Global Initiatives

Chapter 1

Global Initiatives within the 4IR, and the Role of Higher Education

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Introduction

As has already been mentioned in the General Introduction, the title of this book is *Global Initiatives and Higher Education in the Fourth Industrial Revolution*. The way in which the book approaches this title, is to first discuss the different economic initiatives – focused on manufacturing – developed by specific countries to meet the 4IR (Fourth Industrial Revolution) and to critically look at the role of HE (higher education) within these initiatives. One could argue that HE should be key in this new era, as it powerfully shapes the lives of specifically the younger segment of our people with reference to their aspirations, their beliefs, and their identities, focusing on their skills and future livelihoods (Saito 2019:197). The 4IR naturally forms part of these discussions. Specific attention is also given to Africa and the role that this continent should play with regards to HE and/in the 4IR (cf. Marwala 2020), as seen in chapters 4, 5, 7, and 9.

The 4IR has taken (or is taking) the world by storm with, *inter alia*, AI (artificial intelligence),[1] IoT (the internet of things),[2] IIoT (the industrial internet of things),[3] CC (cloud computing),[4] CPS (cyber-physical systems),[5]

1 For more information on AI, cf. Rouse (2020), as well as Chalmers, MacKenzie, and Carter (2021).
2 For more information on IoT, cf. Burgess (2018), Agolla (2018), and Ranger (2020).
3 For more information on IIoT, cf. Schmid (2018).
4 For more information on CC, cf. Tutorialspoint.com. (n.d.).
5 For more information on CPS, cf. Agolla (2018) as well as Ferreira and Serpa (2018).

robotics (advanced robots and co-robots),[6] AR (augmented reality),[7] IoE (the internet of everything),[8] IoS (the internet of services),[9] HVI (horizontal and vertical integration),[10] and BDA (big data analytics),[11] coupled with IoD (the internet of data)[12] being rolled out, in which digital transformation[13] acts as common denominator (Fukuyama 2018:47). In order to meet the demands of this new era, countries all over the world are developing and implementing economic and industrial programmes or plans, also called initiatives. Examples of these initiatives are (chronologically) I4.0 (Industry 4.0, developed in 2011 by Germany), AMP (Advanced Manufacturing Partnership, launched in 2011 by the USA), S5.0 (Society 5.0, developed in 2015 by Japan – cf. Gladden 2019), IdF (Industrie du Futur – *Industry of the Future*, France 2015), Agenda 2063 (Africa's plan – cf. AU 2015), MIC 2025 (Made in China 2025 – also developed in 2015), and Zimbabwe's E5.0 (Education 5.0, developed in 2019).[14]

From an educational perspective, one could argue that these initiatives would be requiring a cohort of professionals who are equipped with knowledge and the expertise to drive the programmes. To realise these goals, excellent (primary, secondary, and higher) education should be a condition to produce excellent/smart experts. Without the necessary education, it would seem to be impossible to reach the level of performance or expertise required from someone to partake in these new initiatives. However, although these initiatives are very high-tech and well explained, also (mostly) with reference to collaboration (not on equal level though) with other countries or 'the world,' education, specifically HE seemingly does not really get the attention that it should – the industry and other technological commodities take priority over HE, as indicated below. While some of these initiatives do not even explicitly

6 For more information on robotics, cf. Dzedzickis, Subačiūtė-Žemaitienė, Šutinys, Samukaitė-Bubnienė, and Bučinskas (2022), as well as Sirlantzis, Larsen, Kanumuru, and Oprea (2019).
7 For more information on AR, cf. Chen, Wang, Chen, Song, Tang, and Tian (2019).
8 For more information on IoE, cf. Banafa (2016).
9 For more information on IoS, cf. Agolla (2018).
10 For more information on HVI, cf. Sewak & Vaidya (2022).
11 For more information on BDA, cf. Rai (2019).
12 For more information on IoD, cf. Agolla (2018).
13 For more information on digital transformation, cf. Boulton (2019).
14 Apart from these initiatives, many other countries in the world also have plans/strategies/initiatives, like Australia 2056 (Reinvent Australia 2016), England's High Value manufacturing Strategy (TSB 2012), the United Arab Emirates with Vision 2021 (UAE n.d.) and the 2030 Agenda for Sustainable Development (NCSDG 2018), Russia in the 21st century (ICD 2010), and the National Vision 2030 of Qatar (GSDP 2008), while South Korea does not have any formal document stating a strategy, but some scholars have deliberated on the development of this country (cf. Chung 2011; Cooke 2017; Hemmert 2007; Kim & Kim 2018; Seong, Popper, & Zheng 2005).

touch on HE, Japan's S5.0 refers continually to collaboration between the corporate sector, government, and HE (GJ 2016), elaborating extensively on the tasks of the first two sectors, and often only implicitly on the latter.

It is common knowledge that education, and for that matter HE, globally does not yet meet the expectations of the corporate world entering the 4IR – according to the government of Japan it was *lagging behind* in 2015 (GJ 2015:6) – currently it still is (Atlason 2020; Jadoul 2021). Fact is that every country has its own standards for education, which obviously differ from those of other countries. Fact is also that no country is an isolated entity. Especially in this new era, collaboration within the various HE systems in our global village is of utmost importance to achieve excellence. However, Chamorro-Premuzic and Frankiewicz (2019a) aver that 'it is hard to argue that the knowledge acquisition historically associated with a university degree is still relevant.' They add that 'meta-analytic reviews have long-established that the correlation between education level and job performance is weak' (Chamorro-Premuzic & Frankiewicz 2019a). This is an indication of why HE is neglected in the workplace.

Already in 2015, the UN (United Nations) issued an *Agenda for Sustainable Development* (UN 2015), containing their SDGs (ssustainable development goals) for 2030, challenging *all nations to work together* in order to reach a sustainable world with reference to and in service of economic development (Fukuyama 2018:47). With these goals at the back of our minds,[15] this book wants to look deeper into the role and requirements of HE in this new era, with specific reference to and collaboration between the abovementioned initiatives, and also the role that Africa can play in it – alternatively, the role that it will play in Africa. However, would it be possible to establish a way of cooperation between these initiatives, complementing each other, and taking 'the world' to a new level in a very short time by means of internationalisation. Currently, it seems to be impossible.

This chapter will shortly discuss the abovementioned initiatives (excluding S5.0 and E5.0) and the role that they are currently playing. Connected to this chapter, is chapter 2 that discusses S5.0 and E5.0 within

15 This Agenda was set, definitely well-knowing of Germany's I4.0 and the USA's AMP, but with no reference to one of these two initiatives. This 'plan of action' has the 'people,' the 'planet,' and 'prosperity' in mind, aiming at the eradication of extreme poverty, and to 'heal and secure' the planet (UN 2015:3). A positive tendency in this Agenda is that the UN called on all countries in the world to take part in a collaborative partnership, strengthening global solidarity (UN 2015:4). Although there are references to education, the betterment of education and specifically HE was not on the Agenda. Technology, with all its components, is also not highly ranked on the Agenda. This Agenda will therefore not form part of the discussions in this chapter.

their contexts and the role that HE plays in these two initiatives. In this chapter then, the mentioned initiatives are discussed, with a cursory look at the role of HE in these endeavours.

Industry 4.0

I4.0 was developed by Germany in 2011, being preceded by Deutschland Digital 2015, which was introduced in 2010 by the BMWi (Bundesministerium für Wirschaft und Energie – Federal Ministry of Economic Affairs and Energy; Horst & Santiago 2018:6). Schroeder (2016:1, 6) refers to this initiative as an evolutionary – and not a revolutionary[16] – enhancement of the production and business model. According to Rojko, it is no surprise that Germany made this innovative move, as this country can be regarded as a world leader in the sector of manufacturing equipment, being 'the world's leading user and provider of digitalised production technologies' (Schroeder 2016:0)[17] with a view of establishing a global I4.0 landscape (Schroeder 2016:6; cf. also Horst & Santiago 2018:vi). Holtkamp and Iyer (2017:Executive Summary, 1) boldly identify the I4.0 initiative with the 4IR, 'a mega-trend that affects every company around the world.' Their reference to the mega-trend may be correct, but there seems to be a significant difference between I4.0 (a local initiative as part of the 4IR) and the 4IR itself, which is a global trend.

Germany developed this initiative to stay 'one of the most influential countries in machinery and automotive manufacturing' (Rojko 2017:80). To assure that they stay there, they have also put PI4.0 (Plattform Industry 4.0) in place in 2013 (DKE 2018:12; cf. also Staufen & Staufen 2018) – 'one of the most emblematic instruments of the strategy' (Horst & Santiago 2018:2; cf. 23-27).[18] PI4.0 consists of professionals representing 'the business sector, the scientific sector, trade unions, politics and consumer groups, [focusing on standardisation,] research and innovation, the security of networked systems, the legal frameworks, and employment and (further) training' (DKE 2018:12). Education and training form one of their working groups (Horst & Santiago 2018:26).

According to Popławski and Kajczuk (2019:24 of 78), I4.0 has three challenges with reference to the 4IR: First, it is expected from the producers

16 With this, Schroeder contrasts I4.0 to the US model which he negatively refers to as 'revolutionary' (Schroeder 2016:1).

17 This is the page before page 1 in the author's 'book,' not being numbered.

18 PI4.0 was created by BITKOM (Bundesverband Informationswirtschaft, Telekommunikation und Neue Medien – German/Federal Association for Information Technology, Telecommunications, and New Media), VDMA (Verband Deutscher Maschinen- und Anlagenbauer – Mechanical Engineering Industry Association), and ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie – Association of the Electro-Technical and Electronic Industries).

to change their existing business models to fit the 4IR and to stay on par with new competitors in the market; second, SMEs (small and medium enterprises) will have to increase their capability to produce software that would be able to link their products to digital technologies; and third, with the 4IR, external producers of software posing a threat to the German products, gaining digital sovereignty over Germany, should motivate the German manufacturers to create better software.

The main idea of I4.0 is to develop the potential of the most recent technologies like IoT,[19] the incorporation of 'technical processes and business processes [in companies,] digital mapping and virtualization of the real world,' and the establishing of the 'smart' factory (production system) and 'smart' products (Rojko 2017:80). Fuchs (2018:281) adds that it propagates a 'combination of [IoT,] big data, social media, cloud computing, sensors, [AI,] robotics, and the application of the combination of these technologies to the production, distribution and use of physical goods.' This results in smart factories[20] complemented by smart products, where the tools and machines are automated (Horst & Santiago 2018:3-4). The implication is that these smart products have embedded sensorics showing their appointed destiny, their product state/status and their environmental conditions. These products are able to 'control their logistical path through the production [process] and even control/optimize the production workflow that concerns them' (Rojko 2017:82). This includes production robots and transportation devices. Therefore, both the '*means* of production and the *product* itself' are fitted with sensors and actuators, which connect the one with the other (Rojko 2017:82; original emphasis). This is called a CPS/CPPS (cyber-physical [production] system) – an integration as well as a communication and cooperation between technology, virtual space, and human beings (called 'super human capital' by Agolla 2018:41), connecting the real and virtual worlds with each other, and constituting a real collaborative network (Ferreira & Serpa 2018:27; cf. Hennies & Raudjärv 2015; Rubio-Tamayo, Gertrudix Barrio, & García García 2017), with M2MI (man to machine interaction) and M2M (machine to machine) communication (Agolla 2018). The way in which these are connected, is called the IoT or IIoT – collaborating by means of cloud computing (Ang, Goh, Saldivar, & Li 2017:4 of 13; Agolla 2018:42-43). In this way, every item can directly be located and kept track of in the production and supply chain.

This will definitely have an influence on 'training and study programmes' in the country (Schroeder 2016:5; cf. Ittermann & Niehaus 2015). At this stage,

19 For more information on IoT, with specific reference to I4.0, cf. Ito, Abd Rahman, Mohamad, Abd Rahman, and Salleh (2020).

20 Horst and Santiago (2018:3) refer to it as digital factories.

the training and further study needed, seemingly do not partner much with HE, as the workplace rather utilises in-service training (Schroeder 2016:5). Ferreira and Serpa (2018:27) argue that, if I4.0 really wants innovation to occur, education and training only in technology would not suffice, as 'both individual and organisational learning for change and flexibility are essential' (cf. also De Abreu 2018; Rotatori, Jeong, & Sleeva 2021). Germany has, however, decided to improve its educational system in order to adapt to the standards of the 4IR and the global competition in education (Popławski & Kajczuk 2019:33 of 78), especially because the developing countries' education levels are rising exponentially.

Although the previous paragraph does not paint a good picture of the utilisation of HE in the workplace of I4.0, Huk positivistically links Education 4.0 to I4.0, stating that the latter lays 'the foundations for modern education' (Huk 2021:40). He builds his argument on the fact that one of I4.0's main challenges is the 'sustainable development in productive processes' (Huk 2021:40; cf. Paravizo, Chaim, Braatz, Muschard, & Rozenfeld 2018) and how to integrate these processes with the digital media (cf. Dalenogare, Benitez, Ayala, & Frank 2018). This results (should result) into a higher productivity efficiency with relation to time and resources (Coşkun, Kayıkcı, & Gençay 2019). The transformation of education in general should therefore be in accordance with I4.0, 'resulting from deeper symbiotic, including emotional, interaction between a human being and a machine' (Huk 2021:40).

Despite all these positives, Fuchs notes ten reasons why he is sceptical about I4.0 (cf. Fuchs 2018:284-287). These reasons are mostly about the technology and workers who will have to work with AI and are in fact not ready or capable to do so. However, nothing is mentioned of the lack of interest in HE in the implementation and the unrolling of I4.0.

The Indo-German Industrial Collaboration[21]

According to Holtkamp and Iyer (2017:Executive Summary), Germany and India have a 'long history of trade' – however, no dates are indicated. This has led to the IGCC (Indo-German Chamber of Commerce) which is to date (according to Holtkamp & Iyer 2017:Executive Summary), the largest global chamber, situated in both India and Germany. This initiative gave rise to Make in India, which was launched in 2014 (MIIM n.d.). At the Hannover Messe 2015,

21 According to Horst and Santiago (2018:1), German industries also partnered with Japan, France, Italy, Australia, and Czechia, and also had a strong influence on Made in China 2025. They also refer to partnerships with Brazil, Egypt, India, Kazakhstan, Mexico, Malaysia, Thailand, and Viet Nam (sic.) (Horst & Santiago 2018:1). Amidst this collaboration, India also has its own goals set for itself, like Strategy for India @ 75 (NITI Aayog 2018), aimed at 2022, when India celebrates its 75th commemoration of freedom.

the largest industrial fair in the world, India became a partner of Germany (Make in India n.d.). India then saw potential in the Mittelstand (middle-class) companies in Germany[22] and implemented MIIM (Make in India Mittelstand!), preparing the way for these companies to enter the Indian market (cf. Nair & Von Laer 2017).

The collaboration between Germany and India, with reference to I4.0, is on the level of economics and society, involving 'industry, government, and academics' (Holtkamp & Iyer 2017:Executive Summary).[23] Germany is regarded as a global leader in manufacturing and technology but, according to Holtkamp and Iyer (2017:Executive Summary), its IT (information technology) sector somehow falls short. Fortunately, India is regarded as having a leading position in the world on the level of IT and its outsourcing of business processes (Holtkamp & Iyer 2017:Executive Summary). On a technical level, I4.0 is considered from both a vertical and a horizontal level of integration: The vertical integration concerns the operations taking place in the 'smart factories,' whereas the horizontal integration refers to 'smart supply chains' being developed between businesses in both countries.

This initiative is hopefully one of a few that could spread to a worldwide collaboration between countries. However, HE is net even mentioned in this endeavour.

Advanced Manufacturing Partnership

AMP (being more elaborately discussed in chapter 3) was launched in 2011 by the government of the USA, as a national endeavour to bring about a closer collaboration between their industries, HE, and the government in order to boost emerging technologies in the country and to create better jobs and job opportunities – all of these would enhance their global competitiveness (The White House 2011; cf. Bonvillian & Singer 2017). They therefore needed to advance their technologies (*inter alia* information technology, biotechnology, and nanotechnology) to create more and better jobs.[24] By

22 Mittelstand companies are the pillars of the industry and economy in Germany. These companies are mostly family owned and small in comparison to the large companies in the country. However, these companies have cutting-edge technologies at their disposal and can be regarded as market leaders with reference to the products that they produce (MIIM n.d.).

23 The two German institutions that are operative in assisting with this process, are DAAD (Deutscher Akademischer Austauschdienst – the German Academic Exchange Service) and DWIH (Deutsche Wissenschafts- und Innovationshäuser – the German House for Research and Innovation).

24 However, according to Bonvillian and Singer (2017:4), some 'legacy economic sectors' are resisting innovation, including the manufacturing sector, fossil fuel energy, the electricity sector, health care, transport – specifically highway

doing this, they would help their manufacturers to reduce production costs, to improve quality, and to accelerate product development (The White House 2011). The aim of this initiative is to build

> domestic manufacturing capabilities in critical national security industries; reducing the time needed to make advanced materials used in manufacturing products; establishing U.S. leadership in next-generation robotics; increasing the energy efficiency of manufacturing processes; and developing new technologies that will dramatically reduce the time required to design, build, and test manufactured goods (The White House 2011).

Five basic models were identified to drive the innovation, namely 'the innovation pipeline,[25] induced innovation, the extended pipeline, manufacturing-led innovations, and innovation organization' (Bonvillian & Singer 2017:7). AMP was established on three pillars: 1) The enabling of innovation; 2) to secure the talent pipeline; and 3) to improve the business climate (PCAST Meeting 2014:4 of 12).

Reference is made to 'leading universities' and companies[26] that would be role players to reach these cutting-edge technologies. It is important to note that the IHEs (institutions of higher education) – initially these were the Carnegie Mellon University, Stanford University, University of Michigan, University of California-Berkeley, Georgia Institute of Technology, and Massachusetts Institute of Technology – committed themselves to collaborate on a multi-university level to share their educational materials along with their best practices concerning innovation and advanced manufacturing. These institutions also involved industry partners as well as prominent government agencies to find and create research opportunities (The White House 2011). This initiative was set to be a local initiative in competition with the world. In 2014, President Barak Obama invited the private sector, the IHEs, and government to collaborate in manufacturing and developing cutting-edge

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transport – and agriculture. GAO (2019:1 of 71) states that this has happened from the turn of the century onward.

25 Bonvillian and Singer (2017:7) refer to this model as a 'pipeline model,' stating that it has dominated the thinking pattern of science and technology in the USA. The implication is that research (invention and innovation) was dumped into the pipeline, expecting the industry to create miracles inside the pipe, and then new products would emerge at the other end. However, the private sector has invented another mode, called 'induced innovation,' where a specific company identifies a gap in the market, and fills it with a 'technology advance.'

26 The manufacturers who were initially involved, are Allegheny Technologies, Caterpillar, Corning, Dow Chemical, Ford, Honeywell, Intel, Johnson and Johnson, Northrop Grumman, Procter and Gamble, and Stryker.

technology tools in order to *compete* with other countries in the world. He motivated these sectors to be autonomous and independent of the rest of the world by inventing their own products and manufacturing it themselves. This would be key to delivering high-quality products and good jobs for all the Americans (The White House 2011; Molnar 2012). This statement paved the way for the government's statement in 2014: 'The U.S. has been the leading producer of manufactured goods for more than 100 years' (PCAST Meeting 2014:2 of 12).

From a German point of view, Schroeder (2016:0, 1) refers to this initiative – obviously with I4.0 in mind, and in a negative sense – as a 'disruptive US model…[with the] potential to crowd out existing production and business models.'

The Industrial Internet of Things

IIoT has been introduced by the GE (General Electric) company in the USA in 2012, referred to by Holtkamp and Iyer (2017:7) as the 'Industrial Internet Initiative.' They regard it as a 'tight integration' of digital innovations and the physical world in order to combine BDA with the IoT (Rojko 2017:78). GE calculated that 46% of the global economy could benefit from this initiative (Rojko 2017:78). According to Rojko (2017:80), the 4IR was instigated by this development of ICT (information and communications technology) with the smart mechanisation of cyber-physical systems as its technological basis, coupled with IoT functionalities. The effect that this initiative would have on the industry, was the innovation and reorganisation of the old ways in which mechanisation was done, which would result in a 'self-organizing cyber physical production system that allows flexible mass custom production and flexibility in production quantity' (Rojko 2017:80). HE was not mentioned here as it apparently did not form part of the focus of this endeavour.

Industrie du Futur

With a commitment towards the UN SDGs – specifically 'SDG9: Industry, Innovation and Infrastructure' (GMIS 2018:9), the French government launched IdF in 2015 as part of their industrial policy (cf. EC 2017; AIdF 2018:3). This was a collaboration between industry and science, 'as an overarching plan and roadmap for industrial renewal' (EC 2017:3). The French strategy, NFI (La Nouvelle France Industrielle – New Industrial France; GRF n.d.) preceded the IdF and was launched by the French government in September 2013. The first phase – NFI – was developed by the National Council for Industry, with contributions by the McKinsey Consultancy, in which they have selected 34 industrial plans. This was the result of a groundbreaking analysis of the growth markets in the world, linked with developments on the level of digitisation

and the industry (EC 2017:5). IdF launched French Fab in 2017, which was a new Made in France initiative with the aim to market French manufacturing globally (GMIS 2018:10).

IdF is established on five pillars (EC 2017:3; GRF 2015:9 of 55). The first pillar is the development of cutting-edge technologies, including IoT and augmented reality. To reach this goal, the French government started to support companies in France with research funding, as well as subsidies and loans. They have also created 'a network of platforms' to test all the new technologies (EC 2017:3; GRF 2015:10 of 55). The second pillar is assistance given to smaller French companies to adapt to new technologies and to engage in projects (GRF 2015:11 of 55). The third pillar concerns the intensive training of employees – 'upskilling the workforce [by] developing training programmes and curricula' (EC 2017:3; cf. GRF 2015:12 of 55). The fourth pillar is collaboration on an international level, focused on industrial standards and alliances (GRF 2015:12 of 55). In this concern they entered into a bilateral cooperation with Germany (I4.0). The fifth pillar is to promote the French industry globally by means of high-quality projects with the 'Creative France Industry' brand on it (EC 2017:3; GRF 2015:13 of 55).

The aim of IdF is mostly threefold: To assist companies in their deployment of digital technologies, to change specific company and business models, and to modernise the production practices of companies (EC 2017:3). This is a collaboration between the government, industry, technology and research stakeholders, and trade unions in order to launch 'a network structure to support digital transformation…where [a] modernisation of production tools and a transformation of business models [are]…required' (EC 2017:3). The objective of IdF is to revolutionise their products in such a way that these products would be wanted globally. Key in this regard is to help France become a leader in the world economy and industrial renewal (EC 2017:3).

Nine thematic areas for industry renewal have been identified, against the backdrop of a 4IR thinking (GRF 2015:18 of 55):

1. *New resources* (eco-industries and chemicals – materials, extractive industries, and primary processing): With this, the government has in mind to provide 'new bio-based and recycled materials' to all their industries (GRF 2015:21 of 55), in this way looking for 'more efficient and more ecological ways of producing [and the d]ouble use of plant-based raw materials in the chemicals industry in France' (GRF 2015:22 of 55).

2. *Smart cities* (eco-industries): The government wants 'resource-efficient cities, from producer to consumer' (GRF 2015:25 of 55).

3. *Eco-mobility* (automobile industry): A cheaper, 'greener, safer mobility [is needed], offering the widest possible range of options [with] vehicles [that are] more economical, more connected and more autonomous to meet…user expectations' (GRF 2015:29 of 55). They obviously have electric vehicles in mind.

4. *Tomorrow's transport* (aerospace, rail, and naval transport for people and goods): Electrification of all their means of transport is tops on their priority list, including a high-speed train and 'ships of tomorrow' (GRF 2015:33 of 55).

5. *Medicine of the future* (more effective healthcare): The government has in mind to deliver low-cost top quality healthcare (GRF 2015:37 of 55).

6. *The data economy*: Digital technologies like smartphones, tablets, computers, laptops, and IoT contain vast quantities of data. These data act as a source of value for the users, which need to be utilised in order to guarantee growth in this sector (GRF 2015:41 of 55).

7. *Smart devices* (digital and consumer goods): This is all about IoT, which should be utilised to enhance everyday life. It includes the production of robots and better smart devices (GRF 2015:45 of 55).

8. *Digital confidence*: This includes a better security system on digital devices for both individuals and companies (GRF 2015:49 of 55).

9. *Smart food choices*: With this, the government has a safer, 'healthier, more sustainable food production with greater export potential' in mind (GRF 2015:53 of 55).

According to the European Commission, each one of these nine areas has its own objectives, time of implementation, and marketing (EC 2017:5). In this manner, IdF wants to be part of the leading countries on the level of production and industry in the world. As has been shown in this section, education, and specifically HE, is almost not mentioned. There could be one of two reasons for this: First, that it is implicated (*obvious*), and second, that the 'training programmes and curricula' mentioned above, are efficient enough for their workers (EC 2017:3).

Made in China 2025

On 8 May 2015, China developed their initiative called Made in China 2025, which started off as a collaboration between the China Ministry of Industry and Information Technology and experts from the China Academy of Engineering

(Rojko 2017:78; Ma, Wu, Yan, Huang, Wu, Xiong, & Zhang 2018). This was regarded as a 'ten-year, comprehensive blueprint' (USCC 2017:6 of 80) to 'transform China from a manufacturing giant into a world manufacturing power' (Ma *et al.* 2018:3; cf. State Council 2015), with the main focus on manufacturing. The reason is given by the State Council (2015) of China: 'Manufacturing is the main pillar of the national economy, the foundation of the country, tool of transformation and basis of prosperity.'

The Institute for Security & Development Policy (2018:2 of 9) states that the I4.0 of Germany and S5.0 of Japan played a major role in the development and creation of MIC 2025 (cf. OECD 2017). Wübbeke, Meissner, Zenglein, Ives, and Conrad (2016:6 of 73) refer to it as 'smart manufacturing.'

10 strategic industries were targeted, including 'next generation information technology, aviation, rail, new energy vehicles, and agricultural machinery' (USCC 2017:6 of 80). This initiative proposed a 'three-step strategy,' consisting of the following: First, China needs to grow into being a manufacturing power as soon as 2025; second, by 2035, this country wants to reach the 'medium level' of manufacturers in the world; and third, China wants to reach the top list of world manufacturers by 2049 (Ma *et al.* 2018:3-4). This would coincide with the 100th anniversary of an independent PRC (People's Republic of China) (Morrison 2019:1; CBBC n.d.:4). Rojko (2017:78) agrees that China has in mind to move and renovate its manufacturing industry from delivering low-cost products to delivering products with high quality. The aim is to outdo the dominance of Germany and Japan by 2035 and to become a superpower by 2049.

To reach their goal, the government has pointed out and prioritised nine tasks: 1) The improvement and innovation of the manufacturing sector; 2) the integration of IT and industry; 3) the consolidation of the industry; 4) the marketing of Chinese brands; 5) the enforcement of the renewal of production processes to diminish its impact on the environment, called green manufacturing; 6) the innovation of key sectors in the industry, like IT, robotics, better equipment to enter space as well as the oceans, and energy-saving vehicles using new forms of energy; 7) to restructure the manufacturing sector as a matter of priority; 8) to promote industries which are service-oriented and manufacturing-related; and 9) to internationalise their whole manufacturing business (Ma *et al.* 2018:3-4).

According to Phillips, the Chief Executive of the CBBC (China-Britain Business Council), this initiative is very ambitious and aims at the comprehensive upgrading, consolidating, and balancing of the entire manufacturing industry of China (CBBC n.d.:3). The CBBC adds that there is a direct link between this initiative and the Chinese Dream, which focuses on a long-term reform of the Chinese society to harmony and

prosperity. This co-exists with the fact that China's manufacturing was on the decline, amidst an 'oversupply in some industries' (CBBC n.d.:3).

However, not everybody is happy with this initiative, especially not the USA. Looking at MIC 2025, the USA criticises the initiative as distressing not only for its own domestic economy but also for that of their economic partners (USCC 2017:7 of 80). Morrison (2019:1) explicates it, stating that China's evolution to a free market economy is in direct opposition with the USA. With their expanded role in the economic system, there is a possibility that they could distort the global markets including those of the USA. The Trump Administration has included MIC 2025 in their Section 301 actions that they are planning against China. In Section 301, the Administration postulates that MIC 2025 depicts distortive policies with reference to 'technology transfer, intellectual property, and innovation' (Morrison 2019:1). They also allege that China, who only assembled products locally, now wants to also invent these products locally before assembling them.[27] On 15 June 2018, Lighthizer (from the Executive Office of the President of the USA; Lighthizer, 2018) has put it bluntly that the China government is determined to undermine the industry of the USA, and wants to take over the leadership role 'through unfair trade practices and industrial policies' like MIC 2025 (Morrison 2019:1). China took notice of these 'hostilities' and hit back, stating that they are aware of the resentment of the EU, Germany, and the USA towards their initiatives, as this would transform them from being a low-cost manufacturer to a manufacturer with added-value competition (ISDP 2018:1 of 9). Already in 2005, their neighbour, South Korea had concerns about 'a rising China,' as clarified in a report of the Korea Institute of Science and Technology, Evaluation and Planning (Seong, Popper, & Zheng 2005:7). Again, no real mention of HE is made, as the focus is on employees who have to do blue-collar work, not needing any certificate, diploma, or degree.

Agenda 2063

This plan differs from the abovementioned initiatives as it mostly does not have the wellbeing or collaboration of other countries or states in mind. It contains a 50-year plan *by* Africa *for* Africa, continuing the 'pan-African drive over centuries for unity, self-determination, freedom, progress and collective prosperity, pursued under *Pan-Africanism* and *African* Renaissance…and seeks to accelerate the implementation of past and existing continental

27 This is based on and confirmed by a statement made by the Policy of the Institute for Security & Development of China (ISDP 2018:1 of 9), 'The aim is to reduce China's reliance on foreign technology imports and invest heavily in its own innovations in order to create Chinese companies that can compete both domestically and globally.'

initiatives for growth and sustainable development [with emphasis on] an *integrated, prosperous and peaceful Africa*' (AU 2015:2 of 20; original emphasis; cf. AU 2019). This plan must be driven by Africa's own citizens, in this way representing a dynamic force globally. It is focused on a 'development and technological process' (AU 2015:2 of 20; cf. AU 2019) and does not really mention much related to education. It is therefore more concentrating on an internal collaboration between the countries on the continent, than on anything else.

The plan is divided into five 10-year plans, consisting of 12 flagship projects, including both a pan-African E-university and a pan-African virtual university. According to Agenda 2063, both these universities, especially the latter one, are more focused on African students. There is, however, no time schedule for establishing these universities. Currently there are already universities in Africa with international students, specifically in Kenia (cf. chapter 5). Under the heading 'highlights of a few other programmes,' the fourth item refers to 'expanded early childhood education and compulsory secondary education,' but without elaborating on it (AU 2015:13 of 20). The roll-out of Education 5 by Zimbabwe, which is in line with this item, will be discussed in chapter 2.

The plan is linked to the UN SDGs 1, 2, 3, 4, 6, 7, 8, 9, 11, 13, 14, 15, and 16, with 20 specific goals. That includes, *inter alia*, a high standard of living, well-educated, well-skilled, and well-nourished citizens, transformed economies, modern agriculture, the foundation of an African financial and monetary institution, establishing Africa as a major partner in global affairs, and a united Africa (AU n.d.).

With Agenda 2063, Africa aims to take 'charge of its global narrative to ensure that it reflects continental realities, aspirations and priorities and Africa's position in the world' (AU 2015:18 of 20).

The Initiatives Revisited

This heading acts as a critical note on the absence of a focused HE within the current mentioned world markets and initiatives (cf. Teo, Unwin, Scherer, & Gardiner 2021; Li, Nosheen, Ul Haq, & Gao 2021). Fact is that all the countries in the world have one common goal, which is to generate money. To reach that goal, the industry and manufacturing sector must perform in order to create not only a local market, but a global one.

I4.0 has in mind to create and launch a global I4.0 landscape (Schroeder 2016:6). This does not mean that 'all the countries in the world' will partake in this initiative and become part of it as partners, but that they may link and engage with the initiative by using the products and knowledge created by I4.0. The 'copyright' and honours will stay with Germany. Really commendable

is the Indo-German industrial collaboration where the two countries are working together to a common goal, but each with its own (copyrighted) contribution. The introductory chapter has already discussed the French-German connection, specifically on an educational level. This is really the way forward and should be done on a global scale. France and Germany also have a bilateral cooperation on the level of trade and industry, dating back to as early as 1963 (cf. FFO 2020).

With the launch of AMP, it was clear that this was a local initiative aiming at creating jobs and making the USA more competitive in the global village (Bonvillian & Singer 2017), also becoming the world leader in next-generation robotics (The White House 2011). The launch of IIoT by the GE company would add to that.

The fourth and fifth pillars of IdF of France are linked with a seemingly hidden agenda. Whereas the former refers to collaboration on an international level (cf. GRF 2015:12 of 55), the latter depicts France as becoming a 'leader in the world's industrial renewal' (EC 2017:3). To the credit of France, it must be said that its initiative, which is also very local, is not overwhelmingly competitive of nature like the abovementioned initiatives.

China was not secretive when its state council announced that, with MIC 2025, this country wants to 'transform China from a manufacturing giant into a world manufacturing power' (State Council 2015). Collaboration with China would be possible, but also not on an equal basis. According to Amadeo, the president of WorldMoneyWatch, this initiative has led to China being the world's largest economy in 2020, for a fourth consecutive year (Amadeo 2020).[28] The way in which China executed its plan, attracted much criticism from countries like the USA.

There is nothing wrong with countries aiming to create means to generate money. However, instead of collaboration between countries on a global scale, the buzzword is mostly 'competition.' Countries are rather trying to become totally self-reliant, like the USA and China, than to work together with other countries for the good of both of them and of the world. Further, instead of claiming that *the world* has discovered or invented something like AI or big data, the viewpoint is always that it *must* be ascribed to a specific country and most of the time, to an individual or group in that country. Collaboration between countries takes place but mostly on an unequal basis.

The one notion that is close to being totally ignored in all the initiatives mentioned here, is HE. The impression is that secondary education is good enough, being complemented with in-service training in the sector where a

28 She bases her argument on the fact that China's figures in relation to PPP (purchasing power parity) – which relates the exchange rate between currencies to consumer price levels – are better than that of the USA.

person works. The reason for this can be twofold: 1) HE is not up to standard to meet the expectations of the 4IR, or 2) HE is regarded as redundant and is replaced with in-service training. For many low- to middle-standard jobs, this could be acceptable, but the moment that we talk about jobs requiring real intellectual skills and expertise, jobs where innovation and new inventions are expected, then HE should be imperative and act as a prerequisite. The question, however, is whether HE – inside the 4IR – can live up to the standards of the industrial world.

Then there is Africa. This continent is still suffering from a 'postcolonial disorder'[29] (Oliver & Oliver 2019:53). This disorder eventually became a culture whereby the natives of Africa are still living. Africa is still struggling to rid that culture. This is the reason why the continent's plan, as indicated above, is more inclusive by nature, with more focus on tradition than on HE. Agenda 2063 is therefore a constructive attempt to bring this continent back in the world arena, and should be commended for that reason.

Conclusion

We have discussed five initiatives in the world, namely I4.0 of Germany, enhanced by the Indo-German Industrial Collaboration, AMP and IIoT of the USA, IdF of France, MIC 2025 of China, and Africa's Agenda 2063. These initiatives can generally be described as upheavals and preparations for the imminent 4IR, and it is very important to have these forms of development, manufacturing, and industry on a global scale. However, the way in which these initiatives are executed, could take a far more innovative and disruptive form, neglecting the boundaries of countries, the dominance of the Western world, the negativity associated with the poverty of Africa and other third-world countries, neglecting race, gender, colour, and creed, and just taking hands with everybody in the global village who could contribute in however small way, to make this *world* a better place to live in. The neglecting of HE as a primary component, a stimulus, and in fact an incubator of these initiatives causes great concern for the future of HE. Will HE survive in the 4IR or will it be declared redundant? If it survives, how will it have to adapt to new circumstances and initiatives? The initiatives are there, however in which form, but at this stage, to some extent, without the collaboration of a very vibrant HE, as the latter is *lagging behind* (Atlason 2020; Jadoul 2021). This is the reason why Chamorro-Premuzic and Frankiewicz (2019b) supply six reasons why HE needs to be 'disrupted:'

29 The colonists made two decisions about the African natives: 1) They have redefined African human morality, and 2) they claimed that the 'radical otherness' of the African natives was very close to 'the perimeter of animality' (Mbembe 2001:235).

- Employees need to have skills, more than knowledge.
- The right skills, and not knowledge or titles, give a prospective employee a job.
- University fees are very high, while education levels are in fact low.
- Not knowing this, the expectations of current students are therefore too high.
- The curricula of many universities are too theoretically oriented, neglecting the practical side of students' teaching.
- Universities are thus not boosting meritocracy, but supply the workplace with ill-prepared people.

At this stage, the workplace puts more emphasis on in-service training than on degrees and diplomas. Can we really take exception that they are doing it?

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