility, time for participation, expertise, etc. were selected and participated in this research. The country of origin for all experts in this research is limited to Iran as an emerging economy. This might impact the robustness of the results, which has been discussed in the limitation and future recommendation section. The expert profile is presented in Table 2.

The above experts participated in two rounds of this research. First, for selecting the most relevant managerial micro-foundations toward digital transformation by completing the IFD questionnaire (questionnaire A). Here, a briefing was set for the experts individually (e.g., face-to-face, Ms-Teams, Skype, etc.), and then the completed questionnaires were gathered from the SMEs entrepreneurs within the next two weeks after the briefing session. The SME entrepreneurs mentioned that nearly-two hours were required to complete Questionnaire A. Second, for extracting the causal relationship amongst the managerial micro-foundations nurturing digital transformation via questionnaire B. The same approach was adopted for briefing and gathering the completed questionnaires.

2.2. Phase 2. IFD

The IFD approach in this article has been designed by the authors, via a combination of intuitionistic operators and transforms. There are many limitations between classical Delphi and Fuzzy Delphi including time-consuming, requiring at least two rounds of data gathering, the possibility of change in participants in different rounds, etc. (Mahdiraji, Hafeez, et al., 2020). Moreover, the classical version of the Delphi method is not considering uncertainty in its analysis (Hajiagha et al., 2021). Thus, the authors have proposed a new version of IFD that has been designed and employed to extract and identify the most relevant managerial micro-foundations toward digital transformation in SMEs. The following steps have been applied in this regard.

2.3. Stage 1. Data gathering

First, the list of extracted managerial micro-foundations presented in Table 1, is used as an input for questionnaire A. In this questionnaire, the

Table 3
Linguistic terms and their TIFNs value (Guha & Chakraborty, 2010).

Linguistic term	TIFN value
Extremely Important	(0.9, 1, 1; 0.7, 0.2)
Very Important	(0.7, 0.9, 0.9; 0.7, 0.2)
Important	(0.5, 0.7, 0.7; 0.7, 0.2)
Moderately Important	(0.3, 0.5, 0.5; 0.7, 0.2)
Unimportant	(0.1, 0.3, 0.3; 0.7, 0.2)
Very Unimportant	(0, 0.1, 0.1; 0.7, 0.2)
Extremely Unimportant	(0, 0, 0; 0.7, 0.2)

SME entrepreneurs are asked to determine the importance of each managerial characteristic toward digital transformation. The experts are allowed to select the following linguistic terms to determine the importance of each managerial key characteristic. Table 3 presents the linguistic terms and also the intuitionistic fuzzy values for each term.

2.4. Stage 2. Selection

After all questionnaires (code A) were gathered, the normalised difference of TIFNs between two experts' opinions ($k \in L$) regarding each managerial characteristic (j) was measured via Hamming distance by formula 4 as follows (Fahmi et al., 2017). Assume that A and B are two TIFNs with the membership and non-membership functions of $TIFN(A) = [(a_1, a_2, a_3); \mu_A; \vartheta_A]$ and $TIFN(B) = [(b_1, b_2, b_3); \mu_B; \vartheta_B]$ (Liang et al., 2014).

$$d_j^{k,k+1}(\tilde{A}, \tilde{B}) = \frac{1}{6} (|(1 + \mu_A - \vartheta_A) \times a_1 - (1 + \mu_B - \vartheta_B) \times b_1| + |(1 + \mu_A - \vartheta_A) \times a_2 - (1 + \mu_B - \vartheta_B) \times b_2| + |(1 + \mu_A - \vartheta_A) \times a_3 - (1 + \mu_B - \vartheta_B) \times b_3|) \tag{4}$$

where $d_j^{k,k+1}(\tilde{A}, \tilde{B})$ presents the normalised Hamming distance of two TIFN values between expert k and k + 1 for each managerial characteristic (j). The above formula is repeated for all possible pairs of comparison for each managerial characteristic. As 10 SME entrepreneurs participated in this research, the above formula was repeated 45 times for each managerial characteristic ($C \binom{n}{2} = \frac{n \times (n-1)}{2} = \frac{10 \times 9}{2} = 45$).

Subsequently, the average normalised Hamming distance (NHD) (Abdullah et al., 2021) of each criterion amongst all experts was measured via the following formula.

$$\mu_j(NHD) = \frac{\sum_{k=1}^L d_j^{k,k+1}(\tilde{A}, \tilde{B})}{L} \tag{5}$$

In case the μ_j for each managerial characteristic was above 0.15, it is deleted from the initial list mentioned in Table 1; otherwise, selected for further investigation in the IFDEMATEL stage. This threshold value (0.15) was adopted by the researchers to select the key micro-foundations with the highest consensus amongst the SME entrepreneurs.

2.5. Phase 3. IFDEMATEL

In this article, the intuitionistic fuzzy DEMATEL has been scrutinised (adopted from Govindan et al. 2015; Ocampo and Yamagishi, 2020; Wu et al., 2020; Hajiagha and Kandi, 2021). The following steps were employed on the completed questionnaires (Questionnaire B) completed by the entrepreneurs of SMEs.

2.6. Stage 1. Defuzzification

Each completed questionnaire has been transferred to TIFNs through Table 3 Subsequently, the TIFNs were transferred to crisp values by different operators known as the expected value (EV). Scholars have

developed different operators in this section (e.g., Keshavarzfar & Makui, 2015; Ocampo & Yamagishi, 2020). The authors have applied the following formula to create crisp values from TIFNs, known as Z_{ij}^k , for each expert. Remark that k is the k^{th} SMEs entrepreneur, where $k = \{1, \dots, L\}$, and L is 10 in this research as the total number of SMEs entrepreneurs who participated in the survey to complete the questionnaires in two stages. Remark that there are other approaches in analysing IF-DEMATEL as presented by Govindan et al. 2015, Ocampo and Yamagishi, 2020, Wu et al., 2020, and Hajiagha and Kandi, 2021. Nevertheless, as in the previous phase (IF-Delphi and Hamming normalisation), the uncertainty was considered and investigated via a novel approach, the authors preferred to simplify the IF-DEMATEL phase by using the expected value (EV) instead of other approaches.

$$EV \approx z_{ij}^k = \frac{1}{6} \times (a_1 + (4 \times a_2) + a_3) \tag{6}$$

By using the formula (6), the relationship matrix of critical managerial key micro-foundations for each SME entrepreneur results as follows.

$$Z_{ij}^k = \begin{bmatrix} z_{11}^k & \dots & z_{1n}^k \\ \vdots & \ddots & \vdots \\ z_{m1}^k & \dots & z_{mn}^k \end{bmatrix} \forall k \in L \tag{7}$$

Next, the average value of each cell in each decision matrix is measured via arithmetic mean, as follows. Note that, Z_{ij} denotes the average crisp value of row (i) and column (j).

$$z_{ij} = \frac{1}{L} \sum_{k=1}^L z_{ij}^k \forall i, j \in m, n \tag{8}$$

2.7. Stage 2. DEMATEL

In the MCDM era, a wide range of methods are available to address different research objectives, such as (i) measuring the importance of each characteristic by the best-worst method (BWM) (e.g., Mahdiraji et al., 2020), analytical hierarchical process (AHP), ANP (e.g., Singh et al., 2021), etc.; (ii) ranking different options by Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), *ELimination et Choix Traduisant la REalite* (ELECTRE), Preference Ranking Organisation Method for Enrichment of Evaluations (PROMETHEE) (e.g., Amoozad Mahdiraji et al., 2020), etc.; and (iii) analysing the cause and effect relationship among the micro-foundations by Decision Making Trial and Evaluation Laboratory (DEMATEL) (e.g., Hajiagha & Kandi, 2021), etc. In this research, the causal relationship amongst the managerial micro-foundations toward digital transformation has been considered via IFDEMATEL. First, the normalised direct-relation matrix was formulated by implementing equations (9) and (10). Remark that (s) denotes the normalisation index, and N represents the normalisation matrix (Jafari-Sadeghi et al., 2021).

$$s = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n z_{ij}}, ij = 1, 2, \dots, n \tag{9}$$

$$N = s \cdot Z_{ij} \tag{10}$$

Subsequently, the total relationship matrix, known as TRM or T, results from equation (11).

$$T = N + N^2 + N^2 + \dots = \sum_{i=1}^{\infty} N^i = N \times (I - N)^{-1} \tag{11}$$

According to the TRM (T matrix), for each row and column, the sum was measured where (R_i) and (D_j) reveal the direct and indirect impact of each component (i,j) via equations (12) and (13). Note that, t_{ij} values resulted from the TRM and equation (11). Furthermore, the values of the TRM illustrate the relationship among the managerial micro-

Table 4
Intuitionistic Fuzzy Delphi results for managerial micro-foundations.

Code	Managerial micro-foundations	$\mu_j(NHD)$
TMC ₁	Developing digital literacy to create their analytics	0.14611
TMC ₂	Adapting technology at the workplace to meet a variety of needs during analytics tasks	0.20444
TMC ₃	Commitment towards connecting all remote, branch, and mobile offices to the central office for analytics	0.15444
TMC ₄	Utilising open system network mechanisms to boost analytics connectivity	0.18778
TMC ₅	Providing transparent access to all digital platforms and applications	0.15889
KMC ₁	Commitment towards well-developed financial reporting systems	0.22778
KMC ₂	Being sensitive to information about technological changes in the marketplace	0.26556
KMC ₃	Being sensitive to the science and technology profile of human capital	0.16944
KMC ₄	Working in partnership with international stakeholders towards technical knowledge acquisition	0.21111
KMC ₅	Obtaining information from specialised market surveys	0.13778
KMC ₆	Using of specific techniques or technology to disseminate knowledge	0.19444
KMC ₇	Commitment towards disseminating the latest (digital) knowledge at the workplace	0.16000
KMC ₈	Capacity towards being responsive towards knowledge	0.26000
EIC ₁	Willingness and capability to undertake risk	0.15222
EIC ₂	Capacity toward creativity and innovativeness	0.11667
EIC ₃	Ability to explore and exploit new business opportunities	0.10611
EIC ₄	Capacity toward resource management to address opportunities	0.19556
EIC ₅	Ability to develop and/or create national and international network ties	0.20944
EIC ₆	Capacity to develop novel opportunities for the colleagues through leveraging coaching and mentoring skills and other techniques	0.19167
LMC ₁	Skills and ability for developing the employees' performance	0.14556
LMC ₂	Capabilities and techniques towards potentiating the employees' performance	0.18222
LMC ₃	Capacity to Integrate and manage the employees' cultural differences	0.23111
LMC ₄	Decision-making and responsibility skills	0.18056
LMC ₅	Analytical skills and change management capabilities towards workforce optimisation	0.20444
LMC ₆	Communication capacities towards boosting the employees' commitment	0.14833
LMC ₇	Ability to develop and manage strategic deals and alliances	0.19333
LMC ₈	Ability to manage projects with high performance	0.11778

foundations nurturing digital transformation. In this regard, the values of TRM above the threshold value were considered significant relationships. The threshold value is usually determined by the scholars or the average value of the t_{ij} , known as \bar{t} .

$$R_i = \sum_{j=1}^n t_{ij} \forall i \in m \tag{12}$$

$$D_j = \sum_{i=1}^n t_{ij} \forall j \in n \tag{13}$$

After, the net effect (E_i) and the overall value (P_i) of each managerial key characteristic was measured from the following equations.

$$P_i = \{R_i + D_j | i = j\} \forall i \in m \tag{14}$$

$$E_i = \{R_i - D_j | i = j\} \forall i \in m \tag{15}$$

The maximum value of (P_i) presents the most important characteristic for overall relationships. The positive or negative (E_i) value denotes the cause or reliable nature of the characteristic on the decision-making matrix (Hajiagha & Kandi, 2021). Positive E_i reveals the causes, and negatives represent the effects (Garg & Rani, 2021). Ultimately, the network diagram indicates the causal relationship between the managerial micro-foundations toward digital transformation.

Table 5
Selected managerial micro-foundations from IFD.

Code	Managerial micro-foundations
TMC₁	Developing digital literacy to create their analytics
KMC₅	Obtaining information from specialised market surveys
EIC₂	Capacity toward creativity and innovativeness
EIC₃	Ability to explore and exploit new business opportunities
LMC₁	Skills and ability for developing the employees' performance
LMC₆	Communication capacities towards boosting the employees' commitment
LMC₈	Ability to manage projects with high performance

3. Results and discussion

As indicated in Fig. 2, we report the results and findings of our study in this section. To answer the first research question (RQ1) this research strives to identify the most pertinent managerial behaviours and actions for the digital transformation journey of international SMEs. In this regard, through a systematic literature review in phase one, we explored a total of twenty-seven micro-foundations in four general categories of 'Technology Management Capabilities', 'Knowledge Management Capabilities', 'Entrepreneurial and Innovation Capabilities', and 'Leadership and Management Capabilities' (Table 1).

Subsequently, in phase two, we identified the most pertinent factors by employing IFD. In doing so, after measuring the NHD and the arithmetic mean for each managerial characteristic, the $\mu_j(NHD)$ for each is presented in Table 4 using formulas (4) and (5).

Accordingly, our analysis led to the selection of the seven most critical and relevant micro-foundations nurturing digital transformation from SME entrepreneurs' perspectives. As bolded and underlined in the last column of Table 4 and indicated in Table 5, they include (1) developing digital literacy to create their analytics, (2) obtaining information from specialised market surveys, (3) capacity toward creativity and innovativeness, (4) ability to explore and exploit new business opportunities, (5) skills and the ability for developing the employees' performance, (6) communication capacities towards boosting the employees' commitment, and (7) ability to manage projects with high performance.

To address the second research question, this study aims to explore the cause-effect nature of identified micro-foundations and synthesise their interrelationships, leading to framing the respective conceptual model. In doing so, the IFDEMATEL questionnaire (code B) was sent to the experts and completed and gathered within two weeks. Then the opinion of SME entrepreneurs regarding managerial micro-foundations toward digital transformation was transferred to TIFN values using Table 3. Then by using formulas (6) to (11) the TRM resulted as follows in Table 6.

The bolded and underlined cells are those consisting of values higher than the threshold value (0.315) and should be included as important relationships between two managerial micro-foundations. By employing formulas (12) to (15), the causes, effects, and the importance of each managerial characteristic nurturing digital transformation resulted in Table 7.

The bolded and underlined cells in the fourth column illustrate the causes and the rest with negative values present the effects. The last column also demonstrates the importance of each characteristic in

Table 6
TRM for managerial micro-foundations nurturing digital transformation.

TRM (T)	LMC ₈	KMC ₅	EIC ₃	EIC ₂	LMC ₁	LMC ₆	TMC ₁
LMC₈	0.1287	0.1843	0.2123	0.1046	0.1090	0.1514	0.1706
KMC₅	0.4096	0.2007	0.3424	0.2099	0.2011	0.3091	0.4077
EIC₃	0.3592	0.2428	0.2283	0.1878	0.1829	0.3055	0.3323
EIC₂	0.4935	0.4687	0.5346	0.2427	0.4025	0.4324	0.5283
LMC₁	0.3803	0.3287	0.4524	0.2800	0.1855	0.2959	0.3739
LMC₆	0.3269	0.2982	0.4058	0.2399	0.3505	0.2172	0.3610
TMC₁	0.4468	0.3903	0.5286	0.3949	0.3691	0.4129	0.3408

nurturing digital transformation. As result, Fig. 3 highlights the causality and effectuality of selected factors.

As depicted in Fig. 3, cause factors have positive Ei values and are positioned above the horizontal line whereas effect factors refer to those with negative Ei values (below the horizontal line). Thus, our findings highlight that the selected individual-level micro-foundations in the categories of technology management (TMC₁) is a cause factor while the one in the category of knowledge management (KMC₅) is an effectual factor. However, the micro-foundations in the categories of entrepreneurial and innovation capabilities, as well as leadership and management capabilities, were found to be divergent. That is, although the capacity of entrepreneurs toward creativity and innovativeness (EIC₂) is a causal factor, their ability to explore and exploit new business opportunities (EIC₃) is identified as an effectual factor. Similarly, LMC₁ and LMC₆ represent causality whereas LMC₈ highlights the effectuality. Moreover, the distance of factors from the vertical line (on the left-hand side of the figure) shows their importance and priority. The more distant the factor (e.g., TMC₁) is positioned, the higher priority they have. LMC₈ is also found to have the least important among the selected micro-foundations.

Eventually, considering the cause and effects (Fig. 3) alongside the TRM matrix (Table 6), the causal model illustrating the relationship amongst the managerial micro-foundations nurturing digital transformation is presented in Fig. 4.

According to Fig. 4, among seven selected micro-foundations, the digital literacy and knowledge of international entrepreneurs (TMC₁) are found to be the central characteristic that has a co-association with all other factors. Defined as a capability that incorporates a set of skills, which enable individuals to understand and work with new digital technologies (Stordy, 2015), it is legitimate to consider digital literacy as an essential element in the digital transformation journey of firms. That is, digital literacy help managers to better understand the transformation process, and be prepared to address its challenges (Cetindamar Kozanoglu & Abedin, 2021). Indeed, digital literacy enables SME decision-makers to win the "hearts and minds" of individuals and make a positive impact on other characteristics of digital transformation so that they will beat their rivals who consider employees like a machine (Westerman, 2016). Another important factor in this construct refers to the level of managers' innovativeness (EIC₂) which is directly or indirectly (via other factors) linked with other micro-foundations. This explains that ever-evolving technologies push SME managers to leverage innovative initiatives to not only explore and exploit business opportunities but also find a better communication channel to increase employees' commitment toward the digitalisation process.

Table 7
Causes, effects and the importance of managerial micro-foundations.

Managerial micro-foundations	D(i)	R(i)	E(i)	P(i)
LMC₈	1.0609	2.5452	-1.4843	3.6061
KMC₅	2.0805	2.1136	-0.0331	4.1941
EIC₃	1.8387	2.7044	-0.8657	4.5431
EIC₂	3.1028	1.6597	1.4431	4.7625
LMC₁	2.2968	1.8005	0.4963	4.0973
LMC₆	2.1995	2.1245	0.0750	4.3239
TMC₁	2.8833	2.5146	0.3687	5.3979

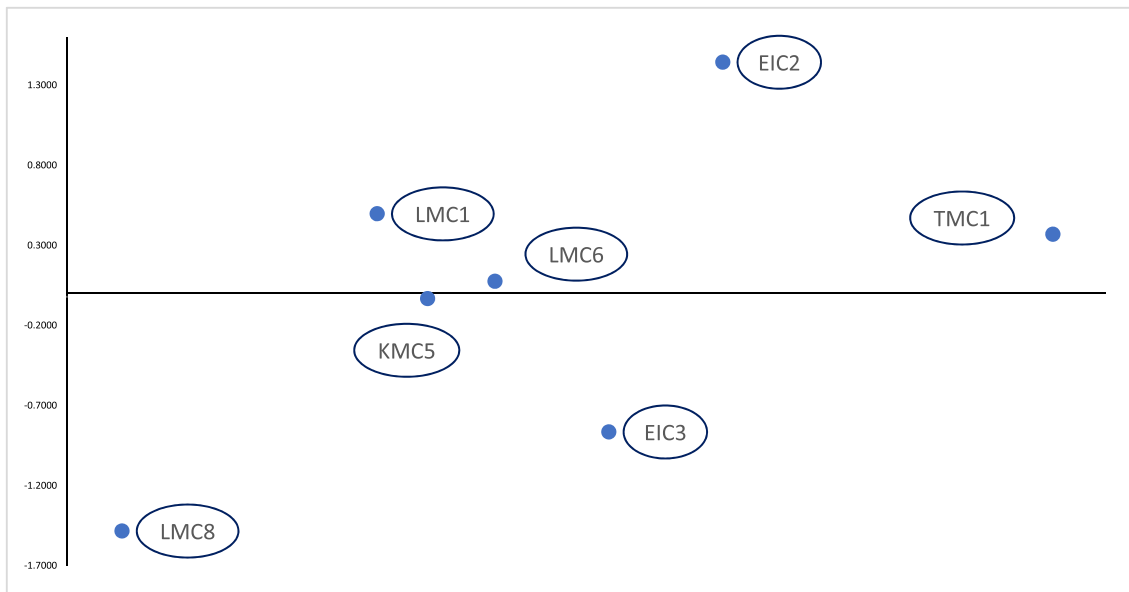


Fig. 3. The network diagram of causes and effects.

Notwithstanding, given that TMC_1 has a correlation with the other six factors, we exclude it from the model but consider it as a control variable since it can influence other predictors. Indeed, TMC_1 is held constant throughout the research to assess the relationship between other factors in a more simplified model. Fig. 5 depicts the revised conceptual framework of managerial micro-foundations toward the digital transformation of international SMEs.

According to Fig. 5, we identified six unique relationships among the managerial actions and behaviours that contribute to their digital transformation decision. The first relationship suggests that SMEs' managers' capacity for creativity and innovativeness (EIC_2) influence their ability to explore and exploit new business opportunities (EIC_3). This can be linked with personal innovativeness, by which individuals are highly eager for technological and digital innovations (Abubakre et al., 2022). Hence, in line with Mancha and Shankaranarayanan (2021), we stress that digital innovator managers are more likely to take

the risk of transformation from non-digital to digital business models and explore new business opportunities. On the other hand, our findings highlight that managers' innovativeness enhances their communication capacities towards boosting the employees' commitment (LMC_8). Given that innovator managers are characterised as highly reliant on information (Esfahani & Reynolds, 2021), they take advantage of communication to diffuse information to influence others to accept and adopt digital innovations (Robson & Robinson, 2013). Accordingly, the first two prepositions build on the entrepreneurial and innovation capabilities (EIC) as well as leadership and management capabilities (LMC) to highlight that:

Proposition 1. In the digital transformation process of international SMEs, managers' creativity and innovativeness have a positive association with their ability to explore and exploit new business opportunities.

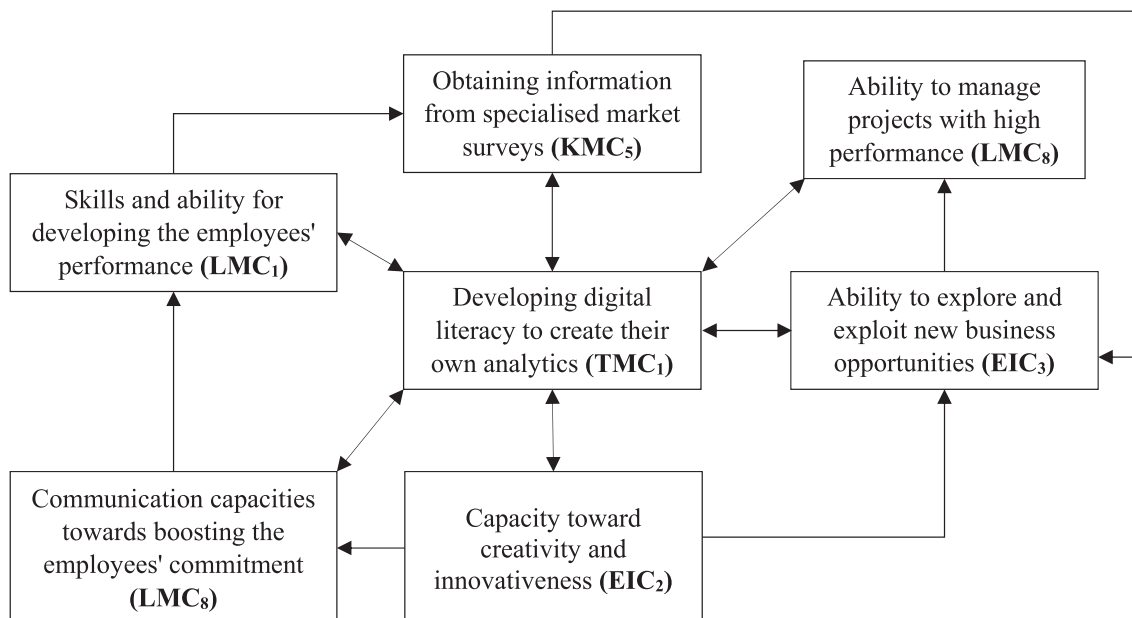


Fig. 4. The identified causal relationship model.

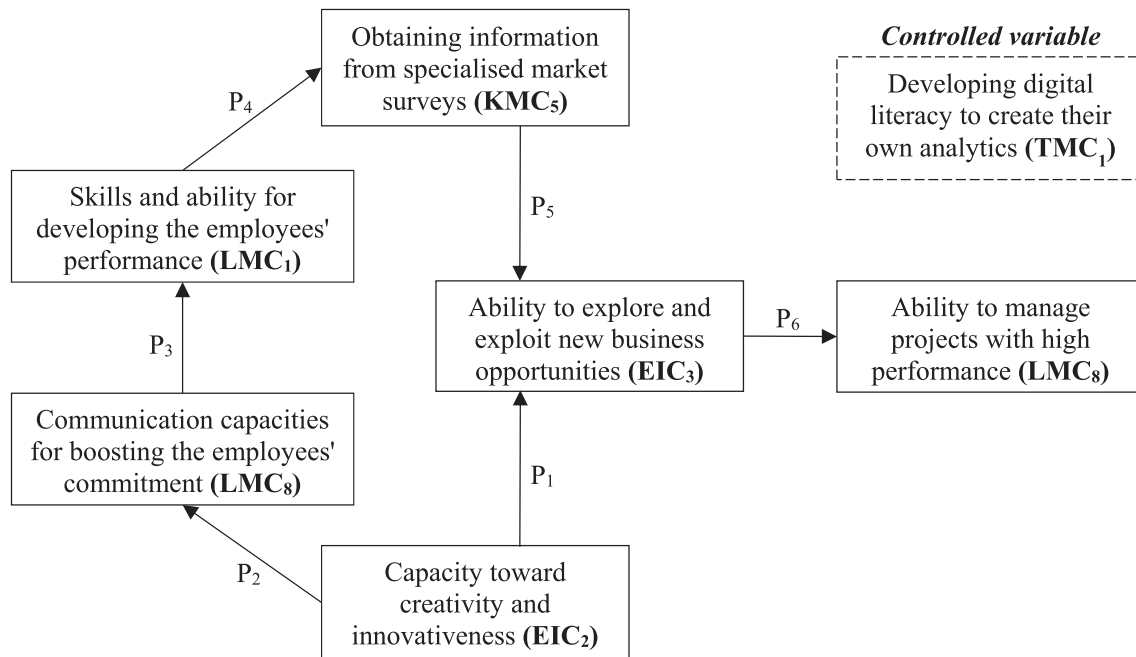


Fig. 5. The (revised) proposed model of managerial micro-foundations for the digital transformation of international SMEs.

Proposition 2. In the digital transformation process of international SMEs, managers’ creativity and innovativeness enhance their communication capacities towards boosting the employees’ digitalisation commitment.

Further, our analysis stresses that SME managers are more likely to develop skills that assist the digital performance of employees (LMC₁) by building on the proper communication capacities (LMC₈). We argue that, in the digitalisation journey, SMEs need to assure that their employees are aware and ready for this fundamental change in their working environment. That is, managers’ transparent communication not only facilitates awareness and readiness among employees at all levels but also assists in improving performance in the digitalised workplace. Therefore, we shed the light on the importance of leadership and management capabilities (LMC) to propose that:

Proposition 3. In the digital transformation process of international SMEs, managers’ communication capacities enhance their ability for developing the employees’ performance.

Moreover, the findings of this research highlight the role of managers’ leadership capabilities in their knowledge management capacities. In this regard, we found that managers with a higher ability to boost the digital performance of their employees (LMC₁) are more likely to employ digital tools to conduct market research and collect specialised market information (KMC₅). That is, following [Hervé et al. \(2020\)](#), we argue that digitalisation provides an opportunity for SME managers to enable employees to conduct advanced market surveys and overcome their liability of foreignness and newness in the foreign markets. Subsequently, in line with the literature (e.g., [Khin & Lim, 2018](#)), our findings confirm that higher market knowledge contributes to better exploration and exploitation of business opportunities. As such we propose that:

Proposition 4. In the digital transformation process of international SMEs, managers’ ability for developing the employees’ performance has a positive association with obtaining information from specialised market surveys.

Proposition 5. In the digital transformation process of international SMEs, managers’ ability for obtaining information from specialised market surveys enhances their capacity to explore and exploit new

business opportunities.

The final preposition focuses on the relationship between entrepreneurial and innovation capabilities and leadership and management capacities. In this regard, we found that managers who excel to take advantage of the business opportunities (EIC₃) have high project management capabilities to undertake the digital transformation process (LMC₈). This is particularly legitimate for small internationalisers, in which managers are central decision-makers for innovative projects. Therefore, their ability to identify hidden business opportunities during the transformation phase contributes to the maximisation of the performance in delivering digitalisation projects. Thus, the final preposition suggests that:

Proposition 6. In the digital transformation process of international SMEs, managers’ ability to explore and exploit new business opportunities has a positive association with their capability to manage projects with high performance.

4. Contributions and implications

The outcomes of our study make additions to the digital transformation studies from different points of view. From the theoretical perspective, the novelty of this research explicitly considers digital transformation from the largely ignored individual-level exploration. While the extant research stresses mainly firm-level capabilities (e.g., [Warner & Wäger, 2019](#)) and country-level characteristics (e.g., [Jafari-Sadeghi et al., 2021](#)), it does not consider the extent to which humans influence the digital transformation unambiguously. As such, the first contribution of this research highlights that more attention needs to be paid to the function of central decision-makers and their competencies in the digital transformation journey of firms. Indeed, this research complements [Sousa and Rocha’s \(2019\)](#) debate in which they argue that digitalisation is dependent on the change management and human response to the transformation rather purchase of new technology. That is, our findings suggest that entrepreneurs play the role of ‘strategic transformation’ managers who can drive firms towards successful digitalisation. This is particularly pertinent to entrepreneurial SMEs that shift to digital-centred operations to leverage it against their lack of knowledge and experience ([Ratten et al., 2016](#); [Sadeghi & Biancone,](#)

2018), as well as the liability of smallness and newness to the foreign markets (Hagen et al., 2019).

Second, the findings of this research offer a novel construct to measure digital transformation at the individual level that explores managers' behaviours and actions contributing to this process. Indeed, we expand the antecedents of the theory of planned behaviour by the development of seven micro-foundations in four categories including manager's capability in technology management, knowledge management, entrepreneurial and innovation management, as well as leadership and managerial capacities. In this regard, our findings support Cetindamar et al. (2021) debate that digital literacy is important for understanding and actualisation the digitalisation opportunities. However, we found unique measures that stress the necessity of top managers and central decision-makers to develop entrepreneurial and leadership skills for the successful digital transformation of international SMEs.

Third, by integrating the theory of planned behaviour, we contribute to the conceptualisation of digital transformation in international entrepreneurship research. In this regard, we developed a total number of six prepositions that explore cause and effect relationships among antecedents considered as predicted by this theory. Accordingly, unlike common qualitative approaches, we take advantage of an expert-based quantitative method to propose a causal model that depicts the relationship among behaviours and actions of international entrepreneurs in their digitalisation journey. According to our model, digital literacy correlates with other factors, hence, was removed from the final framework. Given, its importance to the transformation process, we propose that literature can consider it as a control variable (as we did in this study).

When it comes to practical contributions, the findings of this research shed the light on the role of managers and central decision-makers in the digitalisation process in terms of how their actions and behaviours, and expectations interplay (Zimmermann et al., 2020) and shape strategy and organisation (Eisenhardt et al., 2010) of this transformation. In this regard, we identified a list of important micro-foundations (e.g., the ability to explore and exploit new business opportunities, and skills and the ability for developing the employees' performance) as well as those that have been considered less important by experts (e.g., commitment towards connecting all remote, branch, and mobile offices to the central office for analytics, and utilising open system network mechanisms to boost analytics connectivity). They will assist international entrepreneurs in better understanding the micro-foundations that they need to develop in order to make a successful shift to digital-oriented operations. For example, our results propose that managers invest in their digital literacy (TMC₁) as it is the core capability and have a direct impact on other digitalisation skills. Moreover, developing innovativeness (EIC₂) is another crucial micro-foundation to be invested in by SME managers, whereas project management skills (LMC₈) can be given less priority in the professional development plan for the digital transformation. In a broader perspective, the findings of the Delphi analysis highlight that in the digitalisation journey the priority for professional development are respectively leadership and management capabilities, entrepreneurial and innovation capabilities and equally for technology and knowledge management capabilities.

Finally, from the methodological point of view, this paper benefits from an IFS in a multi-layer decision-making approach encompassing Delphi and DEMATEL in analysing managerial behaviours toward successful digital transformation. To the best knowledge of the authors, the employed approach especially by using normal Hamming distance in IFD and IFDEMATTEL is novel and could be applied by other scholars. The recommended approach is using only one round of data gathering for the IFD approach; thus, making the modified approach more applicable in real-world cases while the experts have limited time to participate in research and decision-making procedures.

5. Conclusion, Limitations, and future research

Given the increasing waves and cycles of digitalisation among businesses, the concept of digital transformation has been studied from various points of view. This paper focuses on the under-developed debates regarding the role of individual-level capabilities and strives to disentangle the micro-foundations of digital transformation among international SMEs. Hence, this research builds on the theory of planned behaviour we identified a total number of twenty-seven factors in four inclusive dimensions of micro-foundations such as technology management capacities, knowledge management capabilities, entrepreneurial and innovation capabilities and leadership and management capabilities. To address our research objectives, we employed a mixed-method analysis. The results of IFD assisted to narrow down the micro-foundations to the top seven individual-level factors. Further, Intuitionistic Fuzzy Decision-Making Trial and Evaluation Laboratory analysis led to the identification of the cause-effect relationship among individual-level capabilities as well as exploration of a conceptual framework that highlights the interrelationships among them.

This study acknowledges several restrictions that may shed the light on the new lines of research for further investigation. First, the context of this research was limited to small enterprises that rely on the digital transformation process to go internationally or remain competitive in their current international journey. As such, we invite researchers to explore the digital transformation journey in other types of firms such as international new ventures or small multinationals. Second, from the geographical scope, the data collection was narrowed down to SMEs in Iran. According to the Global Innovation Index, Iran represents a middle-income emerging economy, which places 26th among 130 countries in the proportion of the hi-tech industries in the national production (Dutta et al., 2021). Notwithstanding, similar to Ferraris et al. (2020), future studies might make a cross-cultural comparison to challenge the validity of our results. For example, more investigation is required to compare and contrast digital transformation micro-foundations in other emerging economies (e.g., BRICS¹). Also, future studies can go beyond emerging market economies and explore the topic in advanced countries (e.g., G7²).

Third, regarding the level of analysis, the current study relies on the theory of planned behaviour to explore micro-foundations at the individual level. This narrowed down the micro-foundations to four inclusive dimensions of technology management capacities, knowledge management capabilities, entrepreneurial and innovation capabilities and leadership and management capabilities. In this regard, a total of twenty-seven factors were identified, which were later limited to the top seven factors, which were related to the central decision-makers of SMEs. However, we call for more research to explore the micro-foundations of other types of human forces (e.g., middle managers, supervisors, normal employees, etc.) in the digital transformation journey.

Fourth, the sample for data collection of our expert-based mixed-method analysis was limited to a total number of ten entrepreneurs in international SMEs. The decision to recruit entrepreneurs in this research ensures that the respondent is the central decision-maker and the most knowledgeable person in the SMEs (Sadeghi et al., 2019). Bashan and Demirel (2019) and Singh et al. (2020) confirm that statistical approaches can be replaced by expert-based methods in case the size of the sample is too small and existing statistical research designs most likely fail to address the problem appropriately. On the other hand, the self-reporting process is most likely to increase biased and desirable responses. We, therefore, invite scholars to employ empirical analyses and examine the proposed relationships with larger samples and check whether reflected entrepreneurs' (experts') opinion is valid in the

¹ Brazil, Russia, India, China, and South Africa.

² Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

broader context (generalisability test).

Finally, from the methodological point of view, as this paper is employing IFD and IFDEMATEL to deal with research objectives and uncertainty of the environment, other uncertainty approaches dealing with the hesitation of the experts have not been considered. Hence, other scholars could benefit from hesitant fuzzy, hesitant linguistic term sets, etc. for further investigation. Moreover, the results of this research are limited to IFD and DEMATEL methods for analysing the causal relationship amongst the factors. However, other methods including interpretive-structural modelling (ISM), structural equational modelling (SEM), etc. could be used in case the relevant data were available to investigate the causal relationship among the factors. Furthermore, intuitionistic fuzzy values have been defuzzified in the first stage of the IFDEMATEL method used in this manuscript. Nonetheless, to deal with more realistic and robust results, non-defuzzified approaches should be considered in future research. In addition, in case the membership and non-membership values used in this research (Table 3) change, the results and conceptual model might be affected. Thus, scholars in the future could investigate the robustness of the results by testing different membership and non-membership values.

CRedit authorship contribution statement

Vahid Jafari-Sadeghi: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Hannan Amoozad Mahdiraji:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gazi Mahabubul Alam:** Project administration. **Alberto Mazzoleni:** Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

See Table A1.

Table A1
Questionnaire A-IF Delphi.

Capability	Code	Variable	Importance
Technological Capabilities	TC1	Developing digital literacy to create their analytics	<input type="checkbox"/> Extremely Important <input type="checkbox"/> Very Important <input type="checkbox"/> Important <input type="checkbox"/> Moderately Important <input type="checkbox"/> Unimportant <input type="checkbox"/> Very Unimportant <input type="checkbox"/> Extremely Unimportant
	TC2	Adapting technology at the workplace to meet a variety of needs during analytics tasks	
	TC3	Commitment towards connecting all remote, branch, and mobile offices to the central office for analytics	
	TC4		

Table A1 (continued)

Capability	Code	Variable	Importance
Knowledge Capabilities	TC5	Utilising open system network mechanisms to boost analytics connectivity	
	KC1	Providing transparent access to all digital platforms and applications	
	KC2	Commitment toward a well-developed financial reporting system	
	KC3	Being sensitive to information about technological changes in the marketplace	
	KC4	Being sensitive to the science and technology profile of human capital	
	KC5	Working in partnership with international stakeholders toward technical knowledge acquisition	
	KC6	Obtaining information from specialised market surveys	
	KC7	Using of specific techniques or technology to disseminate knowledge	
Entrepreneurial Capabilities	KC8	Commitment toward disseminating the latest (digital) knowledge in the workplace	
	EC1	Capacity towards being responsive to knowledge	
	EC2	Willingness and capability to undertake risk	
	EC3	Capacity toward creativity and innovativeness	
	EC4	Ability to explore and exploit new business opportunities	
	EC5	Capacity toward resource management to address opportunities	
Managerial and Leadership Capabilities	EC6	Ability to develop and/or create national and international network ties	
	MC1	Capacity to develop novel opportunities for the colleagues through leveraging coaching and mentoring skills and other techniques	
	MC2	Skills and ability for developing the employees' performance	
	MC3	Capabilities and techniques towards potentiating the employees' performance	
	MC4	Capacity to Integrate and manage the employees' cultural differences	
	MC5	Decision-making and responsibility skills	
	MC6	Analytical skills and change management capabilities towards workforce optimisation	
	MC7	Communication capacities towards boosting the employees' commitment	
MC8	Ability to develop and manage strategic deals and alliances		
		Ability to manage projects with high performance	

Appendix B

See Table B1.

Table B1
Questionnaire B-IF DEMATEL.

Questionnaire	TC1	KC5	EC2	EC3	MC1	MC6	MC8
TC1	***						
KC5		***					
EC2			***				
EC3				***			
MC1					***		
MC6						***	
MC8							***

Please determine the impact of each row on each column by a 9-point Likert scale of linguistic terms (Very Very Low, Very Low, Low, Nearly Low, Moderate, Nearly High, High, Very High, Very Very High).

References

- Abdullah, S., Qiyas, M., & Khan, M. A. (2021). Multi-criteria decision making based on intuitionistic cubic fuzzy numbers. *Granular Computing*, 1–11.
- Abubakar, A. M., Elrehail, H., Alatailat, M. A., & Elçi, A. (2019). Knowledge management, decision-making style and organizational performance. *Journal of Innovation & Knowledge*, 4(2), 104–114.
- Abubakre, M., Zhou, Y., & Zhou, Z. (2022). The impact of information technology culture and personal innovativeness in information technology on digital entrepreneurship success. *Information Technology and People*, 35(1), 204–231. <https://doi.org/10.1108/ITP-01-2020-0002>
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: A commentary on Sniechotta, Presseau, and Araújo-Soares. *Health Psychology Review*, 9(2), 131–137.
- Albats, E., Fiegenbaum, I., & Cunningham, J. A. (2018). A micro level study of university industry collaborative lifecycle key performance indicators. *The Journal of Technology Transfer*, 43(2), 389–431.
- Amoozad Mahdiraji, H., Hafeez, K., & Razavi Hajiagha, S. H. (2020). Business process transformation in financial market: A hybrid BPM-ELECTRE TRI for redesigning a securities company in the Iranian stock market. *Knowledge and Process Management*, 27(3), 211–224. <https://doi.org/10.1002/kpm.1632>
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40(4), 471–499.
- Asim, Z., & Soroshian, S. (2019). Exploring the role of knowledge, innovation and technology management (KNIT) capabilities that influence research and development. *Journal of Open Innovation: Technology, Market, and Complexity*, 5(2), 21.
- Atanassov, K. (1988). Review and new results on intuitionistic fuzzy sets. *Preprint IM-MFAIS-1-88, Sofia*, 5, 1.
- Barnes, T., Pashby, I., & Gibbons, A. (2002). Effective university-industry interaction: A multi-case evaluation of collaborative R&D projects. *European Management Journal*, 20(3), 272–285.
- Bashan, V., & Demirel, H. (2019). Application of fuzzy dematel technique to assess most common critical operational faults of marine boilers. *Politeknik Dergisi*, 22(3), 545–555.
- Bergek, A., Tell, F., Berggren, C., & Watson, J. (2008). Technological capabilities and late shakeouts: Industrial dynamics in the advanced gas turbine industry, 1987–2002. *Industrial and Corporate Change*, 17(2), 335–392.
- Bianchi, P., Calandra, D., Lanzalunga, F., & Sadraei, R. (2022). Emerging Markets and Multiple Sectors for Entrepreneurship: A Multidisciplinary and Multistakeholder Analysis. *International Entrepreneurship in Emerging Markets: Contexts, Behaviours, and Successful Entry*, Routledge, 7–28. <https://doi.org/10.4324/9781003218357-3>
- Bojesson, C., & Fundin, A. (2021). Exploring microfoundations of dynamic capabilities – challenges, barriers and enablers of organizational change. *Journal of Organizational Change Management*, 34(1), 206–222. <https://doi.org/10.1108/JOCM-02-2020-0060>
- Byrd, T. A., & Turner, D. E. (2000). Measuring the Flexibility of Information Technology Infrastructure: Exploratory Analysis of a Construct. *Journal of Management Information Systems*, 17(1), 167–208. <https://doi.org/10.1080/07421222.2000.11045632>
- Camilleri, M. A. (2018). The SMEs' technology acceptance of digital media for stakeholder engagement. *Journal of Small Business and Enterprise Development*.
- Castellani, D., Jimenez, A., & Zanfei, A. (2013). How remote are R&D labs? Distance factors and international innovative activities. *Journal of International Business Studies*, 44(7), 649–675.
- Centamor, J., Parida, V., & Wincint, J. (2019). How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity. *Journal of Business Research*, 100(December 2018), 196–206. Doi: 10.1016/j.jbusres.2019.03.035.
- Cetindamar, D., Abedin, B., & Shirahada, K. (2021). The Role of Employees in Digital Transformation: A Preliminary Study on How Employees' Digital Literacy Impacts Use of Digital Technologies. *IEEE Transactions on Engineering Management*, 1–12. <https://doi.org/10.1109/TEM.2021.3087724>
- Cetindamar Kozanoglu, D., & Abedin, B. (2021). Understanding the role of employees in digital transformation: Conceptualization of digital literacy of employees as a multi-dimensional organizational affordance. *Journal of Enterprise Information Management*, 34(6), 1649–1672. <https://doi.org/10.1108/JEIM-01-2020-0010>
- Choy, C. S., Yew, W. K., & Lin, B. (2006). Criteria for measuring KM performance outcomes in organisations. *Industrial Management and Data Systems*, 106(7), 917–936.
- Covin, J. G., & Miller, D. (2014). International Entrepreneurial Orientation: Conceptual Considerations, Research Themes, Measurement Issues, and Future Research Directions. *Entrepreneurship Theory and Practice*, 38(1), 11–44. <https://doi.org/10.1111/etap.12027>
- Croonen, E. P. M., Brand, M. J., & Huizingh, E. K. R. E. (2016). To be entrepreneurial, or not to be entrepreneurial? Explaining differences in franchisee entrepreneurial behavior within a franchise system. *International Entrepreneurship and Management Journal*, 12(2), 531–553.
- Crupi, A., Del Sarto, N., Di Minin, A., Gregori, G. L., Lepore, D., Marinelli, L., & Spigarelli, F. (2020). The digital transformation of SMEs – a new knowledge broker called the digital innovation hub. *Journal of Knowledge Management*, 24(6), 1263–1288. <https://doi.org/10.1108/JKM-11-2019-0623>
- Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, 9(3), 101–115. <https://doi.org/10.1108/13673270510602809>
- Del Giudice, M., Della Peruta, M. R., & Maggioni, V. (2015). A model for the diffusion of knowledge sharing technologies inside private transport companies. *Journal of Knowledge Management*, 19(3), 611–625.
- Denicolai, S., Zucchella, A., & Magnani, G. (2021). Internationalization, digitalization, and sustainability: Are SMEs ready? A survey on synergies and substituting effects among growth paths. *Technological Forecasting and Social Change*, 166(December 2020), 120650. Doi: 10.1016/j.techfore.2021.120650.
- Dittes, S., & Smolnik, S. (2019). Towards a digital work environment: The influence of collaboration and networking on employee performance within an enterprise social media platform. *Journal of Business Economics*, 89(8–9), 1215–1243. <https://doi.org/10.1007/s11573-019-00951-4>
- Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2021). Global innovation index 2020: who will finance innovations. In *Law and innovations* (Issue 1 (33)). Doi: 10.37772/2518-1718-2021-1(33)-1.
- Eisenhardt, K. M., Furr, N. R., & Bingham, C. B. (2010). CROSSROADS—Microfoundations of performance: Balancing efficiency and flexibility in dynamic environments. *Organization Science*, 21(6), 1263–1273.
- Elbeltagi, I., Al Sharji, Y., Hardaker, G., & Elsetouhi, A. (2013). The role of the owner-manager in SMEs' adoption of information and communication technology in the United Arab Emirates. *Journal of Global Information Management (JGIM)*, 21(2), 23–50.
- Esfahani, M. S., & Reynolds, N. (2021). Impact of consumer innovativeness on really new product adoption. *Marketing Intelligence & Planning*, 39(4), 589–612. <https://doi.org/10.1108/MIP-07-2020-0304>
- Fahmi, A., Abdullah, S., Amin, F., Siddiqui, N., & Ali, A. (2017). Aggregation operators on triangular cubic fuzzy numbers and its application to multi-criteria decision making problems. *Journal of Intelligent & Fuzzy Systems*, 33(6), 3323–3337.
- Favoretto, C., Mendes, G. H. de S., Filho, M. G., Gouvea de Oliveira, M., & Ganga, G. M. D. (2022). Digital transformation of business model in manufacturing companies: challenges and research agenda. *Journal of Business and Industrial Marketing*, 37(4), 748–767. Doi: 10.1108/JBIM-10-2020-0477.
- Felin, T., Foss, N. J., Heimeriks, K. H., & Madsen, T. L. (2012). Microfoundations of routines and capabilities: Individuals, processes, and structure. *Journal of Management Studies*, 49(8), 1351–1374.
- Ferraris, A., Degbey, W. Y., Singh, S. K., Bresciani, S., Castellano, S., Fiano, F., & Couturier, J. (2022). Microfoundations of Strategic Agility in Emerging Markets: Empirical Evidence of Italian MNEs in India. *Journal of World Business*, 57(2), Article 101272. <https://doi.org/10.1016/j.jwb.2021.101272>
- Ferraris, A., Giudice, M. D., Grandhi, B., & Cillo, V. (2020). Refining the relation between cause-related marketing and consumers purchase intentions: A cross-country analysis. *International Marketing Review*, 37(4), 651–669. <https://doi.org/10.1108/IMR-11-2018-0322>
- Ferraris, A., Mazzoleni, A., Devalle, A., & Couturier, J. (2019). Big data analytics capabilities and knowledge management: Impact on firm performance. *Management Decision*, 57(8), 1923–1936. <https://doi.org/10.1108/MD-07-2018-0825>
- Garg, H., & Rani, D. (2021). Some Information Measures Based on Centroid, Orthocenter, Circumcenter and Incenter Points of Transformed Triangular Fuzzy Numbers and their Applications. 0123456789 *Cognitive Computation*. <https://doi.org/10.1007/s12559-021-09842-9>
- Ghezzi, A., & Cavallo, A. (2020). Agile business model innovation in digital entrepreneurship: Lean startup approaches. *Journal of Business Research*, 110, 519–537.
- Govindan, K., Khodaverdi, R., & Vafadarnikjoo, A. (2015). Intuitionistic fuzzy based DEMATEL method for developing green practices and performances in a green supply chain. *Expert Systems with Applications*, 42(20), 7207–7220. <https://doi.org/10.1016/j.eswa.2015.04.030>
- Guha, D., & Chakraborty, D. (2010). A theoretical development of distance measure for intuitionistic fuzzy numbers. *International Journal of Mathematics and Mathematical Sciences*, 2010.

- Hagen, B., Zucchella, A., & Ghauri, P. N. (2019). From fragile to agile: Marketing as a key driver of entrepreneurial internationalization. *International Marketing Review*, 36(2), 260–288. <https://doi.org/10.1108/IMR-01-2018-0023>
- Hajiagha, S. H. R., Alaei, S., Mahdiraji, H. A., & Yaftian, F. (2021). International collaboration formation in entrepreneurial food industry: Evidence of an emerging economy. *British Food Journal*. <https://doi.org/10.1108/BFJ-08-2021-0884>
- Hajiagha, S. H. R., & Kandi, N. A. (2021). A Hybrid Interval-Valued Intuitionistic Fuzzy Aggregation Operator-Based Algorithm for Team Member Selection of International Entrepreneurs. In *Empirical International Entrepreneurship* (pp. 395–438). Springer.
- Hajiagha, S. H. R., Mahdiraji, H. A., Hashemi, S. S., & Zavadskas, E. K. (2015). Evolving a linear programming technique for MAGDM problems with interval valued intuitionistic fuzzy information. *Expert Systems with Applications*, 42(23), 9318–9325. <https://doi.org/10.1016/j.eswa.2015.07.067>
- Hamburg, I. (2019). Implementation of a digital workplace strategy to drive behavior change and improve competencies. *Strategy and Behaviors in the Digital Economy*.
- Hashemi, S. S., Hajiagha, S. H. R., Zavadskas, E. K., & Mahdiraji, H. A. (2016). Multicriteria group decision making with ELECTRE III method based on interval-valued intuitionistic fuzzy information. *Applied Mathematical Modelling*, 40(2), 1554–1564. <https://doi.org/10.1016/j.apm.2015.08.011>
- Heavin, C., & Power, D. J. (2018). Challenges for digital transformation—towards a conceptual decision support guide for managers. *Journal of Decision Systems*, 27, 38–45. <https://doi.org/10.1080/12460125.2018.1468697>
- Hervas-Oliver, J.-L., Sempere-Ripoll, F., & Boronat-Moll, C. (2021). Technological innovation typologies and open innovation in SMEs: Beyond internal and external sources of knowledge. *Technological Forecasting and Social Change*, 162, Article 120338.
- Hervé, A., Schmitt, C., & Baldegger, R. (2020). Digitalization, Entrepreneurial Orientation and Internationalization of Micro-, Small- and Medium-Sized Enterprises. *Technology Innovation Management Review*, 10(4).
- Hinterhuber, A., & Nilles, M. (2021). Digital transformation, the holy grail and the disruption of business models. *Business Horizons*.
- Hock-Doegen, M., Claus, T., Kraus, S., & Cheng, C. F. (2021). Knowledge management capabilities and organizational risk-taking for business model innovation in SMEs. *Journal of Business Research*, 130(December 2019), 683–697. Doi: 10.1016/j.jbusres.2019.12.001.
- Hosseinzadeh, M., Samadi Foroushani, M., & Sadraei, R. (2022). Dynamic Performance Development of Entrepreneurial Ecosystem in the Agricultural Sector. *British Food Journal*, 124(7), 2361–2395. <https://doi.org/10.1108/BFJ-08-2021-0909>
- Hughes, M., Rigtering, J. P. C., Covin, J. G., Bouncken, R. B., & Kraus, S. (2018). Innovative behaviour, trust and perceived workplace performance. *British Journal of Management*, 29(4), 750–768.
- Jafari-Sadeghi, V., Mahdiraji, H. A., Devalle, A., & Pellicelli, A. C. (2022). Somebody is hiding something: Disentangling interpersonal level drivers and consequences of knowledge hiding in international entrepreneurial firms. *Journal of Business Research*, 139, 383–396.
- Jafari-Sadeghi, V., Amoozad Mahdiraji, H., Bresciani, S., & Pellicelli, A. C. (2021). Context-specific micro-foundations and successful SME internationalisation in emerging markets: A mixed-method analysis of managerial resources and dynamic capabilities. *Journal of Business Research*, 134(May), 352–364. <https://doi.org/10.1016/j.jbusres.2021.05.027>
- Jafari-Sadeghi, V., Garcia-Perez, A., Candeló, E., & Couturier, J. (2021). Exploring the impact of digital transformation on technology entrepreneurship and technological market expansion: The role of technology readiness, exploration and exploitation. *Journal of Business Research*, 124(2021), 100–111. <https://doi.org/10.1016/j.jbusres.2020.11.020>
- Jiang, F., Wang, G., & Jiang, X. (2019). Entrepreneurial orientation and organizational knowledge creation: A configurational approach. *Asia Pacific Journal of Management*, 36(4), 1193–1219.
- Keshavarzfar, R., & Makui, A. (2015). An IF-DEMATEL-AHP based on triangular intuitionistic fuzzy numbers (TIFNs). *Decision Science Letters*, 4(2), 237–246.
- Khin, S., & Lim, T. H. (2018). Entrepreneurial opportunity recognition, exploitation and new venture success: Moderating role of prior market and technology knowledge. *International Journal of Entrepreneurship*, 22(4), 1–7.
- Kotarba, M. (2018). Digital transformation of business models. *Foundations of Management*, 10(1), 123–142.
- Lähtenmäki, I., Nätti, S., & Saraniemi, S. (2022). Digitalization-enabled evolution of customer value creation: An executive view in financial services. *Journal of Business Research*, 146(July 2021), 504–517. <https://doi.org/10.1016/j.jbusres.2022.04.002>
- Larjovuuri, R.-L., Bordin, L., Makiniemi, J.-P., & Heikkilä-Tammi, K. (2016). The Role of Leadership and Employee Well-Being in Organizational Digitalization. *What'S Ahead in Service Research? New Perspectives for Business and Society*.
- Lee, H., & Choi, B. (2003). Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination. *Journal of Management Information Systems*, 20(1), 179–228.
- Li, F. (2020). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Technovation*, 92–93(January 2017), 102012. Doi: 10.1016/j.technovation.2017.12.004.
- Liang, C., Zhao, S., & Zhang, J. (2014). Aggregation operators on triangular intuitionistic fuzzy numbers and its application to multi-criteria decision making problems. *Foundations of Computing and Decision Sciences*, 39(3), 189–208.
- Lin, B.-W., & Berg, D. (2001). Effects of cultural difference on technology transfer projects: An empirical study of Taiwanese manufacturing companies. *International Journal of Project Management*, 19(5), 287–293.
- Mahdiraji, H. A., Hafeez, K., Kord, H., Kamardi, A. A., Amoozad Mahdiraji, H., Hafeez, K., Kord, H., & Abbasi Kamardi, A. A. (2020). Analysing the voice of customers by a hybrid fuzzy decision-making approach in a developing country's automotive market. *Management Decision*. <https://doi.org/10.1108/MD-12-2019-1732>
- Mahdiraji, H. A., Zavadskas, E. K., Arab, A., Turskis, Z., & Sahebi, I. G. (2021). Formulation Of Manufacturing Strategies Based On An Extended SWARA Method With Intuitionistic Fuzzy Numbers: An Automotive Industry Application. *Transformations in Business & Economics*, 20(2).
- Mahdiraji, H. A., Zavadskas, E. K., Skare, M., Kafshgar, F. Z. R., & Arab, A. (2020). Evaluating strategies for implementing industry 4.0: A hybrid expert oriented approach of BWM and interval valued intuitionistic fuzzy TODIM. *Economic Research-Ekonomska Istraživanja*, 33(1), 1600–1620.
- Mancha, R., & Shankaranarayanan, G. (2021). Making a digital innovator: Antecedents of innovativeness with digital technologies. *Information Technology and People*, 34(1), 318–335. <https://doi.org/10.1108/ITP-12-2018-0577>
- Manfreda, A., & Štemberger, M. I. (2018). *Establishing a partnership between top and IT managers: A necessity in an era of digital transformation*. Information Technology & People.
- Mardani, A., Nikoosokhan, S., Moradi, M., & Doustar, M. (2018). The Relationship Between Knowledge Management and Innovation Performance. *Journal of High Technology Management Research*, 29(1), 12–26. <https://doi.org/10.1016/j.hitech.2018.04.002>
- Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. *Business & Information Systems Engineering*, 57(5), 339–343.
- Matt, C., Hess, T., Benlian, A., & Wiesbeck, F. (2016). Options for formulating a digital transformation strategy. *MIS Quarterly Executive*, 15(2), 6.
- Mimoun, L., Torres, L. T., & Sobande, F. (2017). When High Failure, Risky Technology Leads to Market Expansion: The Case of the Fertility Services Market. *ACR North American Advances*, 45, 773–774.
- Mohammed, A. A., Ferraris, A., & Troise, C. (2021). CSR practices and creativity during COVID-19 pandemic in the emerging market: Investigating the mediating effect of affective commitment. *Management Decision*. <https://doi.org/10.1108/MD-08-2021-1021>
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029–1055.
- Nambisan, S., & Luo, Y. (2021). Toward a loose coupling view of digital globalization. *Journal of International Business Studies*, 52(8), 1646–1663. <https://doi.org/10.1057/s41267-021-00446-x>
- Nasiri, M., Ukko, J., Saunila, M., & Rantala, T. (2020). Managing the digital supply chain: The role of smart technologies. *Technovation*, 96–97(May 2019), 102121. Doi: 10.1016/j.technovation.2020.102121.
- O'Kane, C., Zhang, J. A., Cunningham, J. A., & O'Reilly, P. (2017). What factors inhibit publicly funded principal investigators' commercialization activities? *Small Enterprise Research*, 24(3), 215–232.
- Ocampo, L., & Yamagishi, K. (2020). Modeling the lockdown relaxation protocols of the Philippine government in response to the COVID-19 pandemic: An intuitionistic fuzzy DEMATEL analysis. *Socio-Economic Planning Sciences*, 72(July), Article 100911. <https://doi.org/10.1016/j.seps.2020.100911>
- Pathade, P. A., Ghadle, K. P., & Hamoud, A. A. (2020). Optimal solution solved by triangular intuitionistic fuzzy transportation problem. In *Computing in Engineering and Technology* (pp. 379–385). Springer.
- Plewa, C., Korff, N., Johnson, C., Macpherson, G., Baaken, T., & Rampersad, G. C. (2013). The evolution of university-industry linkages: A framework. *Journal of Engineering and Technology Management*, 30(1), 21–44.
- Porfirio, J. A., Carrilho, T., Felício, J. A., & Jardim, J. (2021). Leadership characteristics and digital transformation. *Journal of Business Research*, 124(October 2020), 610–619. Doi: 10.1016/j.jbusres.2020.10.058.
- Ratten, V., Ferreira, J., & Fernandes, C. (2016). Entrepreneurial and network knowledge in emerging economies: A study of the Global Entrepreneurship Monitor. *Review of International Business and Strategy*, 26(3), 392–409. <https://doi.org/10.1108/RIBS-11-2015-0076>
- Razavi Hajiagha, S. H., Ahmadzadeh Kandi, N., Amoozad Mahdiraji, H., Jafari-Sadeghi, V., & Hashemi, S. S. (2022). International entrepreneurial startups' location under uncertainty through a heterogeneous multi-layer decision-making approach: Evidence and application of an emerging economy. *International Journal of Entrepreneurial Behaviour and Research*, 28(3), 767–800.
- Rezaei, M., Giovando, G., M., Rezaei, Sh., Sadraei, R. (2022) What are the fundamental knowledge-sharing drivers in small family businesses in the restaurant and fast-food industry? *British Food Journal*, 124(7), 2149–2178. Doi: 10.1108/BFJ-08-2021-0948.
- Rezaei, M., Jafari-Sadeghi, V., Cao, D., & Amoozad Mahdiraji, H. (2021). Key indicators of ethical challenges in digital healthcare: A combined Delphi exploration and confirmative factor analysis approach with evidence from Khorasan province in Iran. *Technological Forecasting & Social Change*, 167(2021), Article 120724. <https://doi.org/10.1016/j.techfore.2021.120724>
- Ritala, P., Baiyere, A., Hughes, M., & Kraus, S. (2021). Digital strategy implementation: The role of individual entrepreneurial orientation and relational capital. *Technological Forecasting and Social Change*, 171(May), Article 120961. <https://doi.org/10.1016/j.techfore.2021.120961>
- Robson, A., & Robinson, L. (2013). Building on models of information behaviour: Linking information seeking and communication. *Journal of Documentation*, 69(2), 169–193. <https://doi.org/10.1108/00220411311300039>
- Sadeghi, V. J., & Biancone, P. Pietro. (2018). How micro, small and medium-sized enterprises are driven outward the superior international trade performance? A multidimensional study on Italian food sector. *Research in International Business and Finance*, 45(October 2018), 597–606. Doi: 10.1016/j.ribaf.2017.07.136.
- Sadeghi, V. J., Nkongolo-Bakenda, J.-M., Anderson, R. B., & Dana, L.-P. (2019). An institution-based view of international entrepreneurship: A comparison of context-based and universal determinants in developing and economically advanced

- countries. *International Business Review*, 28(6), Article 101588. <https://doi.org/10.1016/j.ibusrev.2019.101588>
- Salisu, Y., & Abu Bakar, L. J. (2019). Technological capability, relational capability and firms' performance. *Revista de Gestão*, 27(1), 79–99. <https://doi.org/10.1108/revge-03-2019-0040>
- Schumann, C. A., & Tittmann, C. (2015). Digital business transformation in the context of knowledge management. *Proceedings of the European Conference on Knowledge Management, ECKM*, 671–675.
- Scott, R. W. (2007). *Institutions and organizations: Ideas and interests*. Sage Publications.
- Scotto, V., Beatrice, O., Valentina, C., Nicotra, M., Di Gioia, L., & Farina Briamonte, M. (2020). Uncovering the micro-foundations of knowledge sharing in open innovation partnerships: An intention-based perspective of technology transfer. *Technological Forecasting and Social Change*, 152(January), Article 119906. <https://doi.org/10.1016/j.techfore.2019.119906>
- Selimović, J., Pilav-Velić, A., & Krndžija, L. (2021). Digital workplace transformation in the financial service sector: Investigating the relationship between employees' expectations and intentions. *Technology in Society*, 66(April). <https://doi.org/10.1016/j.techsoc.2021.101640>
- Singh, C., Singh, D., & Khamba, J. S. (2020). Analyzing barriers of Green Lean practices in manufacturing industries by DEMATEL approach. *Journal of Manufacturing Technology Management*.
- Singh, M., Rathi, R., Antony, J., & Garza-Reyes, J. A. (2021). Lean Six Sigma project selection in a manufacturing environment using hybrid methodology based on intuitionistic fuzzy MADM approach. *IEEE Transactions on Engineering Management*.
- Sousa, M. J., & Rocha, Á. (2019). Skills for disruptive digital business. *Journal of Business Research*, 94, 257–263.
- Stordy, P. (2015). Taxonomy of literacies. *Journal of Documentation*, 71(3), 456–476. <https://doi.org/10.1108/JD-10-2013-0128>
- Strange, R., & Zucchella, A. (2017). Industry 4.0, global value chains and international business. *Multinational Business Review*, 25(3), 174–184. <https://doi.org/10.1108/MBR-05-2017-0028>
- Tabrizi, B., Lam, E., Girard, K., & Irvin, V. (2019). Digital transformation is not about technology. *Harvard Business Review*, 13(March), 1–6.
- Thite, M. (2022). Digital human resource development: Where are we? Where should we go and how do we go there? *Human Resource Development International*, 25(1), 87–103.
- Van Steenbergen, E. F., van der Ven, C., Peeters, M. C. W., & Taris, T. W. (2018). Transitioning towards new ways of working: Do job demands, job resources, burnout, and engagement change? *Psychological Reports*, 121(4), 736–766.
- Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122(July 2018), 889–901. <https://doi.org/10.1016/j.jbusres.2019.09.022>
- Verma, V. K., & Chandra, B. (2018). An application of theory of planned behavior to predict young Indian consumers' green hotel visit intention. *Journal of Cleaner Production*, 172, 1152–1162.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems*, 28(2), 118–144. <https://doi.org/10.1016/j.jsis.2019.01.003>
- Wales, W. J., Kraus, S., Filsler, M., Stöckmann, C., & Covin, J. G. (2021). The status quo of research on entrepreneurial orientation: Conversational landmarks and theoretical scaffolding. *Journal of Business Research*, 128, 564–577. <https://doi.org/10.1016/j.jbusres.2020.10.046>
- Wang, Y., Lo, H.-P., Zhang, Q., & Xue, Y. (2006). How technological capability influences business performance: An integrated framework based on the contingency approach. *Journal of Technology Management in China*.
- Warner, K. S. R., & Wäger, M. (2019). Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long Range Planning*, 52(3), 326–349. <https://doi.org/10.1016/j.lrp.2018.12.001>
- Weber, E., Büttgen, M., & Bartsch, S. (2022). How to take employees on the digital transformation journey: An experimental study on complementary leadership behaviors in managing organizational change. *Journal of Business Research*, 143 (January), 225–238. <https://doi.org/10.1016/j.jbusres.2022.01.036>
- Westerman, G. (2016). Why digital transformation needs a heart. *MIT Sloan Management Review*, 58(1). <https://doi.org/10.7551/mitpress/11645.003.0019>
- Westerman, G., Bonnet, D., & McAfee, A. (2014). *Leading digital: Turning technology into business transformation*. Harvard Business Press.
- Wrede, M., Velamuri, V. K., & Dauth, T. (2020). Top managers in the digital age: Exploring the role and practices of top managers in firms' digital transformation. *Managerial and Decision Economics*, 41(8), 1549–1567. <https://doi.org/10.1002/mde.3202>
- Wu, M., Coleman, M., Abdul Rahaman, A. R., & Edziah, B. K. (2020). Successor selection in family business using theory of planned behaviour and cognitive dimension of social capital theory: Evidence from Ghana. *Journal of Small Business and Enterprise Development*, 27(6), 905–926. <https://doi.org/10.1108/JSBED-05-2019-0152>
- Wu, Y., Wu, C., Zhou, J., Zhang, B., Xu, C., Yan, Y., & Liu, F. (2020). A DEMATEL-TODIM based decision framework for PV power generation project in expressway service area under an intuitionistic fuzzy environment. *Journal of Cleaner Production*, 247, 119099. <https://doi.org/10.1016/j.jclepro.2019.119099>
- Yeow, A., Soh, C., & Hansen, R. (2018). Aligning with new digital strategy: A dynamic capabilities approach. *The Journal of Strategic Information Systems*, 27(1), 43–58.
- Yu, H., Fletcher, M., & Buck, T. (2022). Managing digital transformation during re-internationalization: Trajectories and implications for performance. *Journal of International Management*, 28(4), 100947. <https://doi.org/10.1016/j.intman.2022.100947>
- Zawislak, P. A., Cherubini Alves, A., Tello-Gamarrá, J., Barbieux, D., & Reichert, F. M. (2012). Innovation capability: From technology development to transaction capability. *Journal of Technology Management & Innovation*, 7(2), 14–27.
- Zeike, S., Bradbury, K., Lindert, L., & Pfaff, H. (2019). Digital leadership skills and associations with psychological well-being. *International Journal of Environmental Research and Public Health*, 16(14), 1–12. <https://doi.org/10.3390/ijerph16142628>
- Zimmermann, A., Hill, S. A., Birkinshaw, J., & Jaecel, M. (2020). Complements or substitutes? A microfoundations perspective on the interplay between drivers of ambidexterity in SMEs. *Long Range Planning*, 53(6), 101927.

Vahid Jafari-Sadeghi is a Lecturer in International Business and the Programme Director of MSc International Business at Aston Business School. Before joining Aston University, Vahid was a senior lecturer in International Entrepreneurship at the Newcastle Business School, Northumbria University, and lecturer in Business Strategy at the School of Strategy and Leadership at Coventry University. He is an active researcher in the field of international entrepreneurship, particularly in the area of SME internationalisation. Vahid has published papers in leading international journals such as *International Business Review*, *Journal of Business Research*, *Technological Forecasting and Social Change*, *Journal of International Entrepreneurship*, etc. Dr Jafari-Sadeghi is an associate editor at the *EuroMed Journal of Business*, and a member of the editorial board of the *International Journal of Entrepreneurship and Small Business*, *International Journal of Business and Globalisation*, and *British Food Journal*. He has served as the lead guest editor for the special issues at the *International Journal of Entrepreneurial Behavior & Research*, *Journal of Theoretical and Applied Electronic Commerce Research*, and *British Food Journal*. Vahid has edited various books in Springer and Routledge and performed as track chair and presenter for several international conferences.

Hannan Amoozad Mahdiraji, PhD, is currently a lecturer in Strategy and Business Analytics at the School of Business at the University of Leicester. Before, Hannan was a senior lecturer in Business and Management at the Leicester Castle Business School at De Montfort University, lecturer of Operations and Supply Chain Management at the School of Strategy and Leadership at Coventry University, and Assistant Professor in Management Science at the Faculty of Management at the University of Tehran. Hannan holds his PhD in Management Science-Operations Management and his main interest areas include multiple-criteria decision-making methods, game theory, and supply chain management. His h-index is currently 26 with more than 1500 citations. Since 2012 he has published 73 research papers in famous international journals including *expert systems with applications*, *applied mathematical modelling*, *cleaner production*, *technological forecasting and social change*, *journal of business research*, *management decision*, etc. Hannan has edited a book in Springer and served as a guest editor for a special issue at the *Journal of Theoretical and Applied Electronic Commerce Research*.

Gazi Mahabubul Alam, PhD, FRSA is an internationally recognised Public Policy Analyst with an especial focus to Higher Education. Countries of his work experience include Malaysia, Bangladesh, UK and the USA. He works for both institute of Higher Education and Partner for Development. Before he moved to the University Putra Malaysia, he was a professor at the University of Malaya and East West University. Further to his postgraduate degree in Business Administration, Alam acquired MA in International Education and Development from the University of Sussex and a PhD from the University of Nottingham. He received a distinguished fellowship from the Royal Society of Arts. He has published a number of papers and they received a notable amount of citation in the Scopus and ISI indexed. His paper on private Higher Education received best citation award from the Web of Science.

Alberto Mazzoleni received the PhD Degree in Business Administration in 2001 in the University of Brescia, Italy. He is Associate Professor of Business Administration in the Department of Economics and Management, University of Brescia, Italy. He teaches Financial Accounting and Crisis management courses in the University of Brescia, Italy. His main areas of research include financial analysis, crisis management and digital transformation, on which several international publications have been focused. He's Associate Fellow of the EuroMed Academy of Business.