

Nyagadza, Brighton; Pashapa, R.; Chare, A.; Mazuruse, G.; Hove, P. K.

Article

Digital technologies, Fourth Industrial Revolution (4IR) & Global Value Chains (GVCs) nexus with emerging economies' future industrial innovation dynamics

Cogent Economics & Finance

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Nyagadza, Brighton; Pashapa, R.; Chare, A.; Mazuruse, G.; Hove, P. K. (2022) : Digital technologies, Fourth Industrial Revolution (4IR) & Global Value Chains (GVCs) nexus with emerging economies' future industrial innovation dynamics, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 10, Iss. 1, pp. 1-14, <https://doi.org/10.1080/23322039.2021.2014654>

This Version is available at:

<https://hdl.handle.net/10419/303549>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Digital technologies, Fourth Industrial Revolution (4IR) & Global Value Chains (GVCs) nexus with emerging economies' future industrial innovation dynamics

B. Nyagadza, R. Pashapa, A. Chare, G. Mazuruse & P. K. Hove

To cite this article: B. Nyagadza, R. Pashapa, A. Chare, G. Mazuruse & P. K. Hove (2022) Digital technologies, Fourth Industrial Revolution (4IR) & Global Value Chains (GVCs) nexus with emerging economies' future industrial innovation dynamics, Cogent Economics & Finance, 10:1, 2014654, DOI: [10.1080/23322039.2021.2014654](https://doi.org/10.1080/23322039.2021.2014654)

To link to this article: <https://doi.org/10.1080/23322039.2021.2014654>



© 2022 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.



Published online: 05 Jan 2022.



Submit your article to this journal [↗](#)



Article views: 12675



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 35 View citing articles [↗](#)



Received 3 May 2021
Accepted 2 December 2021

*Corresponding author: B. Nyagadza
Department of Marketing at
Marondera, University of Agricultural
Sciences & Technology (MUAST),
Zimbabwe
E-mail: brightonnyagadza@gmail.com

Reviewing editor:
Robert Read, Economics, University
of Lancaster, UNITED KINGDOM

Additional information is available at
the end of the article

DEVELOPMENT ECONOMICS | RESEARCH ARTICLE

Digital technologies, Fourth Industrial Revolution (4IR) & Global Value Chains (GVCs) nexus with emerging economies' future industrial innovation dynamics

B. Nyagadza^{1*}, R. Pashapa², A. Chare², G. Mazuruse⁴ and P. K. Hove⁵

Abstract: The advent of the Fourth Industrial Revolution (4IR) has the potential to transform emerging economies to another developmental echelon by increasing productivity and improving future fluidity of innovation across various industries. Predictively, 4IR in emerging economies will come with newest technologies that are disruptive. This technological innovation will cause changes not only in industries and business but also in societies in general. The current article is based on the Preferred Reporting Items for Systematic Literature Review and Meta-Analysis (PRISMA) of secondary data sources, mainly peer reviewed reputable journal articles. The purpose is to draw conclusions and to identify the research gaps. Results depicted that the key challenge is for the emerging economies to establish ways of engaging themselves into Global Value Chains (GVCs) that are dynamic in nature. Future researchers are encouraged to consider alternative methodologies to examine 4IR and GVCs nexus with emerging economies' within a longitudinal research design. Systematic literature review in the current article is based on a structural analysis methodology to frame the categories of the major analysis in combination with scientific rigour to a broad and complex problem. The current

ABOUT THE AUTHOR

Brighton Nyagadza is a lecturer in the department of Marketing at Marondera University of Agricultural Sciences & Technology (MUAST), Zimbabwe.

Rumbidzai Pashapa is a lecturer in department of Supply Chain Management at the Marondera University of Agricultural Sciences and Technology (MUAST), Zimbabwe.

Anyway Chare is currently a lecturer in the department of Marketing at Marondera University of Agricultural Sciences & Technology (MUAST), Zimbabwe.

Gideon Mazuruse is a Mathematics and Statistics lecturer in the Teaching Learning Institute (TLI), Marondera University of Agricultural Sciences Technology (MUAST), Zimbabwe.

Precious Hove is Executive Dean of Agribusiness Faculty at the Marondera University of Agricultural Sciences and Technology (MUAST), Zimbabwe.

PUBLIC INTEREST STATEMENT

The development of Fourth Industrial Revolution (4IR) or Industry 4.0 in emerging technologies shall result in the creation of new opportunities for emerging economies growth and development. The quality of life will increase as well as income per capita. The 4IR will bring greater partnerships via digital platforms, creating a level play field for collaborating emerging economies in controlling their resources and sovereignty. More possibilities may be created to enhance industrial production processes through integration of intelligent and automated mechanisms. Due to this, industries are developing new ways of dealing with digital disruption affecting the strategic value chains and operations. The advance of artificial intelligence and machine learning, the adoption of Block chain, and the manifest automation of jobs, the advent of 3D printing and additive manufacturing, nanotechnology and the logistical impact of self-driving cars mean that the very structure of society will change.

scientific research study contributes to theory, practice and future research directions.

Subjects: Development Studies; Politics and Development; Regional Development; Sustainable Development; Economics and Development

Keywords: innovation; Fourth Industrial Revolution (4IR); futures studies; Global Value Chains (GVCs); new digital technologies; sustainable development

1. Introduction & research contextualisation

Establishing technological innovation appetite in various emerging economies' industries is meant to address, respond and navigate within digital disruptive complexities brought by 'the new world order' or 'the new normal'. Dynamics that are brought by changes resulting from the Fourth Industrial Revolution (4IR) to emerging economies' industrial innovation is as old as human settlement (McAfee & Brynjolfsson, 2017). Due to this, automation has been and will be increased (Kim, 2020). Majority of the decisions that are currently being made by human beings will be made by the digital algorithms (Rolland et al., 2018), which are much sharper in accuracy, provided there is no unbiased data, which maybe erroneous (Kim, 2020; McAfee & Brynjolfsson, 2017). Digitally connected technologies with intelligent systems, shall revolutionise (Nyagadza, 2019a) and optimise digital Global Value Chains (GVCs) (Amsden, 2001) with interconnection of network systems, thus Internet-of-Things (Bauernhansl et al., 2014; Foresight, 2013; Younus et al., 2009), and this will affect how industries in emerging economies the way they shall operate in the near future (Micheler et al., 2019). Prior research studies have focussed on examining the interface between the African body and twenty-first century emergent disruptive technologies (Nhemachena, 2021), the 4IR and how the EU can lead it (Schäfer, 2018), the 4IR and its implications for regional economic integration in ASEAN (Menon & Fink, 2019), a holistic model for global 4IR readiness assessment barriers to 4IR adoption and its performance implications BRICS countries in GVC (Seniuk, 2019), developing disruptive products for emerging economies (Hang et al., 2010) and other related studies.

However, the current novel research study is focussed on achieving the following research objectives: (i) to analyse the link between digital technologies and emerging economies industrial growth; (ii) to evaluate the rise and diffusion of the 4IR in emerging economies; and (iii) to explore the GVCs and their links to the 4IR for future industrial innovation. In order to investigate the posed research objectives and filling the literature gaps, the researchers drew theoretical insights from Preferred Reporting Items for Systematic Literature Review and Meta-Analysis (PRISMA).

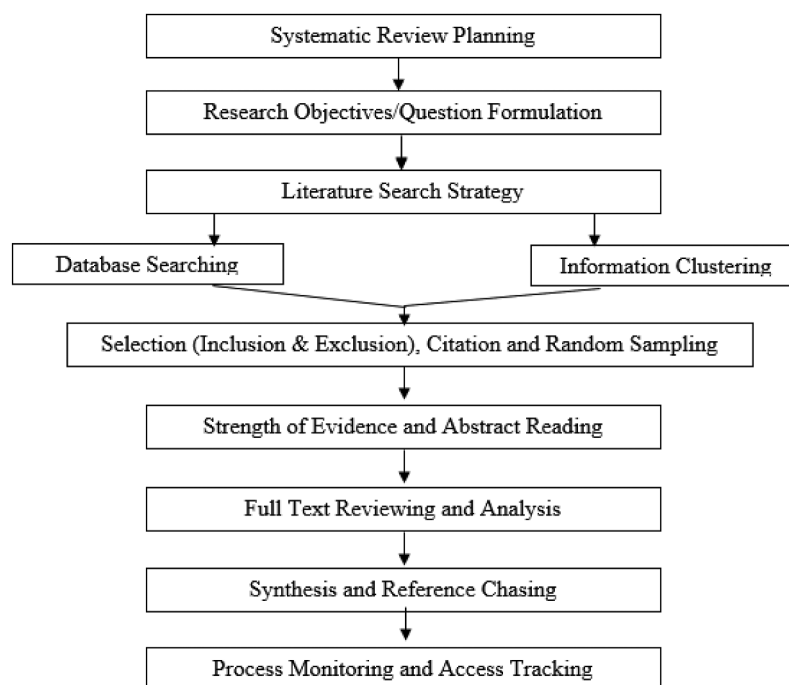
The research article is structured as follows: development of the introduction and research contextualisation, are tackled in the first section, this is followed by a section on methodological delineations, then analysis of results, and finally the conclusions, research implications, limitations, future research directions and policy recommendations to emerging economies' governments are presented.

2. Research methodology

This study is based on systematic review of secondary data sources; mainly peer reviewed journal articles. Methodology applied in the current study (PRISMA depicted in Figure 1) (Liaoa et al., 2018; Moher et al., 2009) has been used by many researchers; but for it to be effective, there is need for exhaustive bibliography search of studies published in prior years (Tranfield et al., 2003) and proper stating of concepts (Belinski et al., 2020; Liao et al., 2017). It also benefits from some policy reports, as well as reports from national and international organisations. The process involves a predetermined and comprehensive approach of searching, analysing and synthesising extant literature (Rukasha et al., 2021) on implications of the digital technologies, 4IR and GVCs nexus with emerging economies' future industrial innovation dynamics. The purpose being to draw conclusions and identifying the research gaps. Usually PRISMA is used, as it is recommended for replicability (Denyer & Tranfield,

Figure 1. Preferred Reporting Items for Systematic Literature Review and Meta-Analysis (PRISMA) flow chart.

Source: Researchers' Conception (2021).



2009) in public policy studies. Initial stage of the review process involved the refining and definition of the research objectives, which were in line with the topic. After this was done, we conducted database selection, where there was need to check on the databases which published peer reviewed articles, reports, practitioner viewpoints and proceedings on the topic under study. The major databases used was Scopus and Web of Science, due to the fact that they are the world's largest abstract and citation databases of peer-reviewed literature. For validity and reliability considerations, we avoided the inclusion of sources of literature from some online sources and newspapers. In line with this, secondly, we identified the key terms meant for optimising the search process. These included innovation, 4IR, new digital technologies, development, futures studies, etc. Succeeding to this stage was article search. We manually searched the articles from the selected databases. A total of 145 probable articles emerged from the search process. Compatibility was conducted to check on how suitable the selected articles were during the evaluation process. To fulfill, exclusion and inclusion criteria, we checked the search terms in the titles, the key words, abstracts and full texts of the identified articles. Exclusion was on articles without full text, non-related and loosely related and inclusion was on partially related, and closely related articles. Alignment to the research objectives was made to make sure there is a concise approach to the whole process. Full descriptors are depicted in Table 2. During the process, a total of 42 articles were dropped due to duplication, irrelevancy and inappropriateness. The remainder articles were further evaluated by other independent researchers for methodological quality using the Oxford Quality Scale. A minimum threshold of three out of five was required to include the article in the research study. Lastly, data extraction and population was done in line with the provisions of content analysis procedure (Nyagadza et al., 2020a). The population procedure was executed by comparing, integrating and summarising themes that emerged from the systematic review process. All the three researchers independently confirmed the credibility and rigour of the research study findings.

2.1. Articles consulted

Table 1 indicates the number of articles that were consulted by the authors during the systematic literature review in line with the key words used in the databases search process such as digital

Table 1. Digital technologies, 4IR, GVC and emerging economies databases search process

Field of Study	Representative Research articles (from 2012 to 2021) (N = 143)
Digital Technologies	Schäfer (2018), Cezarino et al. (2019), Menon and Fink (2019), Rai (2017), Mühleisen (2018), Maeyen and Van Klyton (2020), Xu et al. (2018), Schwab (2016), Akileswaran and Hutchinson (2019).
4IR	Bauer et al. (2018), Belinski et al. (2020), Kamble et al. (2018), Jabbour et al. (2018), Sanders et al. (2016), Mrugalska and Wyrwicka (2017), Santos et al. (2017), Dolgui et al. (2018), Tripathi and Gupta (2021), Ardito et al. (2019), Belinski et al. (2020), Luthra and Mangla (2017).
GVCs	Anner (2015), Baldwin (2012), Bhagwati (1958), Dünhaupt and Herr (2020), Farole (2016), Frederico et al. (2019), Gereffi (1994), Gereffi and Frederick (2010), Yeung (2014), Rodrik (2018), Milberg and Winkler (2013), UNCTAD (2013), Zhu and Morgan (2018), Xiao et al. (2020), Banga (2021), Szalavetz, (2019), World Bank (2016, 2020).
Emerging Economies	Lundvall (2016), Lee and Malerba (2017), Binz and Truffer (2017), Primi and Toselli (2020), Lee et al., (2019), Gereffi (2014, 2018), Ahmad and Primi (2017), World Bank (2010, 2017), Corrocher et al. (2018), Ferraz et al. (2019).

Table 2. Inclusion and exclusion criteria of papers and their explanations

I/E	Criteria	Criteria Explanations
Exclusion	Without full-text (WF)	The authors have no access to its full text.
	Non-related (NR)	Its definition about the subject neither related.
	Loosely related (LR)	It does not contain any description related to the subject. It is only used as loose expression cited in the text without being the main focus.
Inclusion	Partially related (PR)	It lists one or more but without detailed description.
	Closely related (CR)	An official document that contains the detailed descriptions of the subject under study.

Source: Secondary Data (2021).

technologies, 4IR, GVC and emerging economies. The majority bibliography or references that were able to meet the following criteria were consulted:

- Heralded online after March 2012 (due to the fact that the 4IR concept came to be of much interest to academics and practitioners from 2012, after it was presented in the Hanover Fair in Germany, 2011);
- Contained search items in the title, abstract and/or keywords;
- Provided they were written in English language;
- They were published in conference proceedings, journals, book series, policy reports or books.

In a bid to get enough convincing research rigour, the researchers came up with a list of influential researchers in top tier journals and book chapters heralded by renowned international and global publishers. Evidence from the systematic literature review indicates that the publication of digital

technologies, 4IR, GVC and Emerging economies has not only limited to the latter, but also to the developed and developing world economies, as depicted in the methodology section. Table 2 indicates papers' inclusion and exclusion criteria policy and their explanations.

2.2. Why PRISMA methodology was adopted for the current study?

The current PRISMA methodology for this particular study was adopted, as compared to other methodologies, due to the fact that it leads to development of the research questions which further make contribution to the enhancement of scientific knowledge (Tranfield et al., 2003). Furthermore, the PRISMA approach makes the researchers to be able to search for gaps found in the literature reviews, which serve as sources of insight and future direction for the original substantive benefits for the emerging researchers in the areas of Digital Technologies, 4IR and GVCs. In line with prior research, present reality may be improved and prepared for the future research.

3. Results

This section presents the results from PRISMA focussing on Digital Technologies, 4IR and GVCs nexus with emerging economies' future industrial innovation dynamics.

3.1. Digital technologies and emerging economies' industrial innovative growth

Digital Technologies are as a result of the emergence of 4IR dynamic disruptive technologies. These disruptive technologies are now being used to transform sections of the humans into posthuman or transhuman cyborgs or biology-technology hybrids (Flores, 2018a; Martins et al., 2019; Nhemachena, 2021). Digital technologies are going to unlock the potential for sustainable industrial innovation in emerging economies, through facilitating the inter-linkages in the enhanced production process. Innovation, scientific discovery and the rate at which technology is deployed, adapted and scaled have all fuelled technological advancement (Schäfer, 2018). While industrialised economies possess a reputation for innovation, many other developing economies do not and are still trying to catch up. Technological advancement is frequently linked to the development of novel and useful products through ingenuity and invention (Akileswaran & Hutchinson, 2019; Schwab, 2016). However, in many developing economies, it is more prevalent to implement and scale technological solutions developed elsewhere (International Finance Corporation, 2017).

Globally, digital revolution is having a significant impact, though the rate of change fluctuates relative to geographic location and industry (Akileswaran & Hutchinson, 2019). Innovations in technology are transforming the conduct of business organisations, causing an upsurge in economic prospects that call for innovative skills (Rai, 2017). The whole world is experiencing the 4IR, with digital and physical assets, as well as biological science, all converging. Business organisations are progressively adopting digital practices (Menon & Fink, 2019). White-collar jobs are being performed using digital robots and the ride-sharing economy is booming (Rai, 2017). This technological innovation will cause a drastic change not only in business but also in societies in general (Xu et al., 2018). Education and competition policies will need to be revised. Schools and universities should prepare future generations to work in the emerging economy by aligning their skills with trends in the digital sphere (Schäfer, 2018). Societies in emerging economies will also need to prioritise retraining workers whose skills have been timed out (Cezarino et al., 2019). Similarly, production reorganisation places new strains on competition policies to ensure that new techniques do not become the domain of a few firms that monopolise the market (Mühleisen, 2018). Disruptive technologies directly related to 4IR such as Artificial Intelligence (AI), Robotics, Block Chain and 3D printing are changing the social, economic and political systems (Menon & Fink, 2019), often in unpredictable, revolutionary and speedy ways (Schwab, 2016). The technologies such as self-learning technologies algorithms, self-driving cars, human-machine interconnection and big data analytics (Cezarino et al., 2019; Schäfer, 2018), are emerging faster, to the extent that their adoption is moving so quickly (Menon & Fink, 2019).

3.2. Fourth industrial revolution (4IR)

4IR or Industry 4.0 (I4.0) can be defined as the transformation to novel systems, which bring together the physical and digital technologies to an increasingly interconnected population of

active users (Tripathi & Gupta, 2021). First proposal of the 4IR was mentioned in a paper in 1985 (Rostow, 1985), which applied the Kondratieff Cycle and long-term cyclical trends in resource enhancing activities to discuss its meaning (Liaoa et al., 2018). It has been adopted as part of the 2020 High Technology Plan in November 2011 (Ardito et al., 2019), by the German government as a strategic initiative (Belinski et al., 2020).

The development of 4IR emerging technologies shall result in the creation of new opportunities for emerging economies growth and development. The quality of life will increase as well as income per capita. Major researches on the subject of 4IR impact on industrial sustainability (Jabbour et al., 2018; Kamble et al., 2018), manufacturing using lean management systems (Mrugalska & Wyrwicka, 2017; Sanders et al., 2016), development of industrial products (Santos et al., 2017), industrial production control (Dolgui et al., 2018), industrial performance management measurement and GVCs (Dünhaupt & Herr, 2020; Frederico et al., 2019; Zhu & Morgan, 2018) have been conducted to date with an aim to see its economic and societal impact. The 4IR will bring greater partnerships via digital platforms, creating a level play field for collaborating emerging economies in controlling their resources supply chain and sovereignty (Belinski et al., 2020). Examples cited to buttress this argument include the transformed agriculture in Israel and new and emerging trends in Rwanda and Ghana. The challenge however remains the accessibility of that technology to ordinary farmers in poor countries. Given that many emerging economies' citizens are barely literate, it also poses challenges since many of them cannot use the technology for their benefit (Belinski et al., 2020).

3.3. Global value chains (GVCs), 4IR and industrial innovation

GVCs came to existence as a result of international trade deregulation and liberalisation (Herr & Dünhaupt, 2019), as well as the innovations in the financial, telecommunications and transportation systems. In today's world, the prevailing trade occurs through enhanced GVCs. Their governance and leadership is through big multi-national exporting firms, and the production processes are complex and non-market based (Herr & Dünhaupt, 2019). The rapid increase in GVCs will significantly influence business operations in international trade (Xiao et al., 2020). In recent years the trend in international production has changed as a result of the emergence of GVCs. Manufacturing processes are now dispersed across different countries. GVCs describe the full range activities (tangible or intangible), undertaken by inter-company networks on a global scale, to bring a product or service from its point of origin to its end user and beyond (Gereffi & Fernandez-Stark, 2016). The concept of GVCs is connected to supply chains because the trade networks have become global in scope, due to more intermediate goods being traded across borders, involving all the newly emerging economies (UNCTAD, 2013). A closer look at these emerging economies trends around the globe clearly depict that fewer of these economies have benefited from the growing global interconnectedness (Primi & Toselli, 2020). In reference to the emerging economies, the negative effects of the 4IR would more impactful given the disadvantages it creates in the GVCs. This is as result of the fact that being in a GVCs does not guarantee upgrading of technology, diversification, innovation, productivity and knowledge creation (Lee et al., 2019; World Bank, 2016). GVCs analysis makes a vivid framework for understanding any product in the global commerce by showing commercially relevant life of products, from research, development and design (Sobel-Read, 2014).

3.4. Connecting 4IR, GVCs and the human resources training: which way to follow?

The convergence of strategic emerging economies' resources sovereignty, control and ownership with the 4IR emerging technologies can also be seen as a panacea meant to achieve the Sustainable Development Goals (SDGs). This would be meant to explore the intended domains as highly interconnected system that would make the operations in the emerging economies' industries and businesses to be simplified than to be viewed as complex in nature (Manda & Dhaou, 2019). For example, Africa, through the functioning of the 4IR emerging technologies, would be able to sustainably drive digital human resources training transformations to be more understandable and tractable. The technologies are beginning to take shape in major emerging economies such as the BRICS in the areas such as energy, agriculture, education, banking, entertainment and transport. If we

consider the challenges which the current world faces and the knowledge and skills that may be required, creativity, innovation, ingenuity, higher order and critical thinking are indispensable to providing the abstract problems that face the world (Fayomi et al., 2019). The world of work is changing as a result of the massive increase in internet connectivity and big data and automation. Increased use of robots in industrial production jeopardises many jobs especially in the manufacturing sector.

3.5. Impact of 4IR in sub-Saharan region

The 4IR has been progressing and spreading like a wildfire throughout all parts of the world, presenting a plethora of opportunities for growth particularly to developing economies. However, the onus is on the developing economies themselves to take advantage of the opportunities presented in order to realise any meaningful benefit from the 4IR boom. If the world's developing economies are to use the advantage presented by the 4IR, they would be compelled to establish structures to address issues to do with adoption, accessibility, affordability and the application of technologies (Adhikari, 2019). One of the fundamental matters that least developed economies need to look into is the early adoption of technologies. Leapfrogging and harnessing technologies as they are introduced can go a long way in positioning least developed economies for growth through technology. Whilst early adoption of technologies usually result in positive results, laggard economies often face the challenge of always following the leader meaning they will always be playing catch-up, therefore remaining one or more steps behind in development (Lee, 2021). Therefore, it is imperative upon developing economies to identify and take up new technologies to drive the growth of their value chains and ultimately their economies. Emerging economies face the challenge of acquiring technologies largely due to barriers such as licence and patent rights. However, with so many open source technologies around, developing economies can circumvent the challenges of patents and licence requirements by harnessing relevant open source technologies (Adhikari, 2019). Open source technologies such as the block chain can be adopted and adapted to suit particular functional requirements.

Consequently, it can be argued that through the 4IR emerging technologies, internet connection is and shall be much higher in sub-Saharan Africa (Deloitte, 2018). More than half of the South African population has digital access to the internet, standing at 59%, compared to other countries in the Southern African Development Community (SADC) (Nyagadza, 2019a). The World Economic Forum has made a research report on the readiness of countries which are well positioned in the development of production with the coming in of 4IR emerging technologies. For emerging African countries and their available resources, South Africa proved to have topped the ranking. This was based on whether the countries can be able to take advantage of technological changes that could be rooted from the 4IR. The following figure clearly depicts that South Africa has the highest chances of production effectiveness and resources control through the coming in of the 4IR. There are some indices used by the World Economic Forum (WEF) to assess the readiness included changes associated with global leaders, high potential, legacy champions and followers (Mothobi et al., 2017). The failure to achieve some of the matters related to the control, ownership and sovereignty in terms of emerging economies' resources, many of them proved to be having scarcity in terms of internet connectivity for the wireless radio frequencies. This ultimately leads to strong inefficiencies. High speed internet connectivity is a super prerequisite for the 4IR investments in its emerging technologies.

Common challenges that have been so observable in the emerging countries in harnessing the resources control, ownership and sovereignty through adoption of the 4IR technological dynamics, include but not limited to legislature—inconsistencies and bottlenecks in policies related to ICT, broadband, data protection, privacy and integrity, cybersecurity, artificial intelligence; poor ICT infrastructure—copper cables, fibre optic cables, microwave satellites; data pricing—which is highly competitive by internet service providers, causing problems of access to rural counterparts; licensing of radio frequencies—lack of digitally smart technical skills and knowledge; energy and power development—poor electricity distribution in much parts of

African rural areas; skills development—lack of skills development to support the diffusion of stem education, innovation and policies as well as fix labour supply mismatch. Subsequent development of the key “smart Africa” initiatives can be a solution to the problems haunting the African continent in resources control, ownership and sovereignty. These may need to be focussed on major sectors such as finance, health, agriculture, cities, education and governance (Africa, 2018). Capacity building is required deal with the support and controls for strategic innovation. Further to this, there is need to do things differently by using the digital technology more effectively, integrating the information and probably redesigning the integrated operations planning, control and decision support systems, predictive maintenance and shared values for efficiency (Deloitte, 2018). In line with this, in order to establish a leverage to 4IR dynamics for resources control and ownership such as those in the mining sector, there is need to make recognition of the responsibilities when implementing policies frameworks for business and government. However, the challenges of the 4IR emerging technologies in the control of emerging economies’ industrial resources and sovereignty establishment may include, but not limited to, sufficiency issues related to maturity befitting technological disruption and whether there can be affordability to the costs faced (Micheler et al., 2019; Ordoobadi, 2011; Van der Velden et al., 2012) for interoperability reasons (Micheler et al., 2019). The complexities are still visible on how the emerging economies’ industries access to and control over resources has yielded conflicts.

4. Conclusion

Theoretical, practical and future research implications as well as limitations of the study findings are discussed in this section.

4.1. Theoretical implications

There shall be sufficient evidence to argue that the current industrial disruptive transformations are not a merely extension of the Third Revolution but marks the arrival of the 4IR a unique phase in terms of scope, velocity and systems impact. With exponential rather than linear pace, the 4IR shall disrupt almost every industry in every emerging economy (Xu et al., 2018). As the forces of technology are increasing daily, there shall be a mega shift in terms of how the emerging economies businesses are operating (World Economic Forum, 2018b), leading to the re-examination of the way they keep and guard their resources sustainably (Schwab, 2016). There are potential benefits that will result from the development of 4IR due to the changes that the technology shall foster; ranging from, but not limited to economic, social and environmental benefits. The key issue remains ownership and control of the technology which is usually in the hands of minority few white owned corporations (Schwab, 2016). That emerging economies are incapacitated to grapple with the changes in the economy is crystal clear. Given that all the opportunities that the digital revolution represents are premised on super-fast, reliable and affordable connectivity, emerging African economies cannot shoulder this investment by themselves. This means they have to depend on the external environment to support them financially. Besides worsening the debt burden, this has serious implications on the control and ownership of resources in emerging economies. Many cases of emerging economies exchanging minerals, land rights, elephants, rhinoceros and other animals for investment capital point to the fact that the continent is devoid of the necessary technological stamina to compete with the industrialised world in the implementation of the 4IR (Xu et al., 2018). The dependence syndrome that was popular in the 1960s shall be galvanised by the technological colonisation that is being spearheaded by such transformations as 4IR. The 4IR new technology may result in the efficiency of ‘smart agricultural systems’, where there would be technologically connected monitoring devices to control and access as well as move resources, at a lower cost than before (Rukasha et al., 2021). It is in this context that equipment such as Drones for surveying will be very necessary and the use of sensors, big data and machine learning could transform emerging economies’ agricultural productivity, releasing labour for more productive use (World Economic Forum, 2018a). In this scheme of things, it is suggested that such a scenario will increase output and improve food accessibility and security.

4.2. Practical Implications

The African Development Bank recommends the establishment of economic zones and industrial parks to overcome lacking infrastructures and thereby facilitate the development of globally competitive firms (AfDB, 2018a). Through the use of Export Processing Zones (EPZ), Africa can join GVCs and gradually upgrade its way into competitive positions while creating jobs using low-skilled cheap labour as the entry means. The presence of low labour cost is becoming an important driver of FDI attraction into the sub-Sahara region (Debrah et al., 2018; Naudé, 2017; The Africa Competitiveness Report, 2017). Predictively, by 2030, emerging economies will be totally integrated to a digitally revolutionised economy, with technological innovation in all industries for resources control, ownership and sovereignty. The result would be empowered emerging economies with dynamic population in a new world of work. Negative implications can be felt in the emerging economies in the process of controlling, owning of resources and establishing sovereignty under the 4IR emerging technologies. Amongst other factors, there are issues of cyber security risk; hacktivism, data manipulation, corporate espionage, insider threats and general information loss (Deloitte, 2018). World Economic Forum (WEF), expects emerging economies to face challenges as digitalisation may cause serious job losses in all industries (Deloitte, 2018). It is difficult to imagine how a country like Mauritania can compete with a multinational company like Huawei. Against such a background, the unequal relationship is being buttressed by the need for convenience in the twenty-first century. Adaptability of Africa's technology trends has also been viewed as a bit slower, with resultant negative effect to social resources control, ownership and sovereignty. This was unearthed by the research conducted by the World Economic Forum (WEF), World Bank (WB) and African Development Bank (AfDB) (2013), collaboratively.

4.3. Study limitations and future research implications

The study has limitations which may affect the generalisability of the results, since they can only be applied to the literature area studied. Complementary research studies can be done in other parts of the world to be able to come up with cross-cultural comparisons, as well as methodological validation. Another limitation was nature of the study (PRISMA), which does not allow immediate conclusions to be made about the development of digital technologies, 4IR and GVCs. In future, longitudinal empirical research study inquiries can be made in order to check different variations of economic situations in other relevant studies. Future research studies can include evaluating other relevant theoretical frameworks in Digital Technologies, 4IR and GVCs theory. Despite the limitations of the current study, the results have contributed to the better understanding of digital technologies, 4IR and GVCs in emerging economies. The results hopefully may influence further future research study inquiries.

4.4. Policy recommendations to emerging economies' governments

The governments of emerging economies need to take cognisance of the following policy recommendations in order to get positive results in terms of spill overs from the location of GVCs. This is so because the emergence of GVCs, digital technologies and 4IR has brought development of service without borders, enhancing the production of goods, exportation and consumption beyond a country's national economic space. The following are some of the recommendations:

- (a) In order to benefit, the emerging economies governments are encouraged to establish proper geographical proximity to special economic hubs. This will lead to lower transport and transactional costs, accelerating effective and efficient delivery as well as trust improvement.
- (b) Establishment of investment incentives and preferential flexible finance trade policy.
- (c) There is need for making the legal institutions to facilitate proper rule of law, enforcement of contract, protection of rights, risk reduction and intellectual property, so as to increase transparency and security when doing international transactions. These are the lynchpin to GVCs linkages between firms.

- (d) Governments are encouraged to establish enhanced innovation systems, which are necessary for improving efficiency in reducing the complexity of transactions and interactive exchange of modernised technology transfer between domestic firms and leading companies. Elsewhere, these new forms of technology are lauded for presenting an opportunity to deal with current socio-economic problems, however their association with some of the transnational corporations (TNCs) might raises eyebrows.
- (e) Policies that leads to the development of proper seamless logistics, in terms of transportation of goods and facilitation of service efficiency is required across national boundaries.
- (f) Flexible exchange rate and monetary policies can play a major role as a way of avoiding current and capital accounts for the respective emerging economies, with an aim of generating sufficient demand and taking over high-value-creating functions in GVCs. This works hand-in-glove with industrial policy for particular emerging economy.
- (g) Development of local manufacturing industries with integration to regional and GVCs, with comprehensive forward and backward linkages is necessary to benefit a nation and its citizens. This will make the economies able to discover the total spectrum of firms that comprise it and the associated firms, which is essential for normative intervention at domestic and international levels.
- (h) Creation, transfer and absorption of Trade in Value Added (TiVA) as a measure and policy for the refinement of GVCs connecting nations around the globe is a necessity, so as to establish absolute and comparative advantage during trade.
- (i) Policies relating to availability of competent human resources is a key aspect within emerging economies. How this problem can be solved in the present and future circumstances is also a necessity. The governments need to address on which are the best ways to train many people in digital expertise in order to participate in the GVCs of transnationals (TNCs) with an aim of not being only passive employees. This may cut across in various sectors for example in the local entrepreneurs, research, patents and others.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

Author details

B. Nyagadza¹
 E-mail: brightonnyagadza@gmail.com
 ORCID ID: <http://orcid.org/0000-0001-7226-0635>
 R. Pashapa²
 E-mail: rpashapa@muast.ac.zw
 A. Chare²
 E-mail: anychare@gmail.com
 G. Mazuruse⁴
 E-mail: gmazuruse@gmail.com
 P. K. Hove⁵
 E-mail: hovep1975@gmail.com

¹ Department of Marketing at Marondera, University of Agricultural Sciences & Technology (MUAST), Zimbabwe.

² Department of Supply Chain, Management at the Marondera University of Agricultural Sciences and Technology (MUAST), Zimbabwe.

⁴ Mathematics and Statistics, Teaching & Learning Institute (TLI), Marondera University of Agricultural Sciences & Technology (MUAST), Zimbabwe.

⁵ Agribusiness Faculty, Marondera University of Agricultural Sciences and Technology (MUAST), Zimbabwe.

Disclosure statement

The researchers declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Citation information

Cite this article as: Digital technologies, Fourth Industrial Revolution (4IR) & Global Value Chains (GVCs) nexus with emerging economies' future industrial innovation dynamics, B. Nyagadza, R. Pashapa, A. Chare, G. Mazuruse & P. K. Hove, *Cogent Economics & Finance* (2022), 10: 2014654.

References

- Adhikari, R. (2019). *6 ways least developed countries can participate in the 4IR* | World Economic Forum. World Economic Forum (WEF). <https://www.weforum.org/agenda/2019/08/6-ways-least-developed-countries-can-participate-in-the-4ir/>
- AfDB. (2018a). *African economic outlook 2018*. African Development Bank Group.
- Africa, S. (2018). *Smart Africa manifesto*. 2013
- Ahmad, N., & Primi, A. (2017). From domestic to regional to global: Factory Africa and factory latin America? In *Chapter 3 in World Bank* (pp. 69–96).
- Akileswaran, K., & Hutchinson, G. (2019). *Adapting to the 4IR: Africa's development in the age of automation*. Tony Blair Institute for Global Change. Retrieved June 16, 2021), from <https://institute.global/sites/default/files/articles/Adapting-to-the-4IR-Africa-s-development-in-the-age-of-automation.pdf>
- Amsden, A. H. (2001). *The rise of the rest: Challenges to the West from late-industrializing economies*. Oxford University Press.
- Anner, M. (2015). Stopping the race to the bottom: Challenges for workers' rights in supply chains in Asia. *FES Briefing Paper*. FES Vietnam, Hanoi.
- Ardito, L., Petruzzelli, A., Panniello, M. U., & Garavelli, A. C. (2019). Towards industry 4.0: Mapping digital

- technologies for supply chain management-market-integration. *Business Process Management Journal*, 25(2), 323–346. <https://doi.org/10.1108/BPMJ-04-2017-0088>
- Baldwin, R. (2012). *WTO 2.0: Global governance of supply chain trade, policy insight*, 64. Centre for Economic Policy Research.
- Banga, K. (2021). Digital technologies and product upgrading in global value chains: Empirical evidence from Indian manufacturing firms. *The European Journal of Development Research*, 1–26.
- Bauer, H., Brandl, F., Lock, C., & Reinhart, G. (2018). Integration of industry 4.0 in lean manufacturing learning factories. *8th Conference on Learning Factories, Procedia Manufacturing* (Vol. 23) pp. 147–152.
- Bauernhansl, T., Ten Hompel, M., & Vogel-heuser, B. (2014). *Industrie 4.0 in produktion, automatisierung und logistik* (1st ed.). Springer Vieweg.
- Belinski, R., Peixe, A. M. M., Frederico, G. F., & Garza-Reyes, J. A. (2020). Organizational learning and Industry 4.0: Findings from a systematic literature review and research agenda. *Benchmarking: An International Journal*, 27(8), 2435–2457. <https://doi.org/10.1108/BIJ-04-2020-0158>
- Bhagwati, J. (1958). Immiserizing growth: A geometrical note. *Review of Economic Studies*, 25(3), 201–205. <https://doi.org/10.2307/2295990>
- Binz, C., & Truffer, B. (2017). Global innovation systems—A conceptual framework for innovation dynamics in transnational contexts. *Research Policy*, 46(7), 1284–1298. <https://doi.org/10.1016/j.respol.2017.05.012>
- Cezarino, L. O., Liboni, L. B., Stefanelli, N. O., Oliveira, B. G., & Stocco, L. C. (2019). Diving into emerging economies bottleneck: Industry 4.0 and implications for circular economy. *Management Decision*.
- Corrocher, N., Mavilia, R., & Giorgio, M. (2018). The sino-german alliance for the fourth industrial revolution: Dynamics and policy implications. *Journal of Economic Policy Reform*, 1–21.
- Debrah, Y. A., Oseghale, R. O., & Adams, K. (2018). Human capital, innovation and international competitiveness in sub-saharan Africa. In *In Africa's competitiveness in the global economy* (pp. 219–248). Palgrave Macmillan.
- Deloitte. (2018). *The future of mining in Africa navigating a revolution*. https://www2.deloitte.com/content/dam/Deloitte/za/Documents/energy-resources/za_Future_of_mining.pdf
- Denyer, D., & Tranfield, D. (2009). Producing a systematic literature review. In D. A. Buchanan & A. Bryman (Eds.), *The sage handbook of organisational research methods* (pp. 671–689). Sage Publications.
- Dolgui, A., Ivanov, D., Sethi, S. P., & Sokolov, B. (2018). Scheduling in production, supply chain and Industry 4.0 systems by optimal control: Fundamentals, state-of-the-art and applications. *International Journal of Production Research*, 56(1–2), 1–22. <https://doi.org/10.1080/00207543.2018.1429119>
- Dünhaupt, P., & Herr, H. (2020). Global value chains – A ladder for development? In *International review of applied economics* (pp. 1–20).
- Farole, T. (2016). Do global value chains create jobs? In *IZA world of labour* (Vol. 291).
- Fayomi, O. S. I., Okokpujie, I. P., Fayom, G. U., & Okolie, S. T. (2019). The challenge of Nigeria researcher in meeting up with sustainable development goal in 21st Century. *Energy Procedia*, 157, 393–404. <https://doi.org/10.1016/j.egypro.2018.11.204>
- Ferraz, C., Kupfer, D., Torracca, J., & Britto, J. (2019). Snapshots of a state of flux: How Brazilian industrial firms differ in the adoption of digital technologies and policy implications. *Journal of Economic Policy Reform*, 1–18.
- Flores, D. S. (2018a). Transhumanism: The big fraud-towards digital slavery. *International Physical Medicine & Rehabilitation Journal*, 3(5), 318–392. <https://doi.org/10.15406/ipmrj.2018.03.00131>
- Foresight (2013). *The future of manufacturing. A new era of opportunity and challenge for the UK Summary Report*. The Government Office for Science.
- Frederico, G. F., Garza-Reyes, J. A., Anosike, A., & Kumar, V. (2019). 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>
- Gereffi, G., & Fernandez-Stark, K. (2016). Global value analysis: A primer. In *Center for globalization governance & competitiveness 2nd ed.* (July).
- Gereffi, G., & Frederick, S. (2010). The global apparel value chain, trade and the crisis. In O. Cattaneo, G. Gereffi, & C. Staritz (Eds.), *Global value chains in A Postcrisis world - A development perspective* (pp. 157–208). World Bank.
- Gereffi, G. (2014). Global value chains in a post-washington consensus world. *Review of International Political Economy*, 21(1), 9–37. <https://doi.org/10.1080/09692290.2012.756414>
- Gereffi, G. (2018). *Global value chains and development: redefining the contours of 21st century capitalism*. Cambridge University Press.
- Gereffi, G. (1994). The organization of buyer-driven global commodity chains: How U.S. Retailers shape overseas production networks. In G. Gereffi & M. Korzeniewicz (Eds.), *Commodity chains and global capitalism* (pp. 95–122). Greenwood Press.
- Hang, C. C., Chen, J., & Subramian, A. M. (2010). Developing disruptive products for emerging economies: Lessons from Asian cases. *Research Technology Management*, 53(4), 21–26. <https://doi.org/10.1080/08956308.2010.11657637>
- Herr, H., & Dünhaupt, P. (2019). Global value chains in economic development (No. 124/2019). Working Paper. International Finance Corporation. (2017). *How technology creates markets trends and examples for private investors in emerging markets*. In IE University Insights. www.ifc.org
- Jabbour, A. B. L. S., Jabbour, C. J. C., Godinho Filho, M., & Roubaud, D. (2018). Industry 4.0 and the circular economy: A proposed research agenda and original roadmap for sustainable operations. *Annals of Operations Research*, 270(1–2), 273–286. <https://doi.org/10.1007/s10479-018-2772-8>
- Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2018). Sustainable Industry 4.0 framework: A systematic literature review identifying the current trends and future perspectives. *Process Safety and Environmental Protection*, 117, 408–425. <https://doi.org/10.1016/j.psep.2018.05.009>
- Kim, B. (2020). Moving forward with digital disruption: What big data, IoT, synthetic biology, AI, blockchain, and platform businesses mean to libraries. American Library Association.
- Lee, K. (2021). *How developing countries can take advantage of the fourth industrial revolution | industrial analytics platform*. <https://iap.unido.org/articles/how-developing-countries-can-take-advantage-fourth-industrial-revolution>
- Lee, K., & Malerba, F. (2017). Catch-up cycles and changes in industry leadership: Windows of opportunity and the responses by actors in sectoral systems. *Research Policy*, 46(2), 338–351. <https://doi.org/10.1016/j.respol.2016.09.006>

- Lee, K., Wong, C.-Y., Intarakumnerd, P., & Limapornvanich, C. (2019). Is the 4th industrial revolution a window of opportunity for upgrading or reinforcing the middle-income trap? *Journal of Economic Policy Reform*, 1–18.
- Liao, Y., Deschamps, F., Loures, E., & Ramos, L. F. P. (2017). Past, present and future of industry 4.0 a systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12), 3609–3629. <https://doi.org/10.1080/00207543.2017.1308576>
- Liaoa, Y., Louresa, E. R., Deschamps, F., Brezinskia, G., & Venâncio, A. (2018). The impact of the fourth industrial revolution: A cross-country/region comparison. *Production*, 28, 1–18.
- Lundvall, B.-Å. (2016). *Learning economy and the economics of hope*. Anthem Press.
- Luthra, S., & Mangla, S. K. (2017). Evaluating challenges to industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environment Protection*, 1–40.
- Maeyen, E., & Van Klyton, A. (2020). *The impact of digital technology usage on economic growth in Africa*. January.
- Manda, M. I., & Dhaou, S. B. (2019). Responding to the challenges and opportunities in the 4th Industrial revolution in developing countries. In *Conference Paper at the International Conference on Theory and Practice of Electronic Governance (ICEGOV2019)*. Melbourne, VIC, Australia. April 3–5. <https://collections.unu.edu/eserv/UNU:7324/p244-Ickson-Manda.pdf08/01/2020>
- Martins, N. R. B., Angelica, A., Chakravarty, K., Svidinenko, Y., Boehm, F. J., Opris, I., Lebedev, M. A., Swan, M., Garan, S. A., Rosenfeld, J. V., Hogg, T., & Freitas, R. A. (2019). Human brain/cloud interface. *Frontiers in Neuroscience*, 13(112), 1–24. <https://doi.org/10.3389/fnins.2019.00001>
- McAfee, A., & Brynjolfsson, E. (2017). *Machine, platform, crowd: Harnessing our digital future* (pp. 64). W. W. Norton & Co.
- Menon, J., & Fink, A. (2019). The fourth industrial revolution and its implications for regional economic integration in ASEAN. *Journal of Asian Economic Integration*, 1(1), 32–47. <https://doi.org/10.1177/2631684618821566>
- Micheler, S., Goh, Y. M., & Lohse, N. (2019). Innovation landscape and challenges of smart technologies and systems – A European perspective. *Production & Manufacturing Research*, 7(1), 503–528. <https://doi.org/10.1080/21693277.2019.1687363>
- Milberg, W., & Winkler, D. (2013). *Outsourcing economics. Global value chains in capitalist development*. University Press.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(7), 264–269. <https://doi.org/10.1371/journal.pmed.1000097>
- Mothobi, O., Chair, C., & Rademan, B. (2017). SADC not bridging digital divide, RIA (Research ICT Africa) Policy Brief, 6
- Mrugalska, B., & Wyrwicka, M. K. (2017). Towards lean production in industry 4.0. *Procedia Manufacturing*, 12, 466–473.
- Mühleisen, M. (2018). The long and short of the digital revolution. *Finance and Development*, 55(2), 4–8.
- Naudé, W. (2017). Entrepreneurship, education and the fourth industrial revolution in Africa. *IZA discussion papers*, No. 10855.
- Nhemachena, A. (2021). Hakuna Mhou Inokumira Mhuru Isiri Yayo: Examining the interface between the African body and 21st century emergent disruptive technologies. *Journal of Black Studies*, 1–20.
- Nyagadza, B. (2021). Futurology reorientation nexus: Fourth industrial revolution. In H. Kazeroony & D. Tsang (Eds.), *Chapter 3 in management education & automation*. Routledge, Taylor & Francis.
- Nyagadza, B., Kabonga, I., Hlungwani, P. M., Chigora, F., & Rukasha, T. (2021). The fourth Industrial Revolution and the Imperatives of African States' Sovereignty over natural resources. In A. Nhemachena, J. Kangira, & B. M. Chiripanura (Eds.), *From #RhodesMustFall movements to #HumansMustFall movements: African liberation movements in the age of the transhumanist geographies of death*. Langaa Research & Publishing Common Initiative Group.
- Nyagadza, B., Kadembo, E. M., & Makasi, A. (2020a). Exploring internal stakeholders' emotional attachment & corporate brand perceptions through corporate storytelling for branding. *Cogent Business & Management*, 7(1), 1–22.
- Nyagadza, B. (2019a). Responding to change and customer value improvement: Pragmatic advice to banks. *The Marketing Review (TMR)*, 19(3), 235–252. <https://doi.org/10.1362/146934719X1577456287719>
- Ordoobadi, S. (2011). Inclusion of risk in evaluation of advanced technologies. *The International Journal of Advanced Manufacturing Technology*, 54(1–4), 413–420. <https://doi.org/10.1007/s00170-010-2938-2>
- Primi, A., & Toselli, M. (2020). A global perspective on industry 4.0 and development: New gaps or opportunities to leapfrog? *Journal of Economic Policy Reform*, 23(4), 371–389. <https://doi.org/10.1080/17487870.2020.1727322>
- Rai, S. K. (2017). *Digital transformation: An opportunity for emerging markets | IE insights*. IE University Insights. <https://www.ie.edu/insights/articles/digital-transformation-an-opportunity-for-emerging-markets/>
- Rodrik, D. (2018). New technologies, global value chains, and the developing economies. *Pathways for prosperity commission background paper series 1*. Oxford, UK.
- Rolland, K. H., Mathiassen, L., & Rai, A. (2018). Managing digital platforms in user organizations: The interactions between digital options and digital debt. *Information Systems Research*, 29(2), 419–443. <https://doi.org/10.1287/isre.2018.0788>
- Rostow, W. W. (1985). The fifth Kondratieff upswing and the fourth industrial revolution: Their meaning for forestry. In *Investments in forestry: Resources, land use and public policy*.
- Rukasha, T., Nyagadza, B., Pashapa, R., & Muposhi, A. (2021). Covid-19 impact on Zimbabwean agricultural supply chains and markets: A sustainable livelihoods perspective. *Cogent Social Sciences*, 7(1), 1–17. <https://doi.org/10.1080/23311886.2021.1928980>
- Sanders, A., Elangeswaran, C., & Wulfsberg, J. (2016). Industry 4.0 implies lean manufacturing: Research activities in industry 4.0 function as enablers for lean manufacturing. *Journal of Industrial Engineering and Management*, 9(3), 811–833. <https://doi.org/10.3926/jiem.1940>
- Santos, K., Loures, E., Piechnicki, F., & Cancigliero, O. (2017). Opportunities assessment of product development process in Industry 4.0. *Procedia Manufacturing*, 11, 1358–1365. <https://doi.org/10.1016/j.promfg.2017.07.265>
- Schäfer, M. (2018). The fourth industrial revolution: How the EU can lead it. *European View*, 17(1), 5–12. <https://doi.org/10.1177/1781685818762890>

- Schwab, K. (2016). *The fourth industrial revolution* (pp. 6–7). Currency.
- Seniuk, N. (2019). BRICS countries in global value chains. *Strategic Analysis*, 43(6), 509–531. <https://doi.org/10.1080/09700161.2019.1669900>
- Sobel-Read, K. B. (2014). Global value chains: A Framework for analysis. *Transnational Legal Theory*, 5(3), 364–407. <https://doi.org/10.5235/20414005.5.3.364>
- Szalavetz, A. (2019). Digitalisation, automation and upgrading in global value chains–factory economy actors versus lead companies. *Post-Communist Economies*, 31(5), 646–670. <https://doi.org/10.1080/14631377.2019.1578584>
- The Africa Competitiveness Report (2017). *Addressing Africa's demographic dividend. the world economic forum with the support of the international bank for reconstruction and development/ the world bank and the African development bank.* www.weforum.org/acr
- Tranfield, D. R., 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), 217–222. <https://doi.org/10.1111/1467-8551.00375>
- Tripathi, S., & Gupta, M. (2021). A holistic model for global industry 4.0 readiness assessment. *Benchmarking: An International Journal*, 1463–5771.
- UNCTAD (2013). *Global value chains and development: Investment and value added trade in the global economy UNCTAD/DIAE/2013/1* Available http://unctad.org/en/PublicationsLibrary/diae2013d1_en.pdf
- Van der Velden, C., Bil, C., & Xu, X. (2012). Adaptable methodology for automation application development. *Advanced Engineering Informatics*, 26(2), 231–250. <https://doi.org/10.1016/j.aei.2012.02.007>
- World Bank. (2010). *Exploring the middle-income-trap, East Asia Pacific economic update* (Vol. 2).
- World Bank. (2016). *Jobs in global value chains.* Jobs Notes Issue No. 1.
- World Bank. (2017). *Global value chains development Report 2017: Measuring and analyzing the impact of GVCs on economic development.*
- World Bank. (2020). *World bank data.* Retrieved April 17, 2020, from <https://data.worldbank.org/indicator/SL.IND.EMPL.ZS?locations=XT>
- World Economic Forum. (2018a). *Centre for the new economy and society.* <https://www.weforum.org/platforms/shaping-the-future-of-the-new-economy-and-society>
- World Economic Forum. (2018b). *Harnessing artificial intelligence for the earth.* http://www3.weforum.org/docs/Harnessing_Artificial_Intelligence_for_the_Earth_report_2018.pdf
- Xiao, H., Meng, B., Ye, J., & Li, S. (2020). Are global value chains truly global? *Economic Systems Research*, 32(4), 540–564. <https://doi.org/10.1080/09535314.2020.1783643>
- Xu, M., David, J. M., & Kim, S. H. (2018). The fourth industrial revolution: Opportunities and challenges. *International Journal of Financial Research*, 9(2), 90–95. <https://doi.org/10.5430/ijfr.v9n2p90>
- Yeung, H. W. (2014). Governing the market in a globalizing era: Developmental states, global production networks and inter-firm dynamics in East Asia. *Review of International Political Economy*, 21(1), 70–101. <https://doi.org/10.1080/09692290.2012.756415>
- Younus, M., Hu, L., Yuqing, F., & Yong, C. P. (2009). *Manufacturing execution system for a subsidiary of aerospace manufacturing industry. In Proceeding - 2009 International Conference on Computer and Automation Engineering ICCAE 2009* (pp. 208–212). Bangkok, Thailand.
- Zhu, J., & Morgan, G. (2018). Global supply chains, institutional constraints and firm level adaptations: A Comparative study of Chinese service outsourcing firms. *Human Relations*, 71(4), 510–535. <https://doi.org/10.1177/0018726717713830>



© 2022 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.

You are free to:

Share — copy and redistribute the material in any medium or format.

Adapt — remix, transform, and build upon the material for any purpose, even commercially.

The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made.

You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

No additional restrictions

You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

***Cogent Economics & Finance* (ISSN: 2332-2039) is published by Cogent OA, part of Taylor & Francis Group.**

Publishing with Cogent OA ensures:

- Immediate, universal access to your article on publication
- High visibility and discoverability via the Cogent OA website as well as Taylor & Francis Online
- Download and citation statistics for your article
- Rapid online publication
- Input from, and dialog with, expert editors and editorial boards
- Retention of full copyright of your article
- Guaranteed legacy preservation of your article
- Discounts and waivers for authors in developing regions

Submit your manuscript to a Cogent OA journal at www.CogentOA.com

