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Development of Human Capital for Industrialisation: Drawing on the Experiences of Best Performers

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Abstract

The experience of most industrialised countries indicate that part of their success was achieved through massive investment in developing human capacity, with particular focus on technical skills that are relevant for industry. Although Africa has a clear agenda to achieve the goal of an inclusive and transformative industrialisation, it has not been very successful in building the requisite skills base. To achieve its industrialisation goal as laid out in Agenda 2063, the Action Plan for the Industrial Development of Africa (AIDA) and the Sustainable Development Goals (SDGs) 2030, a more transformative approach to human capacity development must be a top priority. The continent can also draw lessons from high performers in industrialisation such as Germany, Singapore, Japan and the Republic of Korea. The article therefore examines the strategies that such countries have implemented to achieve success. It draws from the work of Friedrich List which argues that mental power or accumulation of knowledge and experience is the main element of productive power and industrialisation. A qualitative research methodology is applied.

Keywords: Developmental state, industrialisation, 'upper-tail' knowledge, human capacity development

Résumé

L'expérience de la plupart des pays industrialisés indique qu'une partie de leur succès a été obtenue grâce à des investissements massifs dans le développement des capacités humaines, particulièrement sur les compétences techniques pertinentes pour l'industrie. L'Afrique a un programme clair

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pour atteindre l'objectif d'une industrialisation inclusive et transformatrice, mais elle n'a pas tout à fait réussi à créer la base de compétences requise. Pour atteindre l'objectif d'industrialisation énoncé dans l'Agenda 2063, le Plan d'action pour le développement industriel accéléré de l'Afrique (AIDA) et les Objectifs de développement durable (ODD) 2030, une approche plus transformatrice de développement des capacités humaines doit être une priorité absolue. Le continent peut également profiter des enseignements des pays les plus performants en matière d'industrialisation tels que l'Allemagne, Singapour, le Japon et la République de Corée. L'article examine donc les stratégies mises en œuvre par ces pays pour réussir. Il s'inspire des travaux de Friedrich List qui soutient que le pouvoir mental ou l'accumulation de connaissances et d'expériences est l'élément principal du pouvoir productif et de l'industrialisation. Une méthodologie de recherche qualitative est appliquée.

Mots-clés : État et développement, industrialisation, connaissance de la couche supérieure, développement des capacités humaines

Introduction

Industrialisation is one of the key pillars of the African development agenda. Its importance is reflected in its inclusion in Agenda 2063, the continental blueprint for long-term development. The African Union Commission (AUC), in its First Ten-Year Implementation Framework 2014–23 for Agenda 2063, includes a goal on sustainable and inclusive economic growth. One of the outcomes from this goal is 'well educated citizens and a skills revolution underpinned by Science, Technology and Innovation (STI)' (AUC 2015: 18). Another goal of the strategy is to achieve transformed economies of which some of the outcomes are 'STI-driven manufacturing, industrialisation and value addition, economic diversification and resilience' (*ibid.*). The AU has also introduced the Africa Mining Vision of 2009 which, among other objectives, aims to achieve value addition through minerals processing. In recognition of the key role that regional integration can play in industrialisation, the AU's Ten-Year Strategy also includes the establishment of Regional Industrialisation Hubs by 2023. These are to be linked to global value chains and commodity exchanges (*ibid.*: 22).

The experience of industrialised countries demonstrates the important role of human capital development. Industrialisation is generally defined as a process of transforming raw materials, into consumer goods as well as new capital goods. It is also considered as a change in the structure of economic activity whereby the share of industry (particularly manufacturing) in total economic activity is increased. This structural shift normally results in an increase in income (Effiom and Udah 2014: 1744).

With the exception of a few countries such as South Africa, Mauritius and Morocco, the level of industrialisation in Africa is generally low. Furthermore, the continent has a deficit in the human capital that is required for that agenda.

The objectives of this paper are, firstly, to assess the current state of industrialisation and the human capacity development challenges facing the continent. Secondly, to review the experiences of best performers in industrialisation with a focus on their approaches to human capacity development, and finally, to propose strategies to fast-track human capacity development for industrialisation on the continent.

Building on initiatives such as the (AU) Science, Technology and Innovation Strategy for Africa (STISA-2024), which seeks to transform Africa into a knowledge-based and innovation-led society, the paper argues that the continent has to transform its human capacity development approach towards building more Science, Technology, Engineering and Mathematics (STEM), STI and practice-oriented skills for industrialisation.

A qualitative research methodology is applied based on analysis of secondary data on the selected countries, namely, Germany, Singapore, Japan and the Republic of Korea (RoK). Selection criteria consisted of status on industrialisation (as measured by the Competitive Industrial Performance (CIP) Index[1]), development status based on the Human Development Index (HDI) and approaches to and performance on Human Capacity Development (HCD).[2]

The CIP index consists of indicators such as Manufacturing Value Added (MVA), MVA per capita, share of the country in Manufactured Exports, and share in Medium to High Technology Exports. The Human Development Index (HDI) is a proxy for human development. Human capital contributes significantly to a country's labour productivity and competitiveness and that is why this index was selected. This measures human development in three dimensions, namely, life expectancy, education and income. Industrialised countries are characterised by their high GDP which has enabled most of them to improve education and health, resulting in the long life expectancy which most of them enjoy.

Statement of the Problem

The United Nations Industrial Development Organisation (UNIDO) indicates that developing countries in Africa remain on the margins of industrialisation (UNIDO 2016: 14). The very low and declining shares of their MVA to GDP ratio since 1970, and also in their MVA per capita, attests to this. Africa's MVA accounted for only 1.6 per cent of the global total in 2014, and its growth has lagged far behind that of all other regions since 1990 (*ibid.*). The continent also has the lowest regional medium – and high-tech share of manufactures among global regions.

Using the Human Capital Index (HCI), Table 1 indicates that while the average score for the four case countries was around 72 per cent, it was about 60 per cent in the case of the top ranked in Africa. Figure 1 is a graphic presentation of Table 1.

The World Economic Forum (WEF) in its report on the Global Human Capacity Index (GHCI) also makes a similar observation. Figure 2 shows that, in 2017, while North America and Western Europe have narrowed their gap to 26 and 28 per cent respectively, Africa has the largest gap at 47 per cent, implying that the continent had only covered 53 per cent of its human capacity requirements.

Table 1: Human Capital Index (HCI) rankings for selected countries, 2017

Country	Overall score	Rank	Capacity sub-index	Deployment sub-index	Development sub-index	Know-how sub-index
Germany	74.3	6	76.33	69.52	79.38	71.96
Singapore	73.28	11	76.45	70.52	73.62	72.52
Japan	72.05	17	80.96	66.32	73.92	67
Korea	69.88	27	76.59	66.73	73.34	62.87
Republic of Rwanda	61.06	71	47.92	90.06	55.69	50.57
Ghana	61.01	72	64.83	77.35	55.04	46.82
Cameroon	60.76	72	65.43	60.09	55.57	49.6
Mauritius	60.34	73	61.85	76.03	64.59	51.25

Source: (Author) Based on data from WEF, The Global Human Capital Index, p. 9

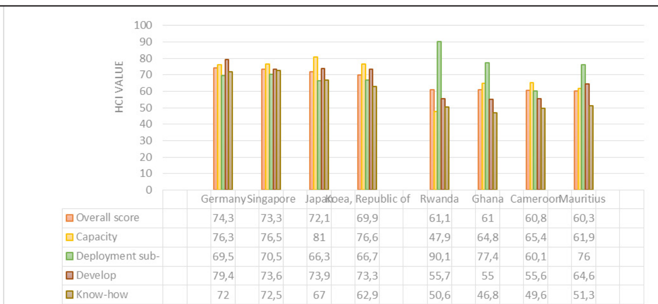

Figure 1: Human Capital Development Index (HCI) by country, 2017 (selected)
Source: (Author) Based on data from WEF, The Global Human Capital Index, p. 9

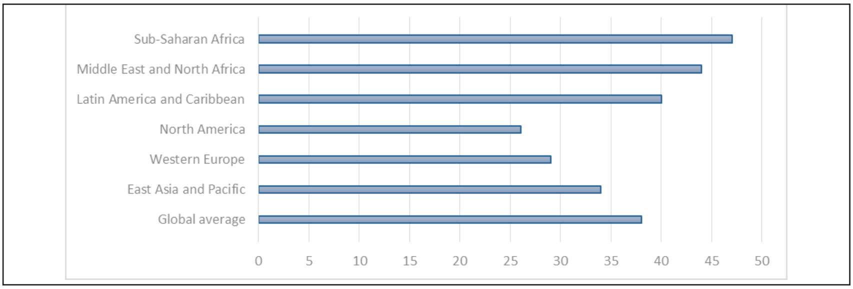

Figure 2: Human Capital Index (per cent) by region, 2017

Source: (Author) Based on data from WEF, The Global Human Capital Index, p. 7

Furthermore, Africa's productivity in manufacturing falls far below that of developed countries. For example, it was 40 per cent of that of the US in 2013 (UNIDO 2016: 9). About 90 per cent of Africa's manufacturing exports are in natural resource–based sectors (*ibid.*: 17).

While STEM education is a key pillar in developing the technical skills and human capacity required for industrialisation in sub-Saharan Africa (SSA), despite progress made, it is relatively lower than in other regions. Even though from 2003 to 2012, the continent registered an improvement in both the quantity as well as its share of global research from 0.44 to 0.72 percent, SSA accounted for less than 1 per cent of the world's research output (Blom, Lan and Adil 2016: 4). SSA also still lags behind other regions in terms of STEM research output. For example, research in the Physical Sciences and STEM constitutes only 29 per cent of all research on the continent (excluding South Africa). In sharp contrast, Malaysia and Vietnam's share in relation to total output was 68 per cent (*ibid.*: 4).

The African Capacity Building Foundation (ACBF) highlights the low state of development of STI on the continent and observes that education is still largely skewed in favour of humanities and social sciences. As evidence, in 2015, while an estimated 3 million African students were enrolled in non-critical technical skill areas, only 1.7 million were in critical technical skill areas (Africa Capacity Building Foundation 2017: 1).

The quality of education is largely poor. For example, in 2016, only five of the world's top 500 universities were in Africa as compared to six in Brazil and 32 in China (*ibid.*: 1). It is also noted that higher education in SSA is still an elite system with participation rates of below 10 per cent in most countries (Cloete, Maassen and Bailey 2015: 6).

Migration of professional personnel is also a challenge. Between 2007 to 2011, for example, close to 450,000 professionals migrated from the continent (*ibid.*).

Other challenges include lack of engineering capacity that has led to import of such skills; curriculum at universities and vocational training institutions which fails to produce problem-solvers; and an absence of partnerships between educational and research institutions and employers, resulting in a mismatch between industry needs and skills-levels of graduates and the underfunding and poor quality of students from vocational and educational training institutions (World Bank 2014).

Theoretical Framework

The relationship between human capacity development and industrialisation is generally conceptualised in the context of long-run economic growth. Whereas traditional market economics tends to focus on the importance of physical capital (such as machines and quantity of human resources) as factors of production, new growth theories emphasise the importance of human capital. Friedrich List, a German political scientist and philosopher, was one of the early scholars to articulate the role of human capital in the growth process. He was critical of classical economic thinking because he felt that it overlooked or ignored the idea of 'productive power' which determined the potential of a country to develop and industrialise.

Freeman (1995: 5) explains List's conception of 'the National System of Political Economy' which was written at a time when Germany embarked on its industrial revolution and was trying to catch-up with earlier industrialisers like Britain. He synthesises List's firm conviction that:

> There scarcely exists a manufacturing business which has no relation to physics, mechanics, chemistry, mathematics or to the art of design. No progress, no new discoveries and inventions can be made in these sciences by which a hundred industries and processes could not be improved or altered. In the manufacturing state, therefore, sciences and arts must necessarily become popular (*ibid.*: 6).

It was this principle that propelled Germany to develop one of the best technical education and training systems in the world, a factor which contributed to its success in overtaking Britain on industrialisation. Freeman also points out that 'today, it is the foundation of the superior skills and higher productivity of the German labour force in many industries' (*ibid.*).

Daastol (2011: 13) also elaborates on List's concept of 'mental or intellectual capital', or '*Geistiges Kapital*' which he considers to have shaped modern approaches to industrialisation *ibid.*: 14). He argues that it is intellectual capital which drives a people's innovative mentality and ability for cooperation, that economic progress depended on building up the mental capital and productive powers of a nation (*ibid.*). Intellectual capital 'creates innovation and constitutes and reshapes collaboration, which constitutes and reshapes nations and (defines and) creates wealth' (ibid.).

These ideas are also supported by other authors based on their analysis of the industrial revolution. They argue that although much of the historical evidence on the relationship between human capital and industrialisation appears to suggest a weak link, the results are different when human capital is disaggregated into literacy and 'upper-tail' knowledge. Squicciarini and Voigtländer (forthcoming).

They indicate that during the industrial revolution, the development of industry was achieved through unskilled or low-skilled labour since technological development at the time was very limited. However, during subsequent phases of growth, and with technological advances, there was demand for more skilled or 'upper-tail' type of labour. In their study, when they analysed the relationship between upper-tail human capital and growth, they found a significant and positive relationship. They concluded that growth of industry required investments in the development of higher level skills to drive the use of technology.

The concept of 'upper-tail' or 'elite' knowledge is defined as knowledge which is embodied in scientific advances and progress (*ibid.*: 4). In these authors' view, it was 'this density in the upper-tail' that was instrumental in advancing the industrial revolution. They argue that the industrial revolution was carried 'not by the skills of the average or modal worker, but by the ingenuity and technical ability of a minority' (Daastol 2011: 1).

New Growth Theories that emerged from the works of economists like Romer (1990: 71) also recognise the importance of endogenous initiatives and efforts to achieve growth through investments in human capital. Similar views are echoed by Hanusheck (2018). Focusing on the composition of human capital, he contends that while basic or initial levels of education are important for 'imitation', higher education is more important for innovation (Hanusheck 2018: 41) He further argues that a more skilled society leads to higher levels of labour productivity as firms are able to introduce new and better production methods. It also makes it relatively easier for firms to introduce new technologies. It also enhances capacity for innovation.

More recently, speaking at the WEF in Davos about the greatest challenges of the Fourth Industrial Revolution, Founder and Executive Chairman, Karl Schwab, argued that 'in the future, *talent*, more than capital, will be the critical factor of production'.[3]

In short, human capital development is closely linked to economic growth through its impact on production, which is the outcome of the industrialisation process.

Review of the Evidence: Human Capital Development Experiences of the Four Country High Achievers

The analysis of the four country cases consists of a review of the performance of each country based on the indicators referred to above, namely, the HDI, CPI and HCI. They are also analysed with respect to the strategies which they have implemented in order to achieve success in HCD.

Performance Based on Selected Indicators

Using the HDI, all four countries are categorised under Very High Human Development (VHHD).[4] They are also among countries with the highest per capita incomes in the world. Singapore has one of the highest per capita incomes in the world (PPP $980,192) and had a HDI value of 0.925.[5] Japan's per capita GDP was 35,804 (US$PPP) and the HDI has increased from 0.814 in 1990 to 0.903 in 2015 and it ranked 17th globally in 2016.[6]

In terms of CIP, using the Medium to High Technology MVA, the share is higher in all four countries (81.2 per cent for Singapore; 63.1 per cent for South Korea, 59.9 per cent for Germany and 54.9 per cent for Japan). These countries performed better than both the US and China whose share was 50.6 and 44 per cent respectively, and in the case of Africa, the relatively more industrialised countries such as Nigeria, Tunisia, South Africa and Botswana, for example, recorded much lower shares of 33.4, 28.8, 24.4 and 16.8 per cent respectively. When the share of MVA in GDP indicator is used, the four countries also perform better, at 29 per cent for the RoK, 26 per cent for Singapore, and 21 per cent for both Germany and Japan. In comparison, the share ranges from 4 to 17 per cent in the African countries that are relatively more industrialised at continental level.

In terms of the overall CIP index, Germany is the most competitive at over 0.5, followed by the RoK and Japan. China is next, followed by Singapore (Figure 4). In Africa, the most competitive is South Africa (0.08) but this is way below the selected four countries. The rest of the listed African countries have CIP values of below 0.03, evidence of low global competitiveness (Figure 5).

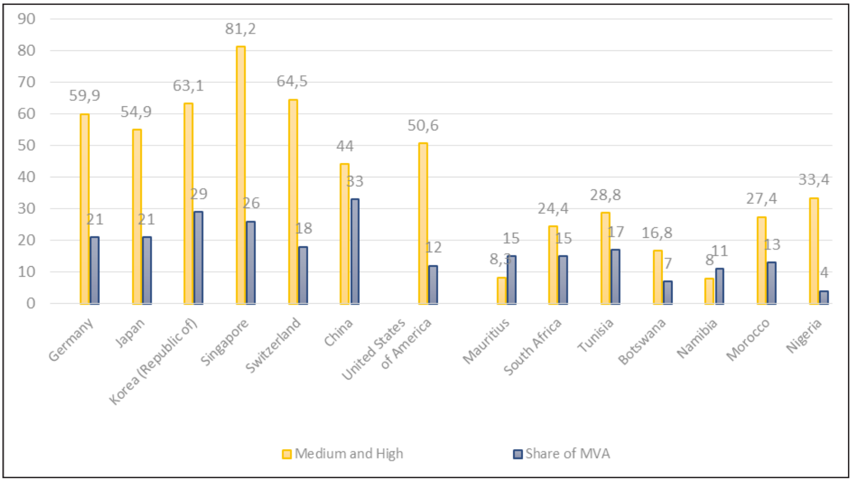

Figure 3: CIP using the Medium to High Technology MVA
Source: (Author) Based on data from UNIDO (2015: 224–7; 2016)

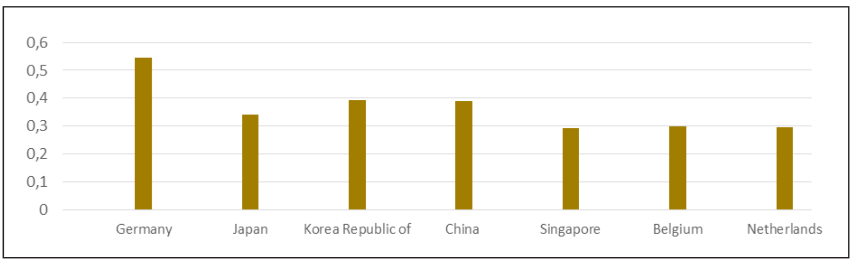

Figure 4: Overall CIP index
Source: (Author) Based on data from UNIDO (2015: 224–7; 2016)

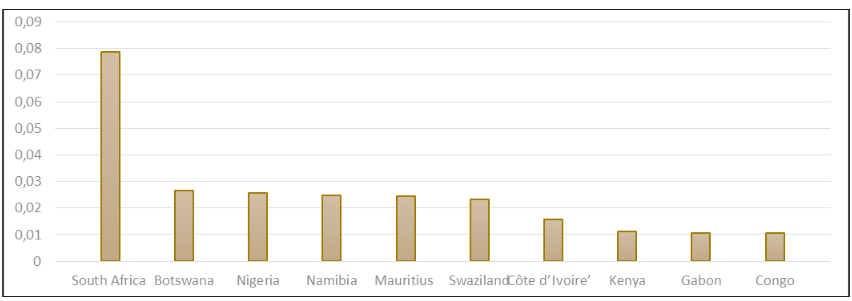

Figure 5: Evidence of low global competitiveness
Source: (Author) Based on data from UNIDO (2017; 2016: 94)

A Review of Human Capital Development Strategies and Successes of the Case Countries

This section summarises the human capacity development strategies used by the selected countries.

Germany

Germany is among the top industrialised countries in the world (UNIDO 2015; 2017). It is also among the world's largest producers, a significant exporter of passenger cars and the third largest exporter of manufactured products after China and the US. Its top manufacturing industries include machine and plant and electronics manufacturing (Deloitte & Touche 2018). One of the major factors behind the country's success are investments in both physical and human capital as well as the kind of model it used. The country's dual Vocational Education and Training (VET) system is cited as one of the key success factors. Germany is considered to have one of the best models of VET, developed on the philosophy of Friedrich List on the role of 'upper-tail' knowledge in economic growth. The VET system emphasises a practical learning/experiential approach to complement classroom learning. It is a dual system in that it combines classroom learning (theory) with practical experience. Apprentices are contracted to work at a company for a period of two to three years during which they also attend theory classes at some vocational school. On completion, they are either hired by the host company, or search for a job with other employers or proceed to university.

The VET is a highly structured system in which the government plays a central coordinating role, providing the regulatory framework and setting standards for quality assurance. The government introduced a skills development levy and a legal mandate for companies to contribute 1 per cent of their payroll towards the fund. It has also established collaborative networks with business chambers or associations who organise companies to deliver the training and vocational schools (Baethge and Wolter 2015). VET has the advantage of matching skills development to demand by employers. In 2012, it is estimated that 500,000 private companies trained about 1.6 million apprentices, and that every year, around 60 per cent of German youth opt for dual training in one of the 350 recognised occupations (Deloitte and Touche 2018: 47). Chambers of skilled crafts and chambers of commerce and industry are mandated by law to coordinate the private companies who deliver training to ensure that they comply with the standards set within regulated qualifications frameworks (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ) 2012: 16). In 2012, more than 800,000 German students participated in an apprenticeship programme in the manufacturing sector (Baethge and Welter 2015: 34).

Human capacity development for industry is not only anchored in its VET system but also in its higher education or tertiary institutions which are among the best in the world in terms of quality and, also their orientation towards STEM-related education. The Times Higher Education (THE) (2018) in its World University Rankings[7] provides evidence on this. It ranked 20 German universities among the top 200 most prestigious in the world (THE 2018). These are listed in Table 2 below.

Table 2: World University Rankings 2018 / List of universities among top 200 globally

Name of University	Ranking	Name of University	Ranking
Ludwig Maximilian	34	Technical University of Berlin	92
Technical University of Munich	41	University of Bonn	100
Heidelberg University	45	University of Gottingen	113
Humboldt University of Berlin	62	University of Mannheim	125
RWTH Aachen University	79	University Charite-Universitätsmedizin	126
University of Freiburg	82	Karlsruhe Institute of Technology	133
Free University of Berlin	88		

Table 3: German universities among top 125 globally in Engineering and Technology 2018

Name of University	Rank
Technical University of Munich	20
RWTH Aachen University	24
Technical University of Berlin	43
University of Stuttgart	77
University of Freiburg	88
Technical University of Dresden	93
University of Erlangen-Nürnberg	95
Technical University of Darmstadt	101-125

Source: THE (2018)

Table 4: German universities among top 100 in Physical Sciences (globally) 2018

Name of University	Ranking
Ludwig Maximilian University	26
Technical University of Munich	30
Heidelberg University	32
University of Bonn	56
RWTH Aachen	59
Karlsruhe Institute of Technology	61
Technical University of Berlin	65
University of Gottingen	70
University of Freiburg	99

Source: THE (2018)

Most of the institutions listed above are renowned in the fields of STEM (*ibid.*). For example, Heidelberg University (rated for space science, neuroscience and physics); RWTH Aachen University (rated for natural sciences and engineering); University of Freiburg (rated one of Europe's top research institutions). The Technical University of Berlin has a reputation for mechanical engineering and engineering management, as well as mathematics and chemistry. Other statistics[8] show that 40 per cent of first-year students in Germany's tertiary sector – mainly comprising university studies and master craftsman programmes – opted for subjects in the STEM fields in 2015. This is significantly higher than the OECD average of 27 per cent. At approximately 35 per cent, Germany also leads the OECD countries in terms of 25 to 64 year-olds with qualifications in the areas of mathematics, science and technology, compared to the OECD average of 25 per cent. The country has also translated research into new products due to its rich base of graduates in STEM fields.

Some authors also observe that German's education system has shifted from 'elite' to mass and now to 'universal' higher education (Hippach-Schneider *et al.* 2017: 31–3) in that, whereas traditionally, higher education tended to be more academic than practice-based, a growing number of higher education institutions are now integrating vocational and academic elements into their programmes, hence the concept of 'dual higher education programmes' (ibid.: 32). These programmes have grown from 512 to 1,505 (*ibid.*: 34) since 2007.

Clearly, through vision, efficient and decentralised management of VET and the higher education system as a whole, Germany has succeeded in developing a high quality human capacity development system that is demand-driven, diversified, funded sustainably and producing a pool of highly skilled workers with requisite knowledge and technical skills for industry.

Singapore

Despite its natural resource constraints, Singapore has built a hub for high-value manufacturing and become a leader in aerospace, semiconductors, chemicals, and biomedical sciences. Five of the world's top ten drugs are manufactured here. Furthermore, despite not having any hydrocarbon reserves of its own, Singapore's integrated energy and chemicals complex – Jurong Island – is the world's fifth-largest producer of refined oil and ranks among the top ten globally in terms of chemicals exports by volume (Ministry of Communication and Information, Singapore 2017:7) Human capital development (HCD) has contributed to that success.

HCD in Singapore became a priority in the 1960s during 'the survival phase' of the country's industrialisation programme (Tan, Koh and Choy 2016). The path to an export-oriented industrialisation demanded a pool of sufficiently skilled workers. To meet that demand necessitated a shift in emphasis from academic to technical education. The government achieved that by developing post-secondary technical and vocational education at the polytechnics. In the 1970s, Singapore embarked on a more systematic, efficient and planning-based approach where it could project its human resource demands in the various sectors of the economy and then plan on the delivery of training that matched those needs (*ibid.*).

Like Germany, Singapore also introduced a VET system which is funded through a skills levy. Unlike Germany, its success in HCD was attained mainly through FDI, large-scale MNCs (mostly from US) rather than domestic enterprises (Siddiqui 2010: 10). The rationale was lack of capacity as the workforce had low levels of education (*ibid.*: 2). By 2001, it is said that the country had close to 5,000 MNEs, accounting for three-quarters of manufactured output and 85 per cent of the country's exports. Because these MNEs required highly skilled labour, the Economic Development Board (EDB) aggressively embarked on strategies to attract FDI. Later on, the government started to demand that the MNEs should share their technologies with local enterprises.

Osman-Gani (2004: 276) emphasises the critical role played by the government through the EDB. He adds that development of a long-term planning framework, in which skills needs are identified and projections into the future estimated, contributed to the success of the HCD. The Strategic Economic Plan (SEP) in 1991 is said to have been one of the first comprehensive initiatives for human capacity development of local workers in that regard (Siddiqui 2010: 10). The government also created effective tripartite institutional infrastructure linking government, employers, unions, educational and vocational institutions to support HCD.[9]

Writing on the success of this country, Ibata-Arens writes:

> Singapore has become a city-state to emulate, as communities all over Asia (including Okinawa, Japan) try to copy its success. Decades of smart national policy –prioritizing infrastructure and human capital investment while attracting foreign direct investment – are the basis of Singapore's success (2012: 14).

Singapore has also invested significantly in the development of STEM education through the university system and technical colleges. Some of its universities and technical colleges are also among the best in terms of the Times Higher Education World Ranking of Universities (see Table 5).

Table 5: Singapore THE World University Rankings 2017

Name of Higher Education Institution	**Ranking**			
	Top 200 globally	**in Computer Science**	**in Physical Sciences**	**in Engineering and Technology**
National University of Singapore	22	31	16	8
Nanyang Technology University	52		42	16

Source: THE (2018)

The government's adaptive approach to HCD has recently been demonstrated by its response to the Fourth Industrial Revolution or Industry 4.0. The EDB, anticipating intense competition from this development, has started on a national strategic response to prepare for the revolution (Open Government Asia 2018). In January 2016, the government created a Committee for Future Economy (CFE). The Committee has been tasked with developing economic strategies for the next decade and with 'building deep capabilities' in response to those changes. The adaptiveness of the government is reflected in the statement:

> The world is going through a period of great uncertainty. Significant structural shifts are taking place in many countries. Industries and jobs are changing rapidly. Amidst the disruption, there will also be opportunities. We cannot be sure which industries will perish and which will flourish. What is certain

> is that Singapore must stay open to trade, people and ideas, and build deep capabilities so that our people and companies can seize the opportunities in the world (*ibid.*).

Japan

Japan has established a globally competitive industry in automobiles, auto parts, semiconductors, robots and electronics industries and so, traditionally, it has been ahead of the rest of the world in automation and implementation of best practices in manufacturing operations (Deloitte & Touche 2018: 49). Like Singapore, the country was faced with the challenge of scarcity of natural resources but saw opportunity in medium to high technology manufacturing for export. Yoshida (2010: 31) gives a detailed account of the evolution of human capacity building in Japan. He indicates that during the early phases of industrialisation, Japan, like Singapore, also depended heavily on imported foreign experts and importing plant and equipment. For example, in 1875, 500 foreign experts (mainly in engineering and academics), were hired from the UK, France, Germany and the US engineers and skilled workers to manage those plants (*ibid.*: 36).

However, over time, the government replaced them with local workers who had subsequently acquired skills either through the skills transfer agreements between the government and the foreign companies or through the government's scholarship programmes which sponsored many Japanese students to study abroad (mainly in the UK, US, Germany and France).

Japan has developed an education system which ranks among the best in the world and is also patterned along the German system in terms of integration of theory and practice in learning. It was ranked among the top performers in the OECD 2012 Programme for International Student Assessment (PISA) in mathematics, science and reading. The Japan Ministry of Education, Culture and Sport (MEXT) has been the chief architect behind the development of a successful education system designed to ensure that students are well equipped in numeracy, mathematics, science and literacy by the time they exit secondary school. Learners are assessed and channeled into different career paths depending on their competencies and aptitudes. In 2002, the Japan Science and Technology Agency, part of MEXT, started the Super Science High School (SSH) programme to improve student performance in maths and science. These schools are selected and funded by MEXT. They are expected to foster close linkages with research and innovation institutions. Students conduct research to find solutions to real life problems. By 2010, there were 126 Super Science High schools in Japan (Ibata-Arens 2012: 15). Details of these schools are provided by Sumida (2013: 277–89) and Tsuneyoshi (2018).

Japan has also established a comprehensive VET system. The Ministry also certifies vocational and practical professional courses. Furthermore, the country has also established universities of world standing. For example, considered the Japanese equivalent of the US Ivy League, its top universities include the universities of Tokyo, Tohoku, Kyoto, Nagoya, Osaka, Kyushu and Hokkaido. It has also established institutes of technology, for example, the Tokyo Institute of Technology (THE 2018). The tertiary education system and technology institutes have enabled Japan to advance in science, mathematics, engineering and computer science and ICT-related education. Table 6 below shows that some of its universities and institutes are among the best in the world in these fields.

Table 6: Japan THE World University Rankings 2017

Name of University	Ranking		
	Among top 100 universities globally	Computer Science	Physical science
University of Tokyo	76	50	36
Kyoto university			62

Source: THE (2018)

Seven of the country's universities were among the top 125 in the THE rankings as Table 7 shows.

Table 7: Japan's universities listed among the top 100 globally (Engineering and Technology)

Name of University	Rank
University of Tokyo	35
Kyoto University	42
Tohoku University	61
Tokyo Institute of Technology	65
Osaka University	98
Kyushu University	101-125
Nagoya University	101-125

Source: THE 2018

It is no wonder that Japan is also at the forefront of Industry 4.0. In June 2014, it established the Robot Revolution Realization Council to coordinate the advanced manufacturing of robots.[10] This should be another indicator of its success in building the human capacity for industrialisation.

Republic of Korea

In the Republic of Korea (RoK) human capital development became a priority in the 1960s as the country embarked on industry development. The depth and sophistication of the skills system varied with the economic cycles of the Korean economy. In the early 1960s and 1970s when the focus was on export-oriented light industries, to the shift towards heavy and chemical industries in the late 1970s and 1980s, government intensified efforts to develop technically more advanced and knowledge-based industries in the 1990s and 2000s. The purpose of the skills drive was to increase the supply of a skilled workforce in response to a growing industry.

The government used a training levy to create a Vocational Training Promotion Fund in 1996. Korea first adopted the skills development system in 1967 by an enactment of the Vocational Training Act to provide a skilled workforce for industrialised and semi-independent organisation to produce highly skilled trainees and technicians.

As evidence of success in building human capacity for industry, higher education/tertiary institutions and institutes of technology of the Republic of Korea are also ranked among the top 200 global performers (according to the THE World University Rankings for 2017). Table 8 lists those institutions which were included on that list. Three of its universities were listed among the top 200 universities globally; one institute of science and technology was among the top 100 institutions in Computer Science and six universities and institutes were among the top 125 universities in Engineering and Technology.

Table 8: Republic of Korea institutions in top universities THE World University Rankings 2017

Name of higher education institution	Ranking			
	Top 200 globally	Computer Science	Physical Sciences	Engineering and Technology
Seoul National University	74			32
Korea Advanced Institute of Science and Technology	95	40	92	27
Sung Kyunkwam University	111			47
Phang University of Science and Technology				52
Karee University				101-125
Ulsan National Institute of Science and Technology				101-125

Source: THE (2018)

Lessons from the Country Experiences

Some lessons can be drawn from the review of the four country cases. Firstly, the primacy of a capable state in providing vision and leadership for a transformative approach to human capacity development. In all four countries, the government was central in the building of an education and skills base that was tailored to the needs of industry. Secondly, the creation of an ecosystem of multi-stakeholder actors within public, private sectors and academia to collaborate in the identification of needed industry skills (demand) and provision of services for human capacity development (supply side), is fundamental to success. Thirdly, integration of theory learning into practice in the context of a well-designed, well-funded vocational education and training system to ensure production of a workforce with requisite technical skills for industry. Fourthly, establishment of a tertiary education system which has a strong component of science, mathematics and technology education and also of a high standard both domestically as well as internationally. Finally, the ability to adapt a nation's strategy to the local context even though, on the surface, it may be construed as politically 'unpalatable'. For example, Singapore, Japan and the RoK, based on their initial capacity challenges, did not hesitate to harness FDI to support their HCD strategies until they had developed their own local capacities.

Conclusion and Recommendation

The successful experience of these four countries with respect to HCD provides useful lessons that African countries can draw from. However, it must be emphasised that they are not a blueprint for what Africa should do to develop the human capital skills for its industrialisation agenda. That is because the social, political environmental and cultural contexts are different.

Nonetheless, those experiences can be useful as a framework to guide the continent in forging new strategies that will transform the current system towards greater orientation to a bias for STEM and STI as well as a comprehensive practice-based skills development approach in the form of a new and expanded VET model. Africa can also build on the STISA-2024 framework by strengthening the integration of HCD in their national development planning frameworks, increasing the allocation of budgets to VET, primary, secondary and higher education and prioritising STEM and STI. Intensive efforts to mobilise domestic and external resources (particularly diaspora remittances) and exploring the possibility of training levies to finance HCD should be considered. It is also critical to forge partnerships within the continent, South–South and North–South Cooperation and enter into agreements on skills and knowledge transfer.

Notes

1. For a full definition of the CIP, see UNIDO (2016).
2. WEF Report, Global Human Capacity Development Index.
3. World Economic Forum. (2018: 2016)
4. Even when using the Inequality Adjusted Human Development Index (IHDI), which is adjusted for income inequality, they have still performed relatively better than the developing world.
5. United Nations Human Development Report 2016.
6. *ibid.*: 202, 214.
7. According to *Education at a Glance 2017*, published by the Organisation for Economic Co-operation and Development or OECD.
8. Kuruvilla, Erickson and Hwang (2002) corroborate these authors on the success of Singapore's education system.
9. Japanese companies currently garner 50 per cent of the global market for factory robots.

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