International Business Review 31 (2022) 101967

Contents lists available at ScienceDirect

International Business Review

journal homepage: www.elsevier.com/locate/ibusrev

Advanced technologies and international business: A multidisciplinary analysis of the literature

Alan A. Ahi [a,d,*,1], Noemi Sinkovics [b,2,3], Yelnur Shildibekov [c,4,5], Rudolf R. Sinkovics [b,d,6,7], Nikolay Mehandjiev [c,8,9]

[a] University of Helsinki, Viikki Campus, 00790 Helsinki, Finland
[b] University of Glasgow, Adam Smith Business School, West Quadrangle, Gilbert Scott Building, Glasgow G12 8QQ, UK
[c] The University of Manchester, Alliance Manchester Business School, Booth Street West, Manchester M15 6PB, UK
[d] LUT University, Skinnarilankatu 34, PL 20, 53851 Lappeenranta, Finland

ARTICLE INFO

Keywords:
Advanced technology
Industry 4.0
Digitalization
Global value chains
International business
Information and communication technology (ICT)
Internet
Artificial intelligence (AI)
3D printing

ABSTRACT

Advanced digital technologies, such as the Internet of Things, blockchain, big data analytics and augmented reality, are gradually transforming the way multinational firms do business. Due to the extent of this transformation many scholars argue that the integration of these technologies marks the commencement of the fourth industrial revolution (Industry 4.0). However, the question how these advanced technologies impact international business activities needs further attention. To this end, we adopt a multidisciplinary approach to review the related literature in international business (IB), general management, information systems, and operations research. We include the two latter fields, because advanced technologies have received more attention in these bodies of literature. Based on our analysis, we discuss the implications of these technologies for international business. Further, we highlight the drivers of technology utilisation by multinational firms and likely outcomes. We also provide future research avenues.

1. Introduction

Advanced digital technologies (*hereafter*, advanced technologies)[10] are developing rapidly. Thus, they are impacting nearly every industry by changing the way firms operate in the global economy (Alcácer, Cantwell, & Piscitello, 2016). Specifically, these technologies shape how firms integrate their geographically dispersed strategic partners, specialised suppliers and customer bases into complex structures, referred to as global value chains (Kano, Tsang, & Yeung, 2020). Further, the adoption of advanced technologies is associated with greater access to international markets and increased international opportunity recognition (Dillon, Glavas, & Mathews, 2020; Sinkovics, Sinkovics, & Jean, 2013). Utilizing advanced technologies may reduce transaction costs (Chen & Kamal, 2016), alter the geographic span and density of global value chains (Hannibal & Knight, 2018; Laplume, Petersen, & Pearce, 2016) and facilitate the international collaboration of firms (Autio,

* Corresponding author at: University of Helsinki, Viikki Campus, 00790 Helsinki, Finland
E-mail addresses: alan.ahi@helsinki.fi (A.A. Ahi), noemi.sinkovics@glasgow.ac.uk (N. Sinkovics), yelnur.shildibekov@gmail.com (Y. Shildibekov), rudolf.sinkovics@glasgow.ac.uk (R.R. Sinkovics), n.mehandjiev@manchester.ac.uk (N. Mehandjiev).
[1] https://orcid.org/0000–0003-1039–5408
[2] https://www.sinkovics.com/noemi
[3] http://orcid.org/0000–0002-5143–6870
[4] http://www.research.manchester.ac.uk/portal/yelnur.shildibekov.html
[5] https://orcid.org/0000–0001-8796–0837
[6] http://www.sinkovics.com/rudolf
[7] https://orcid.org/0000–0002-4471–5054
[8] http://www.research.manchester.ac.uk/portal/n.mehndjiev.html
[9] https://orcid.org/0000–0003-2229–4268
[10] Instead of using the terms *information and communication technology* (e.g., Chen & Kamal, 2016) or *emerging technology* (e.g., Fotaki, Voudouris, Lioukas & Zyglidopoulos, 2020; Hannibal & Knight, 2018), we use *advanced technology* as an umbrella term that includes a number of digital technologies being increasingly adopted by international firms for various value creating and value capturing purposes.

https://doi.org/10.1016/j.ibusrev.2021.101967
Received 14 August 2020; Received in revised form 25 October 2021; Accepted 4 December 2021
Available online 9 December 2021

Mudambi, & Yoo, 2021). Big data analytics, three-dimensional (3D) printing, advanced robotic systems, cloud computing, augmented and virtual reality and blockchain are examples of technologies that are slowly reshaping global value chains.

To date, most international business (IB) research has mainly focused on the role of the internet in firm internationalisation. Examples include studies on cross-border electronic commerce (e.g., Ahi, Sinkovics, & Sinkovics, 2022; Yamin & Sinkovics, 2006), the effect of digital platforms on IB activities (e.g., Brouthers, Geisser, & Rothlauf, 2016; Li, Chen, Yi, Mao & Liao, 2019) and the role of information and communication technology in connecting offshore service providers from an adverse institutional context to global value chains (Sinkovics, Choksy, Sinkovics & Mudambi, 2019). Further, a limited number of IB studies have considered more specific aspects of advanced technologies. However, these studies do not embrace the entire range of technologies under this umbrella term. For example, Hannibal and Knight (2018) and Laplume et al. (2016) limit their focus to the effect of 3D printing on global value chains. Strange and Zuchella's (2017) pioneering review does not include technologies such as augmented reality, cloud computing and blockchain—although these technologies have important implications for IB actors engaged in global value chains because they can expand and alter the relationships between supply chain partners (Ghadge, Weiss, Caldwell & Wilding, 2020). Therefore, despite the high value of prior reviews and conceptual pieces, IB research needs more insights into advanced technologies and the ways they transform global value chains. We position our study against this background and aim to provide a more holistic overview of how different advanced technologies can progress thinking and research in IB.

To this end, we review the application of these technologies in the context of international business activities in the IB literature as well as other domains. In particular, we focus on relevant studies in the information systems and operations research domains that have paid more attention to advanced technologies. We argue that such a multidisciplinary approach develops the potential for knowledge integration and enhances our insights into the relevance for and applicability of these technologies in IB research (c.f., Cheng, Henisz, Roth & Swaminathan, 2009; Shenkar, 2021; Sinkovics & Reuber, 2021).

We organise the rest of the paper as follows. In the next section, we discuss the conceptualisation of advanced technologies and describe the technologies we examine in this study. In Section 3, we present the method we used to identify and analyse relevant articles. In Section 4, we explain our findings in detail, providing a holistic overview of the applicability of advanced technologies in various global value chain components. We also discuss the antecedents and outcomes of using these technologies for multinational firms. In Section 5, we discuss the implications of our review for future IB research, and then conclude the paper in Section 6.

2. Conceptual background on advanced information and communication technologies

In this section, we provide an overview of nine advanced technologies: big data analytics, the Internet of Things (IoT), 3D printing, autonomous robots, augmented and virtual reality, cloud computing, cybersecurity, simulation and blockchain. Many scholars and commentators argue that the integration of these technologies marks the commencement of the fourth industrial revolution or Industry 4.0 (e.g., Liboni, Luciana, Jabbour, Oliveira & Stefanelli, 2019; Rüßmann et al., 2015; Sony & Naik, 2020; Strange & Zucchella, 2017).[11] This emerging technology framework is based on cyber-physical systems coordinated by wireless and internet-based protocols and standards (He, Meadows, Angwin, Gomes & Child, 2020). The key parameters of Industry 4.0 are big data, advanced analytics, human–machine interface, machine-to-machine communication and digital-to-physical transfer (Brun, Gereffi, & Zhan, 2019). We follow Culot et al.'s (2020) categorisation of Industry 4.0 technologies to describe and conceptualise advanced technologies as in Fig. 1.

The first category includes the IoT and augmented and virtual reality, which are technologies with a high share of hardware components and extended network connectivity. The core IoT concept is that objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with other devices over the internet to achieve an objective (Whitmore, Agarwal, & Da Xu, 2015). For example, the technology can digitally connect physical objects within a supply chain to transmit data and interact with one another (Ben-Daya, Hassini, & Bahroun, 2019; Birkel & Hartmann, 2019). The technology offers more reliability, product utilisation and capability than do traditional product boundaries (Porter & Heppelmann, 2014), and hence provides firms with a competitive edge. Two other technologies in this category are augmented reality and virtual reality. The former refers to a set of technologies that superimpose digital data and images on the physical world, whereas the latter replaces physical reality with a computer-generated environment (Porter & Heppelmann, 2017). These closely related technologies have the potential to change how firms interact with customers, train employees and manage their global value chains (Porter & Heppelmann, 2017).

Technologies with a low share of hardware components but extended network connectivity are cloud computing, cybersecurity and blockchain. Cloud computing 'is a form of outsourced shared-resource computing in which computing is pooled in large external data centres and accessed by a range of customers through the Internet' (Venters & Whitley, 2012, p.179). For large firms, the appeal of the cloud is that they can gain increased control over data centre costs, whereas for smaller firms, the cloud lowers entry barriers to computing and facilitates access to large data centres (Venters & Whitley, 2012). The next, cybersecurity, refers to a set of technologies that help firms mitigate cyber risks, such as data breaches and cyberattacks, and therefore reduce value chain vulnerability (Ghadge et al., 2020). Last in this category is one of the most revolutionary technologies of our time—blockchain. It is also known as distributed ledger technology, and it refers to a list of blocks of encrypted digital ledger information, ordered chronologically (Laplume, 2018). A ledger is similar to a database or spreadsheet that allows any participant in the network to record or monitor transactions (Zheng, Ardolino, Bacchetti & Perona, 2020). Blockchain can lower transaction costs for firms while increasing the transparency and automation of intellectual property ownership and payments (Felin & Lakhani, 2018).

In the third category are big data analytics and simulation with a low share of hardware components and relatively low level of network connectivity. The term big data refers to high-volume, high-velocity, high-variety datasets that require processing capabilities that exceed those of traditional data management approaches (Chen & Zhang, 2014). The use of advanced analytic approaches—such as data mining and statistical analysis—to make sense of such unstructured big data is

[11] We note that a scientific consensus is yet to be reached on whether this is the fourth industrial revolution, with some scholars arguing that this is the diffusion phase of the third industrial revolution known as the information age that began in the latter part of the twentieth century (Alcácer et al., 2016). Whether this is the case is beyond the scope of our research; instead, we aim to highlight how advanced technologies and their integration are modifying global value chains.

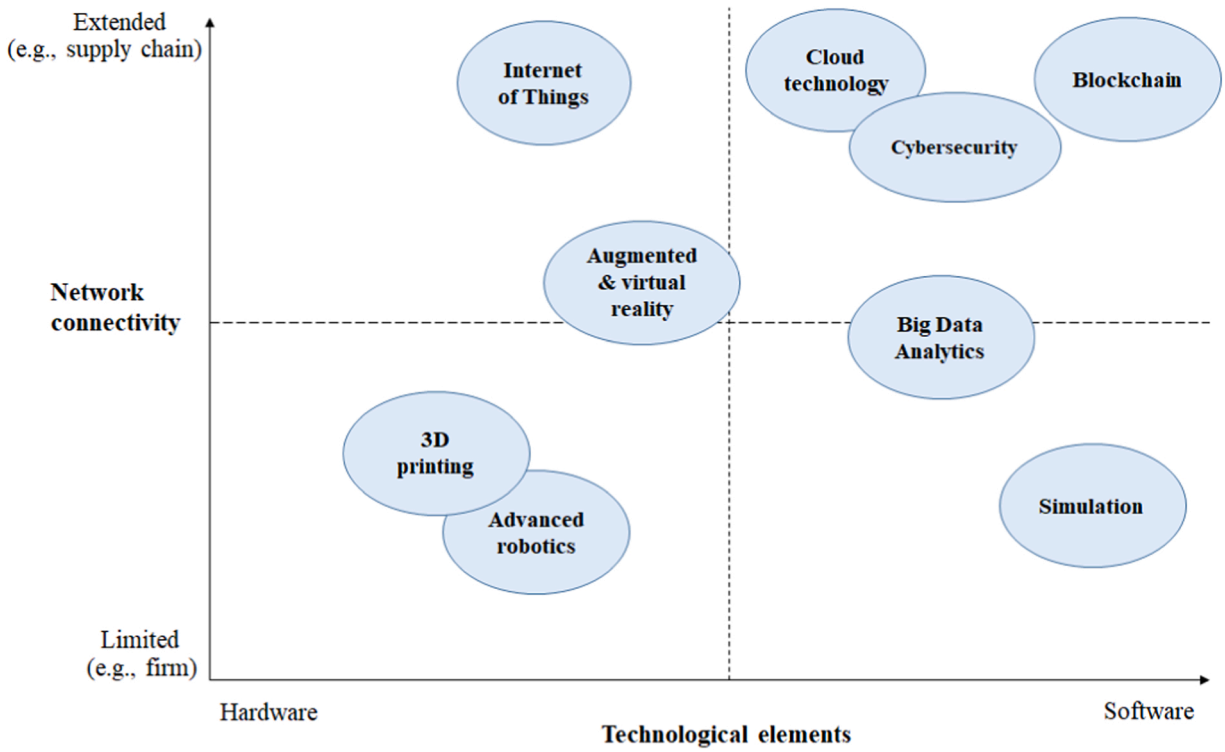

Fig. 1. Categorisation of advanced technologies based on technological elements (hardware v. software) and network connectivity (limited v. extended). Adapted from Culot, Nassimbeni, Orzes, and Sartor (2020).

called big data analytics. Information system scholars broadly conceptualise these techniques as organisational capability and sources of competitive advantage (Dubey, Gunasekaran, Childe, Blome & Papadopoulos, 2019; Gupta & George, 2016). The technology is important for managing global value chains because whereas flows of physical goods and finance were the hallmarks of the previous century, contemporary global business is characterised by intangible flows of data (Luo, 2021b; Nambisan, Zahra, & Luo, 2019). To create value from such a huge amount of data and to coordinate intra- and inter-firm relationships more efficiently, firms need to rely on big data analytics capabilities. The other technology in this category is *simulation*, which is the process of designing a model of a system to describe and analyse its behaviours (Scheidegger, Pereira, de Oliveira, Banerjee & Montevechi, 2018). Simulation technologies allow observing the behaviour of complex processes in a digital environment, and to thus avoid the often costly endeavours of experimenting with the actual system or a physical model (Scheidegger et al., 2018). Among other applications, it is used as a primary problem-solving method for complex production systems (Ferreira, Armellini, & De Santa-Eulalia, 2020).

In the fourth category are 3D printing and advanced robotics, two advanced Technologies that have a high share of hardware components but a low level of connectivity (e.g., Culot et al., 2020). 3D printing—also referred to as 'additive manufacturing'—is an additive process in which layers of material are successively added to build a 3D object (Laplume et al., 2016). Using an initial design based on a digital model, products can be printed at any location via a 3D printer; therefore, suppliers, clients and service firms in the 3D printing industry can be geographically dispersed (Bouncken & Barwinski, 2020; Laplume et al., 2016). Last, we have advanced robots that are automated, versatile machines that increasingly incorporate sensors and machine learning techniques to perform a growing number of tasks (De Backer, DeStefano, Menon & Suh, 2018). Compared with the earlier types of robots, the new types are more autonomous, flexible and cooperative, and are capable of tackling moderately complex assignments and interacting with one another as well as human operators (De Pace, Manuri, Sanna & Fornaro, 2020). Advanced robots can dramatically improve the quality of parts and products and increase productivity in general (De Backer et al., 2018).

3. Review method

We aimed to evaluate existing conceptual and empirical studies on advanced technologies in different streams of literature—information systems, operations research, general management, and IB. To do so, we adopted the systematic analysis method because it offers a transparent process to produce a reliable, comprehensive overview of the literature on a subject (Petticrew & Roberts, 2008). It also ensures replicability for future research and allows exploration and synthesis (Tranfield, Denyer, & Smart, 2003). To conduct our search, we adopted the following approach.

Given that journals in information systems and operations research have numerous publications on advanced technologies, we decided to focus on a selected set of journals. We included leading journals of each discipline because they attract researchers to publish their high-quality studies (cf. Kano, 2020). We based our choice on the AJG/CABS, 2018 journal ranking and selected high-ranking journals, that is, those at 3- and 4-star levels (CABS, 2018). Moreover, we consulted journal ranking articles, particularly in the operations research domain (Petersen, Aase, & Heiser, 2011) and information systems (Willcocks, Whitley, & Avgerou, 2008). We also grounded our choice on existing literature reviews in the fields of IB and management (e.g., Pisani, Kourula, Kolk & Meijer, 2017). Further, we used journal classification and ranking lists by Harzing (2020) and Tüselmann, Sinkovics, and Pishchulov (2016) that rank journals and categorise them into fine-grained disciplinary areas. These steps allowed us to select the top journals of the disciplinary areas, as listed in Appendix A, and to identify impactful, high-quality articles.

Then, we conducted a database search in the ISI Web of Science to identify studies that had keywords relating to advanced Technologies. As regards information systems and operations research, we limited our

search to literature review articles, again, because of the large number of empirical and conceptual articles in these fields. Focusing on literature review articles also allowed us to access a reliable overview of the extant knowledge on the subject and prevent fruitless repetition (Tranfield et al., 2003). Concerning articles in the IB and general management domain, we extended our search to empirical and conceptual articles. This multidisciplinary search yielded a representative sample of the current state of knowledge regarding advanced Technologies within the chosen fields (see Appendix A for the number of articles retrieved from each disciplinary area and journal and Appendix B for our search procedure (cf. Sinkovics & Reuber, 2021)).

To conduct the analysis, instead of employing a deductive procedure based on a predetermined analytical framework, we adopted an inductive approach of theme identification based on interpretative synthesis and evaluation (cf. Jones, Coviello, & Tang, 2011; Sinkovics & Reuber, 2021). We followed the thematic coding principles used in qualitative research to identify themes from our data, where the data were the articles (Bouncken, Qiu, Sinkovics & Kürsten, 2021; Thorpe, Holt, Macpherson & Pittaway, 2005). This approach is in line with the principles of partial pattern-matching, where a systematic inductive approach is adopted to identify patterns—concepts or themes—from data (Sinkovics, 2018). The approach allows researchers to follow a process of matching observed patterns to theoretical patterns (Trochim, 1989). Generally, in pattern-matching, researchers have an active role, yet must also adopt detailed protocols and procedures to ensure analytical rigour and clarify their thought processes (Bouncken et al., 2021; Sinkovics, 2018).

To aid the data analysis, we adapted the widely used 'Antecedents–Phenomenon–Outcomes' logic (see e.g., Pisani et al., 2017; Sinkovics & Reuber, 2021). This logic helped us to systematically analyse and compare articles from different disciplines. We used this approach because it focuses on the relationships between constructs (latent variables not directly measured) that are important in theory building (cf. Bouncken & Barwinski, 2020; Sinkovics & Reuber, 2021). In our analysis, the category of antecedents includes themes that are drivers of, or prerequisite to, using advanced technologies. In the phenomena category, which we termed *areas of use*, we collected themes relating to different global value chain components affected by these technologies. Last, the outcome category comprises the advantages of using these technologies in global value chains. Although we acknowledge the dark side of using advanced technologies, the reason we focus only on their advantages is that most studies in our sample have discussed the benefits of these technologies. Nevertheless, we return to possible disadvantages in the discussion in Section 5.

4. Findings

4.1. Themes, theories, and key findings of disciplinary areas

In this section, we conduct a theme-based analysis of the articles that belong to each of the disciplinary areas, as summarized in Table 1. To categorize the articles within each discipline, we first identify the key technology studied. We then describe the main themes of the articles, the theoretical framework adopted, a summary of the key findings obtained and cite the representative articles.

In operations research, not surprisingly most of the research focuses on the application of advanced technologies in managing supply chains. Many articles, for example, discuss the implications of big data analytics for supply chain management (e.g., Aryal, Liao, Nattuthurai & Li, 2018; Brinch, 2018; Wang, Gunasekaran, Ngai & Papadopoulos, 2016). Compared with other disciplines, the range of technologies studied is broader. In addition to big data analytics – which has received considerable attention in other disciplines too – operations research scholars have also focused on the application of the IoT, blockchain, cybersecurity and cloud. Some have also reviewed Industry 4.0 generally, attempting to integrate related technologies into a specific context such as human resource management (e.g., Frederico, Garza-Reyes, Anosike & Kumar, 2020; Liboni et al., 2019).

Concerning theories used in operations research, scholars have mostly adopted value theory and the resource-based view as the main theoretical frameworks. Value theory suggests that a resource—such as expertise in big data analytics—is valuable if it enables a firm to improve its value-creating activities (Bowman & Ambrosini, 2000; Brinch, 2018). According to the resource-based view, for a firm to improve its performance—e.g., by utilizing big data—organizational resources and management competences matter too (e.g., Akhtar, Frynas, Mellahi & Ullah, 2019; Barney, 1991). Overall, what is noticeable in operations research is that a large number of studies do not explicitly adopt a particular theory, nor do they review the theories used in previous research to explain their findings systematically (e.g., Ghadge et al., 2020). Thus, one can argue that there is a 'theoretical deficit' in many of these studies (cf. Kano et al., 2020).

In information systems, like operations research, big data analytics has received much attention. The focus has been on how organizations can use big data analytics to create value (e.g., Guenther, Mehrizi, Rezazade, Huysman & Feldberg, 2017; Gupta & George, 2016; Wiener, Saunders, & Marabelli, 2020). Thus, the most frequently applied theoretical perspective is value theory. Information systems scholars also adopt the resource-based view, arguing that firms need to develop big data analytics capabilities to create and capture value. 3D printing and cloud technologies have also been studied in information systems research. For example, Goldberg, Deane, Rakes, and Rees (2021) explain the relationship between a firm's shareholder wealth and 3D printing-related announcements, while Venters and Whitley (2012) discuss the general impact of cloud technology on organizations.

The articles in general management cover a limited range of technologies. Big data analytics is the technology that has received much attention. A closer look reveals that a special issue in the British Journal of Management on big data and business performance in 2019 can explain the spike. These studies argue that in the era of big data, successful firms rely predominantly on data analytics skills and capabilities to create value. Other articles in this research domain have investigated how data analytics and artificial intelligence influence the meaning of work and the management of organizations (e.g., Fayard, 2021; Raisch & Sebastian, 2021; Stein, Wagner, Tierney, Newell & Galliers, 2019). The consensus is that, at least in the foreseeable future, these technologies may not replace humans fully but will change the way organizations are managed. Management researchers also examine the ethical issues relating to the use of big data analytics, underscoring concerns regarding security and privacy issues (e.g., Fotaki et al., 2020; Hajli, Shirazi, Tajvidi & Huda, 2021). In addition to data analytics, blockchain has been scrutinised too. For example, Chen, Pereira, and Patel (2021) compare centralised, semi-decentralised and decentralised platform governance, arguing that semi-decentralisation is a higher-performing governance structure. Finally, in general management, there is consistent use of a variety of theories, such as the resource-based view and dynamic capability.

Most research in IB – even work that specifically mentions some of the advanced technologies – adopts a more general approach, as opposed to examining the implication of an individual technology for international business (e.g., Banalieva & Dhanaraj, 2019). In comparison to other disciplines, the coverage of big data analytics is limited, although technologies such as 3D printing have received more attention. IB scholars argue that 3D printing has the potential to shift the location of production activities and shorten global value chains while also increase their geographic dispersion (Hannibal & Knight, 2018; Laplume et al., 2016). One article, by Steenkamp (2020), attempts to explain the application of the IoT in international marketing, arguing that the technology has important implications for managing a firm's brand in global markets. Instead of focusing on a specific technology, other IB scholars explore the influence of Industry 4.0 on backshoring initiatives – relocating manufacturing activities to the home country (Dachs,

Table 1
Key themes, theoretical frameworks and insights of each disciplinary area.

Disciplinary Area	Technology Studied	Key Themes	Main Theoretical Frameworks	Key Insights	Representative Studies
Operations research	Big Data Analytics	Value of big data in logistics and supply chain management and in transforming business processes	Value theory; Business process theory	Value discovery, value creation and value capture represent different value dimensions, which bring different perspectives on the value of big data. Big data can permit real-time access to information, improving decision-making and emergency service response. Big data can be used to analyse customer service and supply chain network and performance; it can also enable integrated enterprise business analytics.	Aryal et al. (2018);Brinch (2018);Wamba, Akter, Edwards, Chopin, and Gnanzou (2015); Wang et al. (2016)
	IoT	IoT and the potential for innovative product-service systems	Value theory	The IoT aided servitisation enables organisations to extend their value chains to better serve their customers, resulting also in increased profitability	Rymaszewska, Helo, and Gunasekaran (2017)
		IoT in supply chain management and associated risks	No theory used/ mentioned	Major research themes in the IoT includes supply chain design, model, and performance. In managing supply chains using the IoT, companies face several economic, social, technological, and political challenges.	Aryal et al. (2018);Birkel and Hartmann (2019)
	Blockchain	Blockchain in supply chain management	Principal agent theory; Transaction cost theory; Resource-based view; Network theory	Blockchain has value for supply chain management in four areas: extended visibility and traceability, supply chain digitalisation and disintermediation, improved data security and smart contracts. Blockchain has been used in the electric power industry but also has the potential to disrupt traditional industries (e.g., health care, transportation, and retail).	Queiroz, Telles, and Bonilla (2020);Treiblmaier (2018); Wang, Han, and Beynon-Davies (2019a)
	Cybersecurity	Managing cyber risk in supply chains	No theory used/ mentioned	There is a strong link between the adoption of information technology and supply chain security systems	Ghadge et al. (2020)
	Cloud	Cloud technologies to support supply chain operations	Innovation Diffusion Theory; Information Processing View	Business process complexity, entrepreneurial culture, and the degree to which existing information systems embody compatibility and application functionality influence the propensity to adopt cloud technologies.	Wu, Cegielski, Hazen, and Hall (2013)
	Industry 4.0	Industry 4.0 and supply chain management	Resource-based view	Introducing the Supply Chain 4.0 concept and identifying research directions. Lack of a digital strategy and resource scarcity are prominent barriers in implementing Industry 4.0.	Frederico et al. (2020);Raj, Dwivedi, Sharma, Jabbour, and Rajak (2020)
		Industry 4.0 and human resource management	No theory used/ mentioned	Industry 4.0 is changing work conditions, work environment and demand for skills	Liboni et al. (2019)
Information systems	Big Data Analytics	Realizing value from big data Implications of Intelligent Automation for knowledge and service work	Value theory	Organizations need to continuously realign work practices, organizational models, and stakeholder interests to reap the benefits from big data. Using big data analytics, organisations are automating tasks. Yet, intelligent automation still involves human contribution.	Guenther et al. (2017);Wiener et al. (2020);Coombs, Hislop, Taneva, and Barnard (2020)
		Development of a big data analytics capability	Resource-based view	Tangible resources (access to data and technology), intangible resources (organizational culture and learning) and human resources create big data analytics capabilities.	Gupta and George (2016)
		Combination of big data and classical management in firm success	Information theory	The combination of big data and classical management models can bring success for big data commerce.	Qi, Zhang, Jeon, and Zhou (2016)
	3D printing	A firm's shareholder wealth and 3D printing-related announcements	Theory building	The stock market places a positive value on announcements associated with rapid prototyping or ad hoc customization applications, while the reaction to announcements related to the use of 3D printing technology for mass production is far less positive.	Goldberg et al. (2021)
	Cloud	Impact of cloud technology on organizations	Theory building	Firms' desires for cloud is categorized into two main dimensions: technology (variety	Venters and Whitley (2012)

(*continued on next page*)

Table 1 (*continued*)

Disciplinary Area	Technology Studied	Key Themes	Main Theoretical Frameworks	Key Insights	Representative Studies
				and scalability) and service (efficiency and simplicity).	
General management	Big Data Analytics	Top management competencies (e.g., quantitative-focused education), relationship-based business networks and environmental sustainability	Relationship-based business networks theory; Social network theory	Management competencies are the key determinants for building relationship-based business networks; they mediate the correlation between the competencies and environmental sustainability. Directly, the competencies also play a vital role in environmental practices.	Akhtar, Khan, Frynas, Tse, and Rao-Nicholson (2018)
		Big data analytics and firm performance	Resource-based view; Configuration theory; Institutional theory; Organizational culture	Big data-savvy teams' skills are the key determinants for big data-driven actions, which can contribute to performance. Big data analytics may enhance performance when combined with other organizational elements such as resources and capabilities. Data-driven supply chain orientation positively influences financial performance and innovation.	Akhtar et al. (2019);Dubey et al. (2019);Wang, Kung, Gupta, and Ozdemir (2019b);Yu, Jacobs, Chavez, and Feng (2019)
		Big data analytics capabilities, innovation capabilities and value creation	Resource-based view; Dynamic capabilities view; Knowledge-based view	Big data analytics capabilities enable firms to generate insights that strengthen dynamic capabilities, which positively impact innovation capabilities. It is not the data or data scientists that generate value; rather, it is the process of data management, where managers can execute data insights promptly.	Mikalef, Boura, Lekakos, and Krogstie (2019);Zeng and Glaister (2018)
		Big data analytics, artificial intelligence, management of organizations and the meaning of work	Labour process theory; Paradox theory	Big data analytics and related technologies (e.g., machine learning) are influencing society and individuals, reshaping the meaning of work. These technologies may not fully replace humans but can bring fundamental changes to the management of organizations.	Fayard (2021);Ferras-Hernandez (2018);Raisch & Sebastian, (2021);Stein et al. (2019)
		Big data analytics, information privacy and other ethical issues in adopting emerging technologies	Resource-based view; Dynamic capabilities view; Corporate governance deviance theory; Legitimacy theory	There are significant concerns regarding security and privacy issues associated with online activities in the era of big data. Emerging technology firms over-conform regarding both corporate governance and ethical practices, yet, they have lower legitimacy levels compared to their non-emerging technology counterparts. Input incompleteness is one of the biases of machine learning. Domain expertise of humans is needed to mitigate the bias.	Choudhury, Starr, and Agarwal (2020);Fotaki et al. (2020);Hajli et al. (2021)
	Blockchain	Blockchain and the value of centralized, semi-decentralized, and decentralized governance	Mechanism design theory	Digital platforms of the infrastructure layer—relative to those of the application layer—tend to become more decentralized. This tendency can be offset by experienced leaders to achieve semi-decentralization.	Chen et al. (2021)
		Blockchain, distributed trust and boundaries of organizations	Organizational ecology; Institutional theory; Transaction cost theory	Because of the novel trust mechanisms of blockchain, some of the core trust assumptions of organizational theories need to be updated.	Seidel (2018)
International Business	Big Data Analytics	Big data management capabilities and employee ambidexterity	Knowledge-based dynamic capabilities view	Big data management allows utilising external knowledge (generated from global users) under resource-constrained environments. Its related capabilities can also be antecedents to the ambidexterity of individual employees.	Shamim, Zeng, Choksy, and Shariq (2020)
		Big data, firms' strategic orientations and business performance	Strategic orientations framework	Big Data has a strategic focus; its usage enhances international performance through strategic orientations.	Gnizy (2019)
	3D printing	Shared digital identity, knowledge ties and the 3D printing industry	Theory building	In the nascent 3D printing industry, firms exchange explicit and tacit knowledge globally, even in weak ties. The exchanges seem to be grounded in identification processes with digital technology forming a shared digital identity.	Bouncken and Barwinski (2020)
		Additive manufacturing and the location of international business	Global factory	Additive manufacturing will put greater emphasis on customization, more specialized products, and small-batch production, leading to a substantial shift in	Hannibal and Knight (2018); Laplume et al. (2016)

(*continued on next page*)

Table 1 (*continued*)

Disciplinary Area	Technology Studied	Key Themes	Main Theoretical Frameworks	Key Insights	Representative Studies
				the location of production and the structure of ownership and governance. Additive manufacturing has the potential to partially reverse the trend towards global specialization of production systems into elements that may be geographically dispersed and closer to the end-users.	
	IoT	IoT and global brand building and management	No theory used/ mentioned	The IoT has profound implications for building and managing a firm's brand in international markets in the future.	Steenkamp (2020)
	Industry 4.0	Backshoring strategy and the adoption of Industry 4.0	Transaction cost theory; Resource-based view; Eclectic theory	Backshoring is associated with the adoption of Industry 4.0 when the firm's priorities are high quality and the reduction of costs tied to non-conformance. I4.0 supports backshoring because it provides higher productivity and flexibility which offers an incentive for firms to locate production close to their home country.	Ancarani, Di Mauro, and Mascali (2019);Dachs et al. (2019)
		Digitalization, firm-specific assets, the governance choices in cross-border transactions	Internalization theory; Network economics	With rising digitalization, the network plays a dual role – as a governance mode and as a strategic resource.	Banalieva and Dhanaraj (2019)

Kinkel, & Jaeger, 2019). IB researchers adopt theories such as the knowledge-based view, the resource-based view, internalization theory, and transaction cost analysis to explain their findings. These theories are naturally more fitting to the context of international business activities and global value chains. For example, to explain how advanced technologies are shaping the management of global value chains, theories such as internalization and transaction cost analysis are more relevant, as they explain interfirm and intrafirm collaboration and trade, and cover issues such as controlling or monitoring a partner firm.

In our sample of articles, some technologies such as simulation, autonomous robots and augmented and virtual reality have not been studied individually. However, articles that focus on Industry 4.0 at a general level also cover these technologies. Further, although we identified some articles in our initial screening process that discussed these specific technologies, they either did not fit our inclusion criteria or were published in journals not selected for analysis. For this reason, we did not include them in our sample. Nevertheless, we used the insights from these articles to inform our analysis. From a temporal perspective, most studies were published in the past few years, highlighting the fast and recent rise of interest in advanced technologies. Particularly noticeable is a sharp increase in the number of publications in the general management and IB domain since 2016, which indicates the increasing relevance of these technologies in managing organizations and their international business activities.

4.2. Areas of use

Because our analysis reveals that cybersecurity and simulation technology have received scant attention in the IB and management literature, we exclude these two technologies from the discussion here. However, we revisit both when discussing future research avenues in Section 5, in which we explain the reasons they are important and relevant for IB and global value chain research. In the rest of this section, we describe the applicability of other advanced technologies in various global value chain components (for a summary of our findings, see Table 2).

4.2.1. Location choice

IB scholars have long studied why multinational firms choose specific locations to conduct their activities (e.g., Dunning, 1980; Rugman & Verbeke, 2004). These firms seek the most advantageous geographic configuration of the value chain; that is, they consider where activities should be located and how they should be distributed to maximise the value created in global value chains (Kano et al., 2020). Traditionally, IB scholars have argued that firms choose a location to achieve economies of scale (i.e., increase production) and to simultaneously decrease transportation costs (Alcácer et al., 2016). Other advantages discussed were the availability of natural resources, labour and supporting government policies (Dunning, 1980). More recently, IB studies have highlighted the role of industrial clusters, connectivity and global cities in choosing a desirable location (Alcácer et al., 2016; Kano et al., 2020).

However, advanced technologies can also shape location choice. Advanced robotics is an example. Robots have become more versatile and mobile and are capable of performing complex tasks with more efficiency than before (De Backer et al., 2018; Liboni et al., 2019). With the ability to interact with one another and work alongside humans, they can now provide the flexibility needed to manufacture customised products at low costs (Ancarani et al., 2019; Rüßmann et al., 2015). These features, coupled with the rising labour costs in emerging markets, have affected the economics of locating manufacturing activities (De Backer et al., 2018; Strange & Zucchella, 2017). Instead of locating these activities far from home, firms in developed economies can choose manufacturing at home as a viable alternative (Dachs et al., 2019). Consequently, some firms have relocated manufacturing activities back to their home country (Dachs et al., 2019). Such backshoring initiatives can lead to reduced costs and enhanced quality control and customer responsiveness (Ancarani et al., 2019).

Moreover, 3D printing technology has the potential to reshape the geographic span and density of global value chains (Laplume et al., 2016). It enables firms to design products anywhere in the world, because to do so, they require only a 3D printer, a computer and relevant software. Therefore, manufacturing can be undertaken in the home country and closer to final customers (Hannibal & Knight, 2018). The technology's ability to compress supply chains has the potential to reduce the international flows of intermediate goods and services, with consequent savings in delivery times and transportation costs (Strange & Zucchella, 2017). As the technology diffuses, in addition to local and online print shops, households can also engage in manufacturing activities (Laplume et al., 2016). Thus, 3D printing technology is associated with the development of value chains that are shorter and more dispersed and local (Laplume et al., 2016). The technology also increases the economy of scope (i.e., production of a greater variety of products per unit of capital), while decreasing transportation costs and the carbon footprint of production activities (Garmulewicz, Holweg, Veldhuis &

Table 2
Implications of advanced technologies for international business[a].

Global value chain components	Advanced technologies	Implications for global value chains
Location choice	Robotics	Relocating manufacturing activities back to the home country
	3D printing	Creating shorter, more local value chains
Governance structure choice	Blockchain	Improving the extent of information processed by foreign partners
	Internet of Things	Facilitating communication within and between firms Allowing quick response to changes
	Blockchain + Internet of Things	Facilitating payments
	Big data analytics	Processing data to mitigate risks Making better decisions in selecting partners Efficiency in drafting contracts Reducing the employee monitoring cost and the potential for opportunistic behaviour
Digital platform networks	Cloud computing	Improving the management of worldwide relationships
	Blockchain	Balancing openness with control and hence improving the platform performance
Exchange of knowledge	Cloud computing	Enhancing knowledge transfer and sharing Providing service platforms to coordinate regional manufacturing activities
	Cloud computing + Internet of Things + Big data analytics	Providing data on the status of objects Storing data and ensuring easy access to data Turning data into applicable knowledge using analytics
	Augmented reality	Providing a richer, more contextualised knowledge exchange
	Advanced Technologies generally	Developing a shared digital identity that facilitates the exchange of knowledge
Human resource management	Augmented reality + Virtual reality	Training employees
	Big data analytics	Improving employee monitoring and evaluation in firms Supporting more informed decisions to meet employees needs

[a] Technologies not mentioned in the literature in relation to global value chains are not listed in this table.

Yang, 2018).

4.2.2. Governance structure

A governance structure is an institutional context within which economic activities occur (Williamson, 1979). By choosing a certain form of governance structure, multinational firms attempt to organise their global value chain activities efficiently. They do so by externalising or internalising activities (Banalieva & Dhanaraj, 2019; Buckley & Strange, 2011). Technological advancements generally affect this choice by facilitating the cross-border coordination of economic transactions and simplifying the access to international talent pools (Kano, 2018). Nevertheless, in managing their global value chain, multinational firms face numerous challenges, some of which advanced technologies can specifically address.

One significant challenge is monitoring and controlling foreign partner firms in the absence of complete trust (MacDuffie, 2011). Blockchain technology can be used to improve the extent of information shared and processed by foreign partners (Nambisan et al., 2019). The technology creates an unchangeable decentralised public ledger and thus enables firms to store and share records of past behaviour (Cuypers, Hennart, Silverman & Ertug, 2021). Thus, it lowers transaction costs and improves the efficiency of markets through less costly verification and by reducing the need for internal control of activities (Catalini & Gans, 2016).

Communication among different value chain actors (e.g., suppliers, assemblers, service provides, customers and lead firms) can represent another challenge in the governance of global value chain networks. IoT can facilitate governance by improving supply chain decision processes (Strozzi, Colicchia, Creazza & Noè, 2017; Zheng et al., 2020). This improvement is possible owing to its ability to provide real-time information on all stages of the supply chain—from sourcing material to delivering finished products—and to thus offer early warning signals for required action (Ben-Daya et al., 2019). This more informed decision process enhances internal communication within the lead firm as well as its interactions with global partners. Consequently, firms can respond rapidly to changes in value chain activities (Ben-Daya et al., 2019). Further, since the IoT provides reliable data on product usage and performance, it allows manufacturing firms to communicate more clearly with end customers and extend their offerings to include services (Rymaszewska et al., 2017).

A combination of blockchain and the IoT can also facilitate payments between suppliers and buyers. For example, at a buyer's warehouse, the IoT can provide tracking devices that can be connected to blockchain. Once the cargo is delivered to the buyer, they can check whether it meets all their conditions (e.g., quality and quantity of the cargo) and then use the smart contract[12] features within the blockchain to automatically release the payment to the supplier (Pournader, Shi, Seuring & Koh, 2020).

Big data analytics can also shape firms' governance structure. When combined with the IoT, big data analytics enables real-time capturing, storing, processing and sharing of data, which in turn increase the transparency within supply chains and facilitate faster, more effective decisions (Aryal et al., 2018). The fast and improved access to relevant data fosters the re-evaluation and, if necessary, the reshaping of global value chains to mitigate risks and potential disruptions (Sheng, Amankwah-Amoah, Khan & Wang, 2021). Big data analytics can also aid the forecasting of demand for products, plant capacities, shipping costs and the fixed operations cost at each potential location (Wang et al., 2016). Further, it can improve the partner selection process through sophisticated methods, such as data mining (Chai & Ngai, 2020) or multi-criteria decision-making techniques (Wang et al., 2016), to analyse the partner's ability to perform particular core tasks (Kano, 2018).

A carefully drafted contract is another mechanism that reduces market uncertainty and lowers the cost of control (Cuypers et al., 2021). The availability of big data on contracts combined with analytics technologies, such as machine learning to analyse data, opens up possibilities for partial or even full automation of contract drafting, review and analysis (Betts & Jaep, 2017; Cuypers et al., 2021; Mills, 2016). Because of automation, enforcing contracts will be considerably more efficient and market-based transactions will be less costly. Hence, firms may tend to increase their outsource activities (Cuypers et al., 2021). Nevertheless, big data analytics may have a profound effect on internalising activities. The application of the technology results in substantial improvement and expansion in the automation of tasks and decision-making in firms (Jarrahi, 2018; Schneider & Leyer, 2019). Therefore, it reduces the need for, and cost of, monitoring and evaluating employees and lowers the likelihood of their engaging in

[12] These digital smart contracts encompass a short programming code stored inside a blockchain; they are enforced once verified by all parties in a transaction (Macrinici, Cartofeanu, & Gao, 2018).

opportunistic behaviour (Cuypers et al., 2021).

4.2.3. Digital platform networks

Advanced technologies have important implications for firms that govern the structure of their value chains through digital platform networks. These platforms are digital systems that facilitate communication, innovation and interaction to support economic transactions (Cennamo, 2019; Chen et al., 2021; Constantinides, Henfridsson, & Parker, 2018). They create a global marketplace that includes actors such as the orchestrating firm (or the platform owner), online payment providers, sellers and logistics providers (Li et al., 2019). Apple's iOS, Google's Android, eBay, and Amazon's marketplace are examples of such platforms.

Within the digital marketplace, cloud computing services can be a source of ecosystem-specific advantages for the platform owner (Li et al., 2019). Cloud services enhance the business agility needed to deliver digital, real-time, experience-focused services (Luo, 2021b). Rather than investing heavily in building information technology (IT) infrastructure, businesses can access a seamless package of storage and business software through cloud computing (Lund et al., 2019). For example, Amazon provides IT capabilities for its online third-party traders via cloud services (Li et al., 2019). Firms can also use cloud-based services to create and deliver value to international customers and foster the management of worldwide resources and relationships (Luo, 2021b). For instance, Amazon uses cloud-based voice services to enhance customer experience (Li et al., 2019).

Blockchain technology also has implications for digital platform governance. Platform owners can use blockchain to implement a semi-decentralised governance structure capable of balancing openness with control (Chen et al., 2021), as opposed to a fully centralised infrastructure governed by a single entity (e.g., a bank).

4.2.4. Exchange of knowledge

The greatest value in global markets is derived from intangible activities that enable the firm to create and internalise knowledge and to access the specialised knowledge of its global partners (Mudambi, 2007, 2008). Internalising such tacit and complex knowledge is the core of a modern multinational firm's advantage and international competitiveness (Banalieva & Dhanaraj, 2019; Tallman & Chacar, 2011). The challenge for lead firms is to transfer this knowledge by maintaining, enabling and controlling information and communication flows among geographically dispersed units (Banalieva & Dhanaraj, 2019; Kano, 2018). Several advanced technologies can facilitate this task.

Cloud services can enhance knowledge transfer and sharing. For example, private cloud environments can be forms of virtual desktops through which geographically dispersed employees have easy access to firm client analytics (Luo & Bu, 2016). For the transfer of explicit knowledge, cloud-based blueprints can identify, store and code relevant information that can be easily retrieved by search functions (Luo & Bu, 2016). Thus, cloud technology can provide the opportunity to create a service platform to coordinate regional value chain activities. Further, the IoT creates the ability to monitor and control objects by providing data on machines, freights, and delivery trucks. Among other applications, the IoT can, for example, enable shipment tracking from one location to another (Lund et al., 2019). Through cloud technology, firms can then store and access these data while analytics techniques allow them to turn the data into applicable knowledge about the status of their supply chains. Moreover, advanced technologies allow a richer, more contextualised exchange of knowledge. For example, augmented reality can be useful for understanding and applying a specific digital technology in intra- and inter-firm transfer of knowledge.

Further, and more generally, using advanced technologies requires advanced skills, such as programming, which are often impervious to digitalisation and can only be transferred through socialised communities (Banalieva & Dhanaraj, 2019). Research results suggest that employees with such skills—for example, those knowledgeable about 3D printing—see themselves as being part of a special community (Bouncken & Barwinski, 2020). They may develop a strong identification with the technology and share their understanding, enthusiasm and values with peers even when located in different firms and international locations (Anthony, Nelson, & Tripsas, 2016; Bouncken & Barwinski, 2020). This leads to a shared digital identity that makes possible the open and risky exchanges of explicit and tacit knowledge among firms (Bouncken & Barwinski, 2020).

4.2.5. Human resource management

Human capital has been an important component in the transfer of knowledge and capability to foreign subsidiaries (Banalieva & Dhanaraj, 2019). To leverage their human capital, multinational firms must train international employees. These firms can use the combination of augmented reality and virtual reality to train employees across the globe. For example, augmented reality and virtual reality enable geographically dispersed experts to collaborate in real-time on holograms of product prototypes (Porter & Heppelmann, 2017). Virtual reality can also help firms improve the cross-cultural training of their employees. For example, firms can use virtual reality to place employees in situations in which they can virtually experience the way people from another culture communicate and behave, and thus learn how to adjust their own behaviours. This learning can mitigate misunderstandings in cross-cultural collaborations by allowing employees to develop an awareness of different cultural contexts (Caligiuri, De Cieri, Minbaeva, Verbeke & Zimmermann, 2020) without a need for physical presence. Virtual reality and simulation also enhance formal training that covers intercultural knowledge and experiential learning (Li, Mobley, & Kelly, 2013; Sit, Mak, & Neill, 2017). The coronavirus disease (COVID-19) pandemic has made virtual international collaboration and training an integral part of international human resource management (Caligiuri et al., 2020), thereby accentuating the significance of these two technologies in this context.

Big data analytics has significant ramifications for monitoring and evaluating employees within firms (e.g., Tambe, Cappelli, & Yakubovich, 2019). Analytics techniques can enable managers to predict the performance of individual employees and teams through mining emails, chats and employee-generated content (Sheng et al., 2021). Moreover, owing to the COVID-19 pandemic, working from home has become a new norm for many employees. Consequently, managing employees while fostering social interactions has become a significant challenge for firms (Sheng et al., 2021). Many office workers worldwide have experienced high levels of stress because of working under these unfamiliar, uncertain conditions (Caligiuri et al., 2020). To address this issue, firms can use 'people analytics'—which uses analytics techniques for talent management—to make more informed decisions by collecting and analysing data on employees' needs, workloads and other stressors (Leonardi & Contractor, 2018; Sheng et al., 2021). On a positive note, the possibility of remote work allows firms to leverage global freelance experts, for example, in domains such as artificial intelligence and big data analytics, particularly if the firm lacks capabilities in these areas (Luo, 2021b). This approach helps firms obtain access to cheaper, faster and more flexible human resources than in-house talent (Manyika, Lund, Bughin, Woetzel, Stamenov & Dhingra, 2016).

4.3. Antecedents of adopting advanced information and communication technologies

To leverage advanced technologies, firms need to have a combination of resources and capabilities in place (Batistic & van der Laken, 2019). For example, big data analytics may not add any value unless there is an appropriate combination of the required IT infrastructure, organisational culture and skilled workforce (Gupta & George, 2016; Wamba et al., 2015). In this section, we provide an overview of the most relevant capabilities that international firms need to possess and must be able to leverage in order to derive benefits from advanced technologies.

4.3.1. Human capital

Human capital is the supply of specialised knowledge and skills that individuals develop over time through education, experience and interactions with peers (Banalieva & Dhanaraj, 2019; Mahoney & Kor, 2015). Human capital can be divided into advanced and generic skills (Simon, 1985). The latter is a general type of knowledge, whereas the former is more industry- or firm-specific (Simon, 1985). To harness the power of advanced technologies, firms need to rely on advanced and unique employee skills (Horváth & Szabó, 2019). For example, to capitalise on big data, firms need data scientists who have expertise in analytics as well as IT (Davenport, Barth, & Bean, 2012). Firms require similar specialised skills to benefit from other advanced technologies, such as cybersecurity, simulation and blockchain. However, the need for specialised skills does not necessarily indicate less dependence on general human capital. To accomplish technology-intensive projects, firms still need to leverage the skills of business-savvy employees since they complement the expertise of those from the IT function (Yeow, Soh, & Hansen, 2018). Thus, firms need technical as well as business skills to enhance their competitiveness (cf. Wang et al., 2019b).

However, technical skills alone cannot provide a long-lasting competitive edge (Dubey et al., 2019). Managerial skills are also necessary to benefit from advanced technologies. These skills are firm-specific and are developed over time as a result of strong interpersonal bonds between organisational members (Bharadwaj, 2000; Mata, Fuerst, & Barney, 1995). Advanced technologies will be of little use if senior managers fail to appreciate the potential of these technologies to reach organisational goals. For example, to create value from big data analytics, managers need to have an in-depth understanding of how and where to apply the insights that data scientists offer (Gupta & George, 2016). Managers can also use big data analytics to devise strategies aimed at developing big data management capabilities among employees (Shamim et al., 2020).

4.3.2. Tangible resources

Tangible resources include financial resources (e.g., equity) and physical assets (e.g., equipment and facilities) (Dubey et al., 2019). To adopt advanced technologies, firms need to have access to the relevant technologies and to have the financial resources to invest in such technologies (Gupta & George, 2016). For example, to use 3D printing or advanced robotics, firms need to have access to 3D printers or advanced robots. Similarly, to create business value through big data analytics, firms need novel technologies—such as NoSQL—to enable the distributed storage and parallel processing of unstructured datasets (Dubey et al., 2019). Other resources that are essential to enable the adoption of advanced technologies include digital infrastructures, such as the internet, data centres and cloud-based services (Constantinides et al., 2018; Dubey et al., 2019; Gupta & George, 2016). Further, firms also need to have sufficient time resources to explore options. For example, to achieve the desired benefits from big data analytics, firms need to spend substantial time exploring the different operating procedures required to implement big data analytics initiatives (Dubey et al., 2019). Therefore, time becomes a critical factor in realising the potential benefits of advanced Technologies (cf. Gupta & George, 2016).

4.3.3. Organisational strategy

Advanced technologies can be both a source of game-changing opportunities and an existential threat to firms (Sebastian, Ross, Beath, Mocker, Moloney & Fonstad, 2020). Technology itself is only part of the complex puzzle that firms must solve to remain competitive in a digital world (Vial, 2019). Firms also need to align selected technologies with their organisational objectives (Henderson & Venkatraman, 1999). Therefore, to create differential value, technological use must be consistent with organisational visions and goals (Mithas, Tafti, & Mitchell, 2013). Similarly, to stay profitable, firms must establish a coherent connection between their business strategy and information systems strategy (Avison, Jones, Powell & Wilson, 2004). Thus, devising appropriate organisational strategies is an important factor in exploiting the benefits of advanced technologies (Vial, 2019).

4.3.4. Organisational culture

Organisational culture has a key role in creating value from advanced technologies. Organisational culture is a set of collective norms, values, beliefs and principles that define appropriate behaviours for various situations (Ravasi & Schultz, 2006). For example, experimenting with advanced technologies requires a firm to cultivate risk-taking behaviours among employees (Vial, 2019). Zeng and Glaister (2018) also showed that a learning- and experiment-oriented organisational culture is likely to help firms create value from big data. Further, to use advanced Technologies, firms must cultivate an evidence-based decision-making culture (Wang et al., 2019b), because such a culture allows firms to make better use of real-time data and make more accurate decisions. Conversely, because of the lack of a supportive organisational culture, employees or managers may resist innovation and new technologies (Horváth & Szabó, 2019).

4.4. Outcomes

IB research has long highlighted the distinct advantages of IT, such as reduced transaction costs, user network economies, speed and scalability, for internationalising firms (Banalieva & Dhanaraj, 2019; Brouthers et al., 2016; Singh & Kundu, 2002). Here, we mention some of the most significant advantages of advanced technologies for international firms that emerged from our analysis.

4.4.1. Environmentally sustainable business

Most traditional manufacturing processes are not environmentally sustainable because they produce substantial waste and unusable surplus material (Strange & Zucchella, 2017). In contrast, technologies such as 3D printing generate little or no waste, with an electronic design that can be optimised to use less material for production (Strange & Zucchella, 2017). Further, many additive manufacturing processes can be reversed, thereby dissolving final products into raw material to be reused (Garmulewicz et al., 2018). Using advanced technologies, firms can manufacture at locations closer to their end customers; therefore, long-distance transportation is not needed, which decreases the carbon footprint of production activities (Garmulewicz et al., 2018). Further, the IoT can connect devices and can therefore provide reliable data about energy flows. Using analytics, the data can be used to develop energy optimisation algorithms to reduce energy consumption (Illa & Padhi, 2018; Zheng et al., 2020). Moreover, using big data analytics, the orchestrating firm in a global value chain can gather sustainability-related data efficiently to forecast, analyse and evaluate economic, environmental and social issues (Wang et al., 2016). Generally, top management competencies, such as quantitative-focused education and the knowledge and experience of advanced technologies, are positively linked to environmental sustainability (Akhtar et al., 2018).

4.4.2. Trust and transparency

Historically, firms have conducted IB in a low-trust environment because of the natural tendency of business actors to engage in opportunistic behaviour. Owing to such behaviours, partner firms do not always share full information, provide an objective assessment of likely outcomes or behave cooperatively (Cuypers et al., 2021). Thus, the lead firm in a global value chain incurs high transaction costs in monitoring foreign partners and writing contracts that limit the interaction risk (Verbeke & Greidanus, 2009). Blockchain technology mitigates this low-trust dynamic by offering novel trust mechanisms (Nambisan et al., 2019; Seidel, 2018). Because the technology enables the recording of past behaviours via a public digital ledger, opportunistic behaviours can be available as searchable information, and this transparency reduces the tendency to behave opportunistically (Cuypers et al., 2021). Therefore, blockchain limits the need for the time-consuming

development of trust over time by fostering reliability in business relationships (Cuervo-Cazurra, Doz, & Gaur, 2020). This technology addresses a crucial problem in managing global supply chain activities, because trust is a key factor in building and sustaining relationships along the supply chain (Kwon & Suh, 2005).

Further, blockchain-based contracts can potentially decrease value chain risks, uncertainty and transaction costs, because they provide greater assurance, lower information asymmetry and real-time information (Contractor, 2021; Schmidt & Wagner, 2019). Blockchain makes the storage and transfer of signed documents secure because it can provide proof of identity and enables supply chain members to record, validate and track transactions in their supply chain (Mainelli, 2017). The technology can also facilitate the validation of information using peer-to-peer validation technology. These features help firms select partners in foreign markets that have a clean record of inter-firm cooperation, with important implications also for selecting a trustworthy trade association in a host market (Brache & Felzensztein, 2019) or a joint venture partner.

Some other advanced technologies can complement blockchain to increase trust further. When combined with blockchain, the IoT facilitates improved monitoring and auditing of internal operations (Nambisan et al., 2019). It enables transactions between devices while blockchain protects these transactions through cryptography and verifies them to ensure the originator of the message is not malware or an external intermediary (Pournader et al., 2020). This feature also addresses a major issue about storing all the transactions in centralised cloud systems: susceptibility to disruption by cyberattacks (Pournader et al., 2020). Relying on big data analytics, firms can also incorporate data, for example, on the weather, politics, economic cycles, competitor actions and price levels, in order to forecast demand more accurately and therefore decrease the risks associated with managing global value chains (Lund et al., 2020).

4.4.3. *Firm performance*

Some of the advanced technologies enable manufacturing firms to mass customise/personalise offerings, which can lead to enhanced productivity and flexibility (Culot et al., 2020; Fatorachian & Kazemi, 2021). For example, robots have been used in production processes for the past few decades to perform repetitive assignments that require strength and moderate control (Stadnicka & Antonelli, 2019). However, technological advances have increased robots' intelligence and safety in the manufacturing processes. Modern robots can learn from human movement to become assistants in the production chain (Somers & Hollinger, 2016). These autonomous robots are becoming intelligent machines that can perform complicated tasks throughout the production process, thereby increasing efficiency (Stadnicka & Antonelli, 2019).

In the era of big data, analytics techniques can dramatically improve firm performance (Sena, Bhaumik, Sengupta & Demirbag, 2019). A decade ago, top-performing organisations used analytics five times more than did their lower-performing counterparts (Lavalle, Lesser, Shockley, Hopkins & Kruschwitz, 2011). A recent systematic review of the literature also suggests that the use of analytics can improve firms' supply chain performance (Batistic & van der Laken, 2019). Even individual managers' competencies, such as familiarity and experience with analytics, can lead to enhanced firm performance (Akhtar et al., 2018).

Despite challenges, augmented reality can also enhance productivity and quality, as evident from the performance of pioneering firms, such as Amazon and General Electric, who have been implementing it (Porter & Heppelmann, 2017). Augmented reality can considerably decrease the time needed to manufacture a product. For example, in the shipbuilding industry, the technology has helped manufacturers to inspect ships to mark for removal of steel construction structures that are not part of the finished ships (Porter & Heppelmann, 2017). Training programs that use augmented reality increase employee productivity to a much greater extent than do programs that do not use it, and therefore tend to improve firm performance. Boeing used the technology to guide trainees through the process of aircraft wing assembly, which led to a 35% reduction in training time and a 90% increase in the number of novice trainees who could operate correctly (Porter & Heppelmann, 2017).

As noted in the prior section, because of cryptography, blockchain technology results in more trust among supply chain partners, which is particularly important given the growing complexity and volume of global transactions (Wang et al., 2016). Such digital trust not only prevents value chain partners from behaving opportunistically (Wang, Craighead, & Li, 2014), but also mitigates the risks associated with collaborative projects, enhances joint decision-making and improves the problem-solving ability of all firms involved in a global value chain (Fawcett, Jones, & Fawcett, 2012). These aspects all lead to more satisfaction, longer-term relationships and, ultimately, enhanced supply chain performance (Nyaga, Whipple, & Lynch, 2010).

5. Discussion

Our review suggests that advanced technologies can reduce transaction costs because they can digitalise supply chains by connecting actors, objects and systems, which simplifies searching, monitoring and coordinating transactions as well as smoothing transportation and logistics (Horváth & Szabó, 2019; Lund et al., 2019). Accordingly, there is a transition from internalising international transactions to more open, decentralised global value chains (Alcácer et al., 2016); that is, firms outsource economic activities to independent partners more often than before. Advanced technologies, such as 3D printing and robotics, also automatise and digitalise manufacturing, with implications for the location of value chain activities. Further, these technologies help digital platform firms manage their transactions and interactions with other firms within the platform network more efficiently than previously. The technologies can also simplify intra- and inter-firm exchange of knowledge and improve the management of geographically dispersed human resources.

Despite these implications, research on the application of advanced technologies is fragmented and young in the IB literature. For example, IB research on cybersecurity is in its infancy, although risk and security are a significant concern in the IB field and is becoming more important (Buckley & Casson, 2021; Pezderka & Sinkovics, 2011) and particularly in the management of global supply chains (Ghadge et al., 2020). Notably, to integrate and coordinate firms' geographically dispersed operations, cybersecurity is imperative; it is the key technology that enhances business intelligence to identify, control and mitigate the risks of using advanced technologies (Luo, 2021a). However, several gaps remain in the collective knowledge. For example, the role of cybersecurity technology in managing intra- and inter-firm relationships and the flow of information is unexplored in IB research. Are firms that invest more in this technology able to operate in global markets and manage their global value chains more successfully?

Simulation is another technology that has received little attention in the IB literature. In operations research, for example, scholars have highlighted its various applications in sectors such as energy, education, healthcare, transportation and agri-food (Taylor, 2019; Utomo, Onggo, & Eldridge, 2018). Simulation is the key technology for developing models to optimise decision-making and production system operations (Ferreira et al., 2020) and to increase supply chain resilience (Carvalho, Barroso, Machado, Azevedo & Cruz-Machado, 2012). The technology can offer multinational firms an advantage regarding controlling subsidiaries, which is important because the headquarters need to ensure that foreign subsidiaries are in strategic alignment with it (Kostova, Marano, & Tallman, 2016). Simulation technology can help the headquarters to control its subsidiaries more effectively by facilitating long-term forecasting and risk management (Stendahl, Schriber, & Tippmann, 2021). Moreover, business schools can use the technology as a teaching instrument for students learning about IB.

Apart from technologies that are under-researched, some topics deserve more attention. One is decision-making. IB research has long

highlighted the importance of firm and managerial decision-making in the internationalisation process (Aharoni, Tihanyi, & Connelly, 2011; Ahi, Baronchelli, Kuivalainen & Piantoni, 2017). Many advanced technologies can be useful here. For example, big data analytics can help firms enhance decision-making and improve strategizing (Guenther et al., 2017). Traditionally, firms were dependent on market surveys to know their customers' requirements and obtain feedback on their offerings (Qi et al., 2016). However, via analytics techniques, firms can analyse large unstructured data from online reviews of their customers to increase their service quality and thus, their competitiveness (Korfiatis, Stamolampros, Kourouthanassis & Sagiadinos, 2019). Similarly, relying on these techniques, firms can use the data originating from various actors in their global value chain to design innovative business models for creating both social and economic value (Guenther et al., 2017). Big data analytics has the potential to bring logic, facts and evidence to intuition and discursive reasoning and to thus enhance managerial decision-making (Mortenson, Doherty, & Robinson, 2015). Real-time data generated by the IoT can also be collected along supply chains and analysed using analytics for supply chain optimisation, decisions in demand forecasting, supply and demand matching, transportation scheduling and last-minute delivery (Sheng et al., 2021). Last, simulation technology, as already noted, can help managers make more informed decisions about their global value chain activities.

We also encourage IB scholars to engage in more research on the dark side of advanced technologies (cf. Pezderka & Sinkovics, 2011; Sinkovics & Sinkovics, 2020; Verbeke & Hutzschenreuter, 2020). For example, income inequality and unemployment are important challenges arising because of the increasing use of these technologies. Although digitalisation can alter the governance of firm-specific assets (e.g., technology and human resources), it can also lead firms to replace their human capital with technology, which can, in turn, widen income inequality and unemployment (Banalieva & Dhanaraj, 2019). For example, brick-and-mortar retailers are increasingly closing their physical outlets as consumers move towards online shopping (Banalieva & Dhanaraj, 2019). In terms of knowledge and service work tasks, scholars tended to consider these to be too difficult to automate since these tasks need a high level of cognitive flexibility and physical adaptability (Lacity & Willcocks, 2016). However, a recent assertion is that technological advancement will transform even these tasks, replacing knowledge workers with sophisticated algorithms that allow the automation of cognitively demanding tasks (Coombs et al., 2020). Particularly vulnerable are traditional sectors, such as retail, transportation, finance and accounting (Felten, Raj, & Seamans, 2021). Therefore, as industries are embracing advanced technologies to improve productivity, we may witness a large structural shift in employment and the nature of work—a societal grand challenge (Ashri, 2020; George, Howard-Grenville, Joshi & Tihanyi, 2016). These transformations raise important avenues for future research, including ethical issues in relation to the application of smart technologies (Bonnefon, 2021), the effects of new ways in which we organise markets and global value chains (Kaili & Psarrakis, 2021) and the broader connections to just transitions and the sustainable development agenda (Hofstetter et al., 2021; Newell & Mulvaney, 2013; Schröder, 2019).

Relying on advanced technologies to conduct IB includes other risks. For example, blockchain promises users that once information relating to a transaction is stored, it cannot be changed or deleted; yet, the technology is not entirely secure, considering the several breaches reported in past years (Madnick, 2019). Similarly, given the lack of consistency in production, the costs of additional testing and the time needed to train engineers, some argue that the near-term expectations about 3D printing are overoptimistic (Roca, Vaishnav, Mendonca & Morgan, 2017). Using big data analytics can also have negative consequences. For example, algorithms that result from analysing big data can reshape the organisational control of employees (Kellogg, Valentine, & Christin, 2020). More information is required about the extent to which using such sophisticated algorithms for managing and monitoring employees is ethical. Further, security issues relating to the IoT, such as data leakage, can disrupt supply chains and diminish the performance of the participant firms (Birkel & Hartmann, 2019). What implications will these issues have for the multinational firms as regards the management of global value chains? How can they avoid these risks or turn them into opportunities to create value? These are interesting opportunities for future research.

To promote the use of advanced technologies, public policy can play an important role. Countries can design and implement such policies to prioritise the allocation of resources toward developing ICT infrastructure and increasing the digital literacy of their population (Georgallis, Albino-Pimentel, & Kondratenko, 2021; Oxley & Yeung, 2001). The reason is that among the basic prerequisites to adopting advanced technologies are the availability of ICT infrastructure and a skilled workforce. Another related issue concerns the widening gap between developed and less-developed economies in adopting advanced technologies. The gap is likely to expand in the future because utilizing technologies such as 3D printing and autonomous robots declines labour-cost advantages associated with operating in less-developed countries. This makes many firms in developed countries likely to relocate their operations to their home base (Ancarani et al., 2019; Dachs et al., 2019), which can pose significant challenges for developing economies (Lund et al., 2019). Designing a concentrated global policy via collaboration among governments can encourage the participation of less-developed economies in ICT adoption and partially address this challenge (Ahi et al., 2022).

Finally, we acknowledge the limitations of our review. We realize that regardless of the approach, identifying relevant literature has inherent shortcomings due to different starting points, inclusion and exclusion criteria and author bias (Jones et al., 2011; Nippa & Reuer, 2019; Papanastassiou, Pearce, & Zanfei, 2020). However, our aim was not to do a definite review, but rather to initiate a process of debate and discussion, creating a common platform of dialogue that links different disciplines (cf. Jones et al., 2011; Papanastassiou et al., 2020). This is a significant contribution because developments from other disciplinary areas do not seem to be sufficiently informing IB scholars (Sinkovics & Sinkovics, 2020).

6. Conclusions

Our review demonstrated that advanced technologies profoundly affect multinational firms' management of their global value chains. These technologies modify how these firms choose a location, select certain governance structures, exchange knowledge, organise digital platform networks and manage their human resources. We also argued that the research on these technologies in IB is still in its infancy. Yet, these technologies are powerful forces in our global economy and our study highlights their pool of untapped potential for IB research. They can enhance firm performance, increase trust in business networks and address some of the grand challenges that humanity faces, such as environmental sustainability. We can expect these technologies to become even more central to multinational firms and to continue to change the structure of global value chains in the future. We hope that our review will encourage IB scholars to continue investigating how these technologies will do so by engaging in empirical and interdisciplinary research.

Acknowledgements

We gratefully acknowledge the financial support that the first author received from the Foundation for Economic Education (Liikesivistysrahasto), Finland. Grant number: 20-11513.

Appendix A. Journals with articles retrieved for the analysis, by disciplinary area

Disciplinary area	Journal*	No. of articles
Information systems		
	Information & Management	2
	Information Systems Frontiers	3
	Journal of Information Technology	2
	Journal of Strategic Information Systems	3
	MIS Quarterly	1
Operations research		
	European Journal of Operational Research	2
	International Journal of Operations & Production Management	1
	International Journal of Production Economics	6
	Journal of Supply Chain Management	1
	Supply Chain Management: An International Journal	8
General management		
	Academy of Management Annals	2
	Academy of Management Review	1
	British Journal of Management	10
	Journal of Management	1
	Journal of Management Inquiry	3
	Journal of Management Studies	1
	Strategic Management Journal	2
	Strategic Organization	1
International business		
	Global Strategy Journal	2
	International Business Review	2
	International Marketing Review	1
	Journal of International Business Studies	2
	Journal of International Marketing	1
	Journal of World Business	2

*Note that we did not list the leading journals in which we found no relevant articles.

Appendix B. Protocol for search, selection and exclusion

A) Criteria for including literature

- Directly and explicitly relates to at least one of the advanced technologies described in Section 2
- Peer-reviewed journal articles only
- For operations research and information systems, review articles only; for IB and management, empirical, conceptual and review articles.

A) Criteria for excluding literature

- Articles that only superficially mention one or some of the advanced technologies (e.g., discussing them as future research avenues)
- Articles focused only on digitalisation, electronic commerce or the use of the internet generally
- Research published in edited books and conference proceedings
- Editorials and commentaries
- Case studies for teaching purposes.

A) Search strategy and scope

- Conducted full search of articles in the Web of Science within the selected journals and using 2011 as the starting cut-off year, because Industry 4.0 as a distinct concept was introduced in that year (Drath & Horch, 2014). This approach also allowed us to capture the latest research in the field, because the rapid development of advanced technologies makes older studies less relevant.

A keyword search in the abstract, title and/or keyword fields of a record.[13].

- TS= ("fourth industrial revolution" OR "industry 4.0" OR "industrie 4.0" OR "smart factory" OR "smart product*" OR "additive manufacturing" OR "3D printing" OR "internet of things" OR "big data" OR "cyber-physical systems" OR "robotics" OR "artificial intelligence" OR "augmented reality" OR "virtual reality" OR "autonomi*ation" OR "digitali*ation" OR "blockchain").

- Initial search (performed on 11 May 2021) resulted in 265 articles.
- Downloaded the bibliographic information (title, year, author and abstract) of the articles into the EndNote reference manager software.
- Read and checked all articles included in this initial database against the inclusion/exclusion criteria.
- Final sample for full analysis: n = 60.

[13] TS stands for topic search in the Web of Science; further, the keyword "industrie 4.0″ was used because the concept was first introduced by the German government with this spelling and some studies have used this term to refer to 'Industry 4.0′.

References

Aharoni, Y., Tihanyi, L., & Connelly, B. L. (2011). Managerial decision-making in international business: A forty-five-year retrospective. *Journal of World Business, 46* (2), 135–142. https://doi.org/10.1016/j.jwb.2010.05.001

Ahi, A., Baronchelli, G., Kuivalainen, O., & Piantoni, M. (2017). International market entry: How do small and medium-sized enterprises make decisions? *Journal of International Marketing, 25*(1), 1–21. https://doi.org/10.1509/jim.15.0130

Ahi, A., Sinkovics, N., & Sinkovics, R. R. (2022). E-commerce policy and the global economy: A path to more inclusive development? *Management International Review*.

Akhtar, P., Frynas, J. G., Mellahi, K., & Ullah, S. (2019). Big data-savvy teams' skills, big data-driven actions and business performance. *British Journal of Management, 30*(2), 252–271. https://doi.org/10.1111/1467-8551.12333

Akhtar, P., Khan, Z., Frynas, J. G., Tse, Y. K., & Rao-Nicholson, R. (2018). Essential micro-foundations for contemporary business operations: Top management tangible competencies, relationship-based business networks and environmental sustainability. *British Journal of Management, 29*(1), 43–62. https://doi.org/10.1111/1467-8551.12233

Alcácer, J., Cantwell, J., & Piscitello, L. (2016). Internationalization in the information age: A new era for places, firms, and international business networks? *Journal of International Business Studies, 47*(5), 499–512. https://doi.org/10.1057/jibs.2016.22

Ancarani, A., Di Mauro, C., & Mascali, F. (2019). Backshoring strategy and the adoption of industry 4.0: Evidence from Europe. *Journal of World Business, 54*(4), 360–371. https://doi.org/10.1016/j.jwb.2019.04.003

Anthony, C., Nelson, A. J., & Tripsas, M. (2016). "Who are you?… i really wanna know": Product meaning and competitive positioning in the nascent synthesizer industry. *Strategy Science, 1*(3), 163–183. https://doi.org/10.1287/stsc.2016.0015

Aryal, A., Liao, Y., Nattuthurai, P., & Li, B. (2018). The emerging big data analytics and iot in supply chain management: A systematic review. *Supply Chain Management-an International Journal, 25*(2), 141–156. https://doi.org/10.1108/scm-03-2018-0149

Ashri, R. (2020). *The ai-powered workplace: How artificial intelligence, data, and messaging platforms are defining the future of work*. Berkeley, CA: Apress L.P.,.

Autio, E., Mudambi, R., & Yoo, Y. (2021). Digitalization and globalization in a turbulent world: Centrifugal and centripetal forces. *Global Strategy Journal, 11*(1), 3–16. https://doi.org/10.1002/gsj.1396

Avison, D., Jones, J., Powell, P., & Wilson, D. (2004). Using and validating the strategic alignment model. *The Journal of Strategic Information Systems, 13*(3), 223–246. https://doi.org/10.1016/j.jsis.2004.08.002

De Backer, K., DeStefano, T., Menon, C., & Suh, J. R. (2018). *Industrial Robotics and the Global Organisation of Production*. Paris: OECD Science, (Technology and Industry Working Papers).

Banalieva, E. R., & Dhanaraj, C. (2019). Internalization theory for the digital economy. *Journal of International Business Studies, 50*(8), 1372–1387. https://doi.org/10.1057/s41267-019-00243-7

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Batistic, S., & van der Laken, P. (2019). History, evolution and future of big data and analytics: A bibliometric analysis of its relationship to performance in organizations. *British Journal of Management, 30*(2), 229–251. https://doi.org/10.1111/1467-8551.12340

Ben-Daya, M., Hassini, E., & Bahroun, Z. (2019). Internet of things and supply chain management: A literature review. *International Journal of Production Research, 57* (15–16), 4719–4742. https://doi.org/10.1080/00207543.2017.1402140

Betts, K. D., & Jaep, K. R. (2017). The dawn of fully automated contract drafting: Machine learning breathes new life into a decades-old promise. *Duke Law & Technology Review, 15*(1J), 216–233.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: An empirical investigation. *MIS Quarterly, 24*(1), 169–196. https://doi.org/10.2307/3250983

Birkel, H. S., & Hartmann, E. (2019). Impact of iot challenges and risks for scm. *Supply Chain Management-an International Journal, 24*(1), 39–61. https://doi.org/10.1108/scm-03-2018-0142

Bonnefon, J.-F. (2021). *The Car that Knew too Much: Can a Machine be Moral?* Cambridge, Massachusetts: The MIT Press.

Bouncken, R. B., & Barwinski, R. (2020). Shared digital identity and rich knowledge ties in global 3d printing-a drizzle in the clouds? *Global Strategy Journal, 11*(1), 81–108. https://doi.org/10.1002/gsj.1370

Bouncken, R. B., Qiu, Y., Sinkovics, N., & Kürsten, W. (2021). Qualitative research: Extending the range with flexible pattern matching. *Review of Managerial Science, 15* (2), 251–273. https://doi.org/10.1007/s11846-021-00451-2

Bowman, C., & Ambrosini, V. (2000). Value creation versus value capture: Towards a coherent definition of value in strategy. *British Journal of Management, 11*(1), 1–15. https://doi.org/10.1111/1467-8551.00147

Brache, J., & Felzensztein, C. (2019). Exporting firm's engagement with trade associations: Insights from Chile. *International Business Review, 28*(1), 25–35. https://doi.org/10.1016/j.ibusrev.2018.07.001

Brinch, M. (2018). Understanding the value of big data in supply chain management and its business processes: Towards a conceptual framework. *International Journal of Operations & Production Management, 38*(7), 1589–1614. https://doi.org/10.1108/ijopm-05-2017-0268

Brouthers, K. D., Geisser, K. D., & Rothlauf, F. (2016). Explaining the internationalization of ibusiness firms. *Journal of International Business Studies, 47*(5), 513–534. https://doi.org/10.1057/jibs.2015.20

Brun, L., Gereffi, G., & Zhan, J. (2019). The "lightness" of industry 4.0 lead firms: Implications for global value chains. In P. Bianchi, C. Ruíz Durán, & S. Labory (Eds.), *Transforming Industrial Policy For The Digital Age* (pp. 37–67). Cheltenham, Glos: Edward Elgar Publishing. https://doi.org/10.4337/9781788976152.00008.

Buckley, P. J., & Casson, M. (2021). Thirty years of international business review and international business research. *International Business Review, 30*(3), Article 101795. https://doi.org/10.1016/j.ibusrev.2021.101795

Buckley, P. J., & Strange, R. (2011). The governance of the multinational enterprise: Insights from internalization theory. *Journal of Management Studies, 48*(2), 460–470. https://doi.org/10.1111/j.1467-6486.2010.00920.x

CABS. (2018). Academic journal guide. London: Chartered Association of Business Schools, Retrieved July 7, 2021, from ⟨https://charteredabs.org/academic-journal-guide-2018/⟩.

Caligiuri, P., De Cieri, H., Minbaeva, D., Verbeke, A., & Zimmermann, A. (2020). International HRM insights for navigating the covid-19 pandemic: Implications for future research and practice. *Journal of International Business Studies, 51*(5), 697–713. https://doi.org/10.1057/s41267-020-00335-9

Carvalho, H., Barroso, A. P., Machado, V. H., Azevedo, S., & Cruz-Machado, V. (2012). Supply chain redesign for resilience using simulation. *Computers & Industrial Engineering, 62*(1), 329–341. https://doi.org/10.1016/j.cie.2011.10.003

Catalini, C., & Gans, J. S. (2016). Some simple economics of the blockchain. *Communications of the ACM, 63*(7), 80–90. https://doi.org/10.1145/3359552

Cennamo, C. (2019). Competing in digital markets: A platform-based perspective. *Academy of Management Perspectives, 35*(2), 265–291. https://doi.org/10.5465/amp.2016.0048

Chen, C. P., & Zhang, C.-Y. (2014). Data-intensive applications, challenges, techniques and technologies: A survey on big data. *Information Sciences, 275*, 314–347. https://doi.org/10.1016/j.ins.2014.01.015

Chen, W., & Kamal, F. (2016). The impact of information and communication technology adoption on multinational firm boundary decisions. *Journal of International Business Studies, 47*(5), 563–576. https://doi.org/10.1057/jibs.2016.6

Chen, Y., Pereira, I., & Patel, P. C. (2021). Decentralized governance of digital platforms. *Journal of Management, 47*(5), 1305–1337. https://doi.org/10.1177/0149206320916755

Cheng, J. L., Henisz, W. J., Roth, K., & Swaminathan, A. (2009). From the editors: Advancing interdisciplinary research in the field of international business: Prospects, issues and challenges. *Journal of International Business Studies, 40*, 1070–1074. https://doi.org/10.1057/jibs.2009.41

Choudhury, P., Starr, E., & Agarwal, R. (2020). Machine learning and human capital complementarities: Experimental evidence on bias mitigation. *Strategic Management Journal, 41*(8), 1381–1411. https://doi.org/10.1002/smj.3152

Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Introduction—platforms and infrastructures in the digital age. *Information Systems Research, 29*, 253. https://doi.org/10.1287/isre.2018.0794

Chai, Junyi, & Eric W.T., Ngai (2020). "Decision-making techniques in supplier selection: Recent accomplishments and what lies ahead". *Expert Systems with Applications, 140*, Article 112903. https://doi.org/10.1016/j.eswa.2019.112903

Contractor, F. J. (2021). The world economy will need even more globalization in the post-pandemic 2021 decade. *Journal of International Business Studies, Advance online publication*. https://doi.org/10.1057/s41267-020-00394-y

Coombs, C., Hislop, D., Taneva, S. K., & Barnard, S. (2020). The strategic impacts of intelligent automation for knowledge and service work: An interdisciplinary review. *Journal of Strategic Information Systems, 29*(4). https://doi.org/10.1016/j.jsis.2020.101600

Cuervo-Cazurra, A., Doz, Y., & Gaur, A. (2020). Skepticism of globalization and global strategy: Increasing regulations and countervailing strategies. *Global Strategy Journal, 10*(1), 3–31. https://doi.org/10.1002/gsj.1374

Culot, G., Nassimbeni, G., Orzes, G., & Sartor, M. (2020). Behind the definition of industry 4.0: Analysis and open questions. *International Journal of Production Economics, 226*, Article 107617. https://doi.org/10.1016/j.ijpe.2020.107617

Cuypers, I. R. P., Hennart, J.-F., Silverman, B. S., & Ertug, G. (2021). Transaction cost theory: Past progress, current challenges, and suggestions for the future. *Academy of Management Annals, 15*(1), 111–150. https://doi.org/10.5465/annals.2019.0051

Dachs, B., Kinkel, S., & Jaeger, A. (2019). Bringing it all back home? Backshoring of manufacturing activities and the adoption of industry 4.0 technologies. *Journal of World Business, 54*(6). https://doi.org/10.1016/j.jwb.2019.101017

Davenport, T. H., Barth, P., & Bean, R. (2012). How "big data" is different. *Mit Sloan Management Review, 54*(1), 43–46.

Dillon, S. M., Glavas, C., & Mathews, S. (2020). Digitally immersive, international entrepreneurial experiences. *International Business Review, 29*(6), Article 101739. https://doi.org/10.1016/j.ibusrev.2020.101739

Drath, R., & Horch, A. (2014). Industrie 4.0: Hit or hype? *Industrial Electronics Magazine, 8*(2), 56–58. https://doi.org/10.1109/MIE.2014.2312079

Dubey, R., Gunasekaran, A., Childe, S. J., Blome, C., & Papadopoulos, T. (2019). Big data and predictive analytics and manufacturing performance: Integrating institutional theory, resource-based view and big data culture. *British Journal of Management, 30* (2), 341–361. https://doi.org/10.1111/1467-8551.12355

Dunning, J. H. (1980). Toward an eclectic theory of international production: Some empirical tests. *Journal of International Business Studies, 11*(1), 9–31. https://doi.org/10.1057/palgrave.jibs.8490593

Fatorachian, H., & Kazemi, H. (2021). Impact of industry 4.0 on supply chain performance. *Production Planning & Control, 32*(1), 63–81. https://doi.org/10.1080/09537287.2020.1712487

Fawcett, S. E., Jones, S. L., & Fawcett, A. M. (2012). Supply chain trust: The catalyst for collaborative innovation. *Business Horizons, 55*(2), 163–178. https://doi.org/10.1016/j.bushor.2011.11.004

Fayard, A. L. (2021). Notes on the meaning of work: Labor, work, and action in the 21st century. *Journal of Management Inquiry, 30*(2), 207–220. https://doi.org/10.1177/1056492619841705

Felin, T., & Lakhani, K. (2018). What problems will you solve with blockchain? *Mit Sloan Management Review, 60*(1), 32–38.

Felten, E., Raj, M., & Seamans, R. (2021). Occupational, industry, and geographic exposure to artificial intelligence: A novel dataset and its potential uses. *Strategic Management Journal, Advance online publication*. https://doi.org/10.1002/smj.3286

Ferras-Hernandez, X. (2018). The future of management in a world of electronic brains. *Journal of Management Inquiry, 27*(2), 260–263. https://doi.org/10.1177/1056492617724973

Ferreira, W. D., Armellini, F., & De Santa-Eulalia, L. A. (2020). Simulation in industry 4.0: A state-of-the-art review. *Computers & Industrial Engineering, 149*. https://doi.org/10.1016/j.cie.2020.106868

Fotaki, M., Voudouris, I., Lioukas, S., & Zyglidopoulos, S. (2020). More accountable, more ethical, yet less trusted: Misplaced corporate governance in the era of big data. *British Journal of Management*. https://doi.org/10.1111/1467-8551.12447

Frederico, G. F., Garza-Reyes, J. A., Anosike, A., & Kumar, V. (2020). Supply chain 4.0: Concepts, maturity and research agenda. *Supply Chain Management-an International Journal, 25*(2), 262–282. https://doi.org/10.1108/scm-09-2018-0339

Garmulewicz, A., Holweg, M., Veldhuis, H., & Yang, A. (2018). Disruptive technology as an enabler of the circular economy: What potential does 3d printing hold? *California Management Review, 60*(3), 112–132.

Georgallis, P., Albino-Pimentel, J., & Kondratenko, N. (2021). Jurisdiction shopping and foreign location choice: The role of market and nonmarket experience in the european solar energy industry. *Journal of International Business Studies, 52*(4), 853–877. https://doi.org/10.1057/s41267-020-00358-2

George, G., Howard-Grenville, J., Joshi, A., & Tihanyi, L. (2016). Understanding and tackling societal grand challenges through management research. *Academy of Management Journal, 59*(6), 1880–1895. https://doi.org/10.5465/amj.2016.4007

Ghadge, A., Weiss, M., Caldwell, N. D., & Wilding, R. (2020). Managing cyber risk in supply chains: A review and research agenda. *Supply Chain Management-an International Journal, 25*(2), 223–240. https://doi.org/10.1108/scm-10-2018-0357

Gnizy, I. (2019). Big data and its strategic path to value in international firms. *International Marketing Review, 36*(3), 318–341. https://doi.org/10.1108/imr-09-2018-0249

Goldberg, D. M., Deane, J. K., Rakes, T. R., & Rees, L. P. (2021). 3d printing technology and the market value of the firm. *Information Systems Frontiers, Advance online publication*. https://doi.org/10.1007/s10796-021-10143-7

Guenther, W. A., Mehrizi, M. H., Rezazade, Huysman, M., & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. *Journal of Strategic Information Systems, 26*(3), 191–209. https://doi.org/10.1016/j.jsis.2017.07.003

Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information & Management, 53*(8), 1049–1064. https://doi.org/10.1016/j.im.2016.07.004

Hajli, N., Shirazi, F., Tajvidi, M., & Huda, N. (2021). Towards an understanding of privacy management architecture in big data: An experimental research. *British Journal of Management, 32*(2), 548–565. https://doi.org/10.1111/1467-8551.12427

Hannibal, M., & Knight, G. (2018). Additive manufacturing and the global factory: Disruptive technologies and the location of international business. *International Business Review, 27*(6), 1116–1127. https://doi.org/10.1016/j.ibusrev.2018.04.003

Harzing, A.-W. (2020). *Journal Quality List* (68th.,). Middlesex, UK: Harzing.com. Retrieved Jul 4, 2021, from. ⟨https://harzing.com/resources/journal-quality-list⟩.

He, Q., Meadows, M., Angwin, D., Gomes, E., & Child, J. (2020). Strategic alliance research in the era of digital transformation: Perspectives on future research. *British Journal of Management, 31*(3), 589–617. https://doi.org/10.1111/1467-8551.12406

Henderson, J. C., & Venkatraman, H. (1999). Strategic alignment: Leveraging information technology for transforming organizations. *IBM systems journal, 38*(2.3), 472–484. https://doi.org/10.1147/SJ.1999.5387096

Hofstetter, J. S., De Marchi, V., Sarkis, J., Govindan, K., Klassen, R., Ometto, A. R., & Vazquez-Brust, D. (2021). From sustainable global value chains to circular economy—different silos, different perspectives, but many opportunities to build bridges. *Circular Economy and Sustainability, 1*(1), 21–47. https://doi.org/10.1007/s43615-021-00015-2

Horváth, D., & Szabó, R. Z. (2019). Driving forces and barriers of industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological Forecasting and Social Change, 146*, 119–132. https://doi.org/10.1016/j.techfore.2019.05.021

Illa, P. K., & Padhi, N. (2018). Practical guide to smart factory transition using iot, big data and edge analytics. *Ieee Access, 6*, 55162–55170. https://doi.org/10.1109/ACCESS.2018.2872799

Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-ai symbiosis in organizational decision making. *Business Horizons, 61*(4), 577–586. https://doi.org/10.1016/j.bushor.2018.03.007

Jones, M. V., Coviello, N., & Tang, Y. K. (2011). International entrepreneurship research (1989–2009): A domain ontology and thematic analysis. *Journal of Business Venturing, 26*(6), 632–659. https://doi.org/10.1016/j.jbusvent.2011.04.001

Kaili, E., & Psarrakis, D. (2021). *Disintermediation Economics: The Impact of Blockchain on Markets and Policies*. Basingstoke: Palgrave Macmillan,.

Kano, A. (2018). Global value chain governance: A relational perspective. *Journal of International Business Studies, 49*(6), 684–705. https://doi.org/10.1057/s41267-017-0086-8

Kano, L., Tsang, E. W., & Yeung, H. W.-c (2020). Global value chains: A review of the multi-disciplinary literature. *Journal of International Business Studies, 51*(4), 577–622. https://doi.org/10.1057/s41267-020-00304-2

Kellogg, K. C., Valentine, M. A., & Christin, A. (2020). Algorithms at work: The new contested terrain of control. *Academy of Management Annals, 14*(1), 366–410. https://doi.org/10.5465/annals.2018.0174

Korfiatis, N., Stamolampros, P., Kourouthanassis, P., & Sagiadinos, V. (2019). Measuring service quality from unstructured data: A topic modeling application on airline passengers' online reviews. *Expert Systems with Applications, 116*, 472–486. https://doi.org/10.1016/j.eswa.2018.09.037

Kostova, T., Marano, V., & Tallman, S. (2016). Headquarters–subsidiary relationships in MNCs: Fifty years of evolving research. *Journal of World Business, 51*(1), 176–184. https://doi.org/10.1016/j.jwb.2015.09.003

Kwon, I. W. G., & Suh, T. (2005). Trust, commitment and relationships in supply chain management: A path analysis. *Supply Chain Management: An International Journal, 10*(1), 26–33. https://doi.org/10.1108/13598540510578351

Lacity, M. C., & Willcocks, L. P. (2016). A new approach to automating services. *MIT Sloan Management Review, 58*(1), 41–49.

Laplume, A. O., Petersen, B., & Pearce, J. M. (2016). Global value chains from a 3d printing perspective. *Journal of International Business Studies, 47*(5), 595–609. https://doi.org/10.1057/jibs.2015.47

Laplume, A. O. (2018). Blockchain ventures and international business. In R. van Tulder, A. Verbeke, & L. Piscitello (Eds.), *International Business in the Information and Digital Age* (Vol. 13, pp. 141–157). Bingley, UK: Emerald Publishing Limited. https://doi.org/10.1108/S1745-886220180000013007.

Lavalle, S., Lesser, E., Shockley, R., Hopkins, M. S., & Kruschwitz, N. (2011). Big data, analytics and the path from insights to value. *Mit Sloan Management Review, 52*(2), 21–32.

Leonardi, P., & Contractor, N. (2018). Better people analytics. *Harvard Business Review, 96*(6), 70–81.

Li, J., Chen, L., Yi, J., Mao, J., & Liao, J. (2019). Ecosystem-specific advantages in international digital commerce. *Journal of International Business Studies, 50*(9), 1448–1463. https://doi.org/10.1057/s41267-019-00263-3

Li, M., Mobley, W. H., & Kelly, A. (2013). When do global leaders learn best to develop cultural intelligence? An investigation of the moderating role of experiential learning style. *Academy of Management Learning & Education, 12*(1), 32–50. https://doi.org/10.5465/amle.2011.0014

Liboni, L. B. C., Luciana, Oranges, Jabbour, C. J. C., Oliveira, B. G., & Stefanelli, N. O. (2019). Smart industry and the pathways to HRM 4.0: Implications for scm. *Supply Chain Management-an International Journal, 24*(1), 124–146. https://doi.org/10.1108/scm-03-2018-0150

Lund, S., Manyika, J., Woetzel, J., Barriball, E., Krishnan, M., Alicke, K., & Hutzler, K. (2020). *Risk, Resilience, and Rebalancing in Global Value Chains*. Boston: McKinsey Global Institute, (from) ⟨https://www.mckinsey.com/business-functions/operations/our-insights/risk-resilience-and-rebalancing-in-global-value-chains⟩.

Lund, S., Manyika, J., Woetzel, J., Bughin, J., Krishnan, M., Seong, J., & Muir, M. (2019). *Globalization in Transition: The Future of Trade and Value Chains*. Washington, DC: McKinsey Global Institute, (from) ⟨https://www.mckinsey.com/featured-insights/innovation-and-growth/globalization-in-transition-the-future-of-trade-and-value-chains⟩.

Luo, Y. (2021a). A general framework of digitization risks in international business. *Journal of International Business Studies*. https://doi.org/10.1057/s41267-021-00448-9

Luo, Y. (2021b). New OLI advantages in digital globalization. *International Business Review, 30*(2), Article 101797. https://doi.org/10.1016/j.ibusrev.2021.101797

Luo, Y., & Bu, J. (2016). How valuable is information and communication technology? A study of emerging economy enterprises. *Journal of World Business, 51*(2), 200–211. https://doi.org/10.1016/j.jwb.2015.06.001

MacDuffie, J. P. (2011). Inter-organizational trust and the dynamics of distrust. *Journal of International Business Studies, 42*(1), 35–47. https://doi.org/10.1057/jibs.2010.54

Macrinici, D., Cartofeanu, C., & Gao, S. (2018). Smart contract applications within blockchain technology: A systematic mapping study. *Telematics and Informatics, 35*(8), 2337–2354. https://doi.org/10.1016/j.tele.2018.10.004

Madnick, S. (2019). Blockchain isn't as unbreakable as you think. *Mit Sloan Management Review, 61*(2), 66–70.

Mahoney, J. T., & Kor, Y. Y. (2015). Advancing the human capital perspective on value creation by joining capabilities and governance approaches. *Academy of Management Perspectives, 29*(3), 296–308. https://doi.org/10.5465/amp.2014.0151

Mainelli, M. (2017). Blockchain will help us prove our identities in a digital world. In C. Tucker (Ed.), *Blockchain: The insights you need*. Boston, Mass: Harvard Business Review Press.

Manyika, J., Lund, S., Bughin, J., Woetzel, J. R., Stamenov, K., & Dhingra, D. (2016). *Digital globalization: The new era of global flows*. San Francisco, CA: McKinsey Global Institute,. Retrieved Dec 16, 2020, from ⟨https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/digital-globalization-the-new-era-of-global-flows⟩.

Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS Quarterly, 19*(4), 487–505. https://doi.org/10.2307/249630

Mikalef, P., Boura, M., Lekakos, G., & Krogstie, J. (2019). Big data analytics capabilities and innovation: The mediating role of dynamic capabilities and moderating effect of the environment. *British Journal of Management, 30*(2), 272–298. https://doi.org/10.1111/1467-8551.12343

Mills, M. (2016). Artificial Intelligence in Law: The State of Play 2016. *T*. homson Reuters Legal Executive Institue,. ⟨https://britishlegalitforum.com/wp-content/uploads/2016/12/Keynote-Mills-AI-in-Law-State-of-Play-2016.pdf⟩.

Mithas, S., Tafti, A., & Mitchell, W. (2013). How a firm's competitive environment and digital strategic posture influence digital business strategy. *MIS Quarterly, 37*(2), 511–536.

Mortenson, M. J., Doherty, N. F., & Robinson, S. (2015). Operational research from taylorism to terabytes: A research agenda for the analytics age. *European Journal of Operational Research, 241*(3), 583–595. https://doi.org/10.1016/j.ejor.2014.08.029

Mudambi, R. (2007). Book review: Offshoring: Economic geography and the multinational firm. *Journal of International Business Studies, 38*(1), 206. https://doi.org/10.1057/palgrave.jibs.8400253

Mudambi, R. (2008). Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography, 8*(5), 699–725. https://doi.org/10.1093/jeg/lbn024

Nambisan, S., Zahra, S. A., & Luo, Y. (2019). Global platforms and ecosystems: Implications for international business theories. *Journal of International Business Studies, 50*(9), 1464–1486. https://doi.org/10.1057/s41267-019-00262-4

Newell, P., & Mulvaney, D. (2013). The political economy of the 'just transition'. *The Geographical Journal, 179*(2), 132–140. https://doi.org/10.1111/geoj.12008

Nippa, M., & Reuer, J. J. (2019). On the future of international joint venture research. *Journal of International Business Studies, 50*(4), 555–597. https://doi.org/10.1057/s41267-019-00212-0

Nyaga, G. N., Whipple, J. M., & Lynch, D. F. (2010). Examining supply chain relationships: Do buyer and supplier perspectives on collaborative relationships differ? *Journal of Operations Management, 28*(2), 101–114. https://doi.org/10.1016/j.jom.2009.07.005

Oxley, J. E., & Yeung, B. (2001). E-commerce readiness: Institutional environment and international competitiveness. *Journal of International Business Studies, 32*(4), 705–723. https://doi.org/10.1057/palgrave.jibs.8490991

De Pace, F., Manuri, F., Sanna, A., & Fornaro, C. (2020). A systematic review of augmented reality interfaces for collaborative industrial robots. *Computers & Industrial Engineering, 149*, 19. https://doi.org/10.1016/j.cie.2020.106806

Papanastassiou, M., Pearce, R., & Zanfei, A. (2020). Changing perspectives on the internationalization of R&D and innovation by multinational enterprises: A review of the literature. *Journal of International Business Studies, 51*(4), 623–664. https://doi.org/10.1057/s41267-019-00258-0

Petersen, C. G., Aase, G. R., & Heiser, D. R. (2011). Journal ranking analyses of operations management research. *International Journal of Operations & Production Management, 31*(4), 405–422.

Petticrew, M., & Roberts, H. (2008). *Systematic Reviews in the Social Sciences: A Practical Guide*. London: John Wiley & Sons.

Pezderka, N., & Sinkovics, R. R. (2011). A conceptualization of e-risk perceptions and implications for small firm active online internationalization. *International Business Review, 20*(4), 409–422. https://doi.org/10.1016/j.ibusrev.2010.06.004

Pisani, N., Kourula, A., Kolk, A., & Meijer, R. (2017). How global is international CSR research? Insights and recommendations from a systematic review. *Journal of World Business, 52*(5), 591–614. https://doi.org/10.1016/j.jwb.2017.05.003

Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard Business Review, 92*(11), 64–88.

Porter, M. E., & Heppelmann, J. E. (2017). Why every organization needs an augmented reality strategy. *Harvard Business Review, 95*(6), 46–57.

Pournader, M., Shi, Y. Y., Seuring, S., & Koh, S. C. L. (2020). Blockchain applications in supply chains, transport and logistics: A systematic review of the literature. *International Journal of Production Research, 58*(7), 2063–2081. https://doi.org/10.1080/00207543.2019.1650976

Qi, J., Zhang, Z., Jeon, S., & Zhou, Y. (2016). Mining customer requirements from online reviews: A product improvement perspective. *Information & Management, 53*(8), 951–963. https://doi.org/10.1016/j.im.2016.06.002

Queiroz, M. M., Telles, R., & Bonilla, S. H. (2020). Blockchain and supply chain management integration: A systematic review of the literature. *Supply Chain Management-an International Journal, 25*(2), 241–254. https://doi.org/10.1108/scm-03-2018-0143

Raisch, S. K., & Sebastian. (2021). Artificial intelligence and management: The automation-augmentation paradox. *Academy of Management Review, 46*(1), 192–210. https://doi.org/10.5465/amr.2018.0072

Raj, A., Dwivedi, G., Sharma, A., Jabbour, A. B. L. d S., & Rajak, S. (2020). Barriers to the adoption of industry 4.0 technologies in the manufacturing sector: An inter-country comparative perspective. *International Journal of Production Economics, 224*, Article 107546. https://doi.org/10.1016/j.ijpe.2019.107546

Ravasi, D., & Schultz, M. (2006). Responding to organizational identity threats: Exploring the role of organizational culture. *Academy of Management Journal, 49*(3), 433–458. https://doi.org/10.5465/amj.2006.21794663

Roca, J. B., Vaishnav, P., Mendonca, J., & Morgan, M. G. (2017). Getting past the hype about 3-d printing. *Mit Sloan Management Review, 58*(3), 57–62.

Rugman, A. M., & Verbeke, A. (2004). A perspective on regional and global strategies of multinational enterprises. *Journal of International Business Studies, 35*(1), 3–18. https://doi.org/10.1057/palgrave.jibs.8400073

Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., & Harnisch, M. (2015). *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*. Boston: Boston Consulting Group.

Rymaszewska, A., Helo, P., & Gunasekaran, A. (2017). Iot powered servitization of manufacturing–an exploratory case study. *International Journal of Production Economics, 192*, 92–105. https://doi.org/10.1016/j.ijpe.2017.02.016

Scheidegger, A. P. G., Pereira, T. F., de Oliveira, M. L. M., Banerjee, A., & Montevechi, J. A. B. (2018). An introductory guide for hybrid simulation modelers on the primary simulation methods in industrial engineering identified through a systematic review of the literature. *Computers & Industrial Engineering, 124*, 474–492. https://doi.org/10.1016/j.cie.2018.07.046

Schmidt, C. G., & Wagner, S. M. (2019). Blockchain and supply chain relations: A transaction cost theory perspective. *Journal of Purchasing and Supply Management, 25*(4), Article 100552. https://doi.org/10.1016/j.pursup.2019.100552

Schneider, S., & Leyer, M. (2019). Me or information technology? Adoption of artificial intelligence in the delegation of personal strategic decisions. *Managerial and Decision Economics, 40*(3), 223–231. https://doi.org/10.1002/mde.2982

Schröder, P. (2019). *Promoting a Just Transition to an Inclusive Circular Economy*. London: Chatham House, The Royal Institute of International Affairs,.

Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K. G., & Fonstad, N. O. (2020). How big old companies navigate digital transformation. In R. D. Galliers, D. E. Leidner, & B. Simeonova (Eds.), *Strategic Information Management* (5th ed..,, pp. 133–150). New York: Routledge. https://doi.org/10.4324/9780429286797.

Seidel, M.-D. L. (2018). Questioning centralized organizations in a time of distributed trust. *Journal of Management Inquiry, 27*(1), 40–44. https://doi.org/10.1177/1056492617734942

Sena, V., Bhaumik, S., Sengupta, A., & Demirbag, M. (2019). Big data and performance: What can management research tell us? *British Journal of Management, 30*(2), 219–228. https://doi.org/10.1111/1467-8551.12362

Shamim, S., Zeng, J., Choksy, U. S., & Shariq, S. M. (2020). Connecting big data management capabilities with employee ambidexterity in Chinese multinational enterprises through the mediation of big data value creation at the employee level. *International Business Review, 29*(6), Article 101604. https://doi.org/10.1016/j.ibusrev.2019.101604

Sheng, J., Amankwah-Amoah, J., Khan, Z., & Wang, X. (2021). Covid-19 pandemic in the new era of big data analytics: Methodological innovations and future research directions. *British Journal of Management, 32*(4), 1164–1183. https://doi.org/10.1111/1467-8551.12441

Shenkar, O. (2021). Using interdisciplinary lenses to enrich the treatment of culture in international business. *International Business Review, 30*(2), Article 101799. https://doi.org/10.1016/j.ibusrev.2021.101799

Simon, H. A. (1985). What we know about the creative process. In R. L. Kuhn (Ed.), *Frontiers in creative and innovative management* (Vol. 4, pp. 3–20). Cambridge, MA: Ballinger.

Singh, N., & Kundu, S. (2002). Explaining the growth of e-commerce corporations (eccs): An extension and application of the eclectic paradigm. *Journal of International Business Studies, 33*(4), 679–697. https://doi.org/10.1057/palgrave.jibs.8491039

Sinkovics, N. (2018). Pattern matching in qualitative analysis. In C. Cassell, A. L. Cunliffe, & G. Grandy (Eds.), *The Sage Handbook of Qualitative Business and Management Research Methods* (pp. 468–485). Thousand Oaks, CA: Sage Publications. https://doi.org/10.4135/9781526430236.n28.

Sinkovics, N., Choksy, U. S., Sinkovics, R. R., & Mudambi, R. (2019). Knowledge connectivity in an adverse context: Global value chains and Pakistani offshore service providers. *Management International Review, 59*(1), 131–170. https://doi.org/10.1007/s11575-018-0372-0

Sinkovics, N., & Reuber, A. R. (2021). Beyond disciplinary silos: A systematic analysis of the migrant entrepreneurship literature. *Journal of World Business, 56*(4), Article 101223. https://doi.org/10.1016/j.jwb.2021.101223

Sinkovics, N., Sinkovics, R. R., & Jean, R. J. B. (2013). The internet as an alternative path to internationalization? *International Marketing Review, 30*(2), 130–155. https://doi.org/10.1108/02651331311314556

Sinkovics, R. R., & Sinkovics, N. (2020). The internet and international marketing - from trigger technology to platforms and new markets. *International Marketing Review, 37*(3), 437–446. https://doi.org/10.1108/imr-07-2019-0185

Sit, A., Mak, A. S., & Neill, J. T. (2017). Does cross-cultural training in tertiary education enhance cross-cultural adjustment? A systematic review. *International Journal of Intercultural Relations, 57*, 1–18. https://doi.org/10.1016/j.ijintrel.2017.01.001

Somers, T., & Hollinger, G. A. (2016). Human–robot planning and learning for marine data collection. *Autonomous Robots, 40*(7), 1123–1137. https://doi.org/10.1007/s10514-015-9502-8

Sony, M., & Naik, S. (2020). Industry 4.0 integration with socio-technical systems theory: A systematic review and proposed theoretical model. *Technology in Society, 61*, Article 101248. https://doi.org/10.1016/j.techsoc.2020.101248

Stadnicka, D., & Antonelli, D. (2019). Human-robot collaborative work cell implementation through lean thinking. *International Journal of Computer Integrated Manufacturing, 32*(6), 580–595. https://doi.org/10.1080/0951192X.2019.1599437

Steenkamp, J. (2020). Global brand building and management in the digital age. *Journal of International Marketing, 28*(1), 13–27. https://doi.org/10.1177/1069031×19894946

Stein, M.-K., Wagner, E. L., Tierney, P., Newell, S., & Galliers, R. D. (2019). Datification and the pursuit of meaningfulness in work. *Journal of Management Studies, 56*(3), 685–717. https://doi.org/10.1111/joms.12409

Stendahl, E., Schriber, S., & Tippmann, E. (2021). Control changes in multinational corporations: Adjusting control approaches in practice. *Journal of International Business Studies, 52*(3), 409–431. https://doi.org/10.1057/s41267-020-00371-5

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

Strozzi, F., Colicchia, C., Creazza, A., & Noè, C. (2017). Literature review on the 'smart factory' concept using bibliometric tools. *International Journal of Production Research, 55*(22), 6572–6591. https://doi.org/10.1080/00207543.2017.1326643

Tallman, S., & Chacar, A. S. (2011). Knowledge accumulation and dissemination in MNEs: A practice-based framework. *Journal of Management Studies, 48*(2), 278–304. https://doi.org/10.1111/j.1467-6486.2010.00971.x

Tambe, P., Cappelli, P., & Yakubovich, V. (2019). Artificial intelligence in human resources management: Challenges and a path forward. *California Management Review, 61*(4), 15–42. https://doi.org/10.1177/0008125619867910

Taylor, S. J. E. (2019). Distributed simulation: State-of-the-art and potential for operational research. *European Journal of Operational Research, 273*(1), 1–19. https://doi.org/10.1016/j.ejor.2018.04.032

Thorpe, R., Holt, R., Macpherson, A., & Pittaway, L. (2005). Using knowledge within small and medium-sized firms: A systematic review of the evidence. *International Journal of Management Reviews, 7*(4), 257–281. https://doi.org/10.1111/j.1468-2370.2005.00116.x

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*(3), 207–222. https://doi.org/10.1111/1467-8551.00375

Treiblmaier, H. (2018). The impact of the blockchain on the supply chain: A theory-based research framework and a call for action. *Supply Chain Management: An International Journal, 23*(6), 545–559. https://doi.org/10.1108/SCM-01-2018-0029

Trochim, W. M. (1989). Outcome pattern matching and program theory. *Evaluation and program planning, 12*(4), 355–366. https://doi.org/10.1016/0149-7189(89)90052-9

Tüselmann, H., Sinkovics, R. R., & Pishchulov, G. (2016). Revisiting the standing of international business journals in the competitive landscape. *Journal of World Business, 51*(4), 487–498. https://doi.org/10.1016/j.jwb.2016.01.006

Utomo, D. S., Onggo, B. S., & Eldridge, S. (2018). Applications of agent-based modelling and simulation in the agri-food supply chains. *European Journal of Operational Research, 269*(3), 794–805. https://doi.org/10.1016/j.ejor.2017.10.041

Venters, W., & Whitley, E. A. (2012). A critical review of cloud computing: Researching desires and realities. *Journal of Information Technology, 27*(3), 179–197. https://doi.org/10.1057/jit.2012.17

Verbeke, A., & Greidanus, N. S. (2009). The end of the opportunism vs trust debate: Bounded reliability as a new envelope concept in research on MNE governance. In A. Verbeke, & H. Merchant (Eds.), *Handbook of Research on International Strategic Management* (pp. 31–63). Cheltenham, UK: Edward Elgar. https://doi.org/10.4337/9781781009147.

Verbeke, A., & Hutzschenreuter, T. (2020). The dark side of digital globalization. *Academy of Management Perspectives*. https://doi.org/10.5465/amp.2020.0015

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

Wamba, S. F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data'can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics, 165*, 234–246. https://doi.org/10.1016/j.ijpe.2014.12.031

Wang, G., Gunasekaran, A., Ngai, E. W., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *International Journal of Production Economics, 176*, 98–110. https://doi.org/10.1016/j.ijpe.2016.03.014

Wang, Q., Craighead, C. W., & Li, J. J. (2014). Justice served: Mitigating damaged trust stemming from supply chain disruptions. *Journal of Operations Management, 32*(6), 374–386. https://doi.org/10.1016/j.jom.2014.07.001

Wang, Y., Han, J. H., & Beynon-Davies, P. (2019a). Understanding blockchain technology for future supply chains: A systematic literature review and research agenda. *Supply Chain Management-an International Journal, 24*(1), 62–84. https://doi.org/10.1108/scm-03-2018-0148

Wang, Y., Kung, L., Gupta, S., & Ozdemir, S. (2019b). Leveraging big data analytics to improve quality of care in healthcare organizations: A configurational perspective. *British Journal of Management, 30*(2), 362–388. https://doi.org/10.1111/1467-8551.12332

Whitmore, A., Agarwal, A., & Da Xu, L. (2015). The internet of things—a survey of topics and trends. *Information Systems Frontiers, 17*(2), 261–274. https://doi.org/10.1007/s10796-014-9489-2

Wiener, M., Saunders, C., & Marabelli, M. (2020). Big-data business models: A critical literature review and multiperspective research framework. *Journal of Information Technology, 35*(1), 66–91. https://doi.org/10.1177/0268396219896811

Willcocks, L., Whitley, E. A., & Avgerou, C. (2008). The ranking of top is journals: A perspective from the London school of economics. *European Journal of Information Systems, 17*(2), 163–168. https://doi.org/10.1057/ejis.2008.9

Williamson, O. E. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law and Economics, 22*(2), 233–261. https://doi.org/10.1086/466942

Wu, Y., Cegielski, C. G., Hazen, B. T., & Hall, D. J. (2013). Cloud computing in support of supply chain information system infrastructure: Understanding when to go to the cloud. *Journal of Supply Chain Management, 49*(3), 25–41. https://doi.org/10.1111/j.1745-493x.2012.03287.x

Yamin, M., & Sinkovics, R. R. (2006). Online internationalisation, psychic distance reduction and the virtuality trap. *International Business Review, 15*(4), 339–360. https://doi.org/10.1016/j.ibusrev.2006.03.002

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. https://doi.org/10.1016/j.jsis.2017.09.001

Yu, W., Jacobs, M. A., Chavez, R., & Feng, M. (2019). Data-driven supply chain orientation and financial performance: The moderating effect of innovation-focused complementary assets. *British Journal of Management, 30*(2), 299–314. https://doi.org/10.1111/1467-8551.12328

Zeng, J., & Glaister, K. W. (2018). Value creation from big data: Looking inside the black box. *Strategic Organization, 16*(2), 105–140. https://doi.org/10.1177/1476127017697510

Zheng, T., Ardolino, M., Bacchetti, A., & Perona, M. (2020). The applications of industry 4.0 technologies in manufacturing context: A systematic literature review. *International Journal of Production Research, 59*(6), 1922–1954. https://doi.org/10.1080/00207543.2020.1824085

Alan A. **Ahi** (PhD, LUT University, FI) is a postdoctoral fellow at the University of Helsinki, Forest Economics and Marketing Research Unit. Prior to this position, he worked as a postdoctoral researcher at the School of Business and Management, Lappeenranta University of Technology, Finland. His research interests include broad areas of international business and entrepreneurship, with a current focus on environmental sustainability and digital technologies. His work has been published in journals such as *Journal of International Marketing*, *European Business Review* and *Critical Perspectives on International Business* and as chapter contributions to edited volumes. E-mail: alan.ahi@helsinki.fi, https://orcid.org/0000–0003–1039–5408

Noemi Sinkovics (PhD, The University of Manchester, UK) is Senior Lecturer in International Business at Glasgow University, Adam Smith Business School, UK. Prior to that, she worked at The University of Auckland, NZ and The University of Manchester, UK. Her research interests are theoretical and practical issues around entrepreneurship (including international and social entrepreneurship) and social, environmental and economic upgrading in global value chains. Her work has been published in *International Business Review, International Marketing Review, Journal of Business Research, Journal of World Business, Management International Review, Journal of International Management, European Journal of International Management, Journal of Interactive Marketing, Critical Perspectives on International Business* and as chapter contributions to edited volumes. Email: noemi.sinkovics@gmail.com, https://www.sinkovics.com/noemi

Yelnur Shildibekov (PhD scholar, The University of Manchester, UK) is Teaching Assistant in Financial and Digital Innovations in International Business at Alliance Manchester Business School, The University of Manchester. His current research interests include Industry 4.0 and the technologies, global value chains and inter-organizational relationships. Email: Yelnur.Shildibekov@manchester.ac.uk

Rudolf R. Sinkovics (PhD, WU-Vienna, AT) is Professor of International Business at Glasgow University, Adam Smith Business School, UK, and Visiting Professor at Lappeenranta/Lahti University of Technology, Finland. His research covers issues of inter-organizational governance, and the role of ICT, with a current focus on responsible business. His work has been published in journals such as *Journal of International Business Studies, Management International Review, Journal of World Business, International Business Review, Journal of International Management, Journal of Business Research, Journal of International Marketing and International Marketing Review*. He is co-editor-in-chief for *critical perspectives on international business*, Consulting editor for *Journal of World Business* and Associate editor for *Transnational Corporations* and serves on a number of editorial boards. E-mail: rudolf.sinkovics@gmail.com, https://www.sinkovics.com/rudolf.

Nikolay Mehandjiev (PhD, The University of Hull) is a Professor of Enterprise Information Systems at the Alliance Manchester Business School, the University of Manchester. He researches digital technology and its transforming role for the industry, and the role of end users in customizing and adapting technology. His most recent collaborative project on demand-driven supply networks within Industry 4.0 is funded by the EC H2020 program and involves Airbus and Comau. Mehandjiev has published more than 150 peer-reviewed research outputs and has edited three special issues of international journals. He has held visiting positions with SAP Research Lab, Atos Origin SAE, BT Research Labs. Email: n.mehandjiev@manchester.ac.uk