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The Risks of Industry 4.0 on Cambodia's Garment Sector: Analysis and Ways Forward

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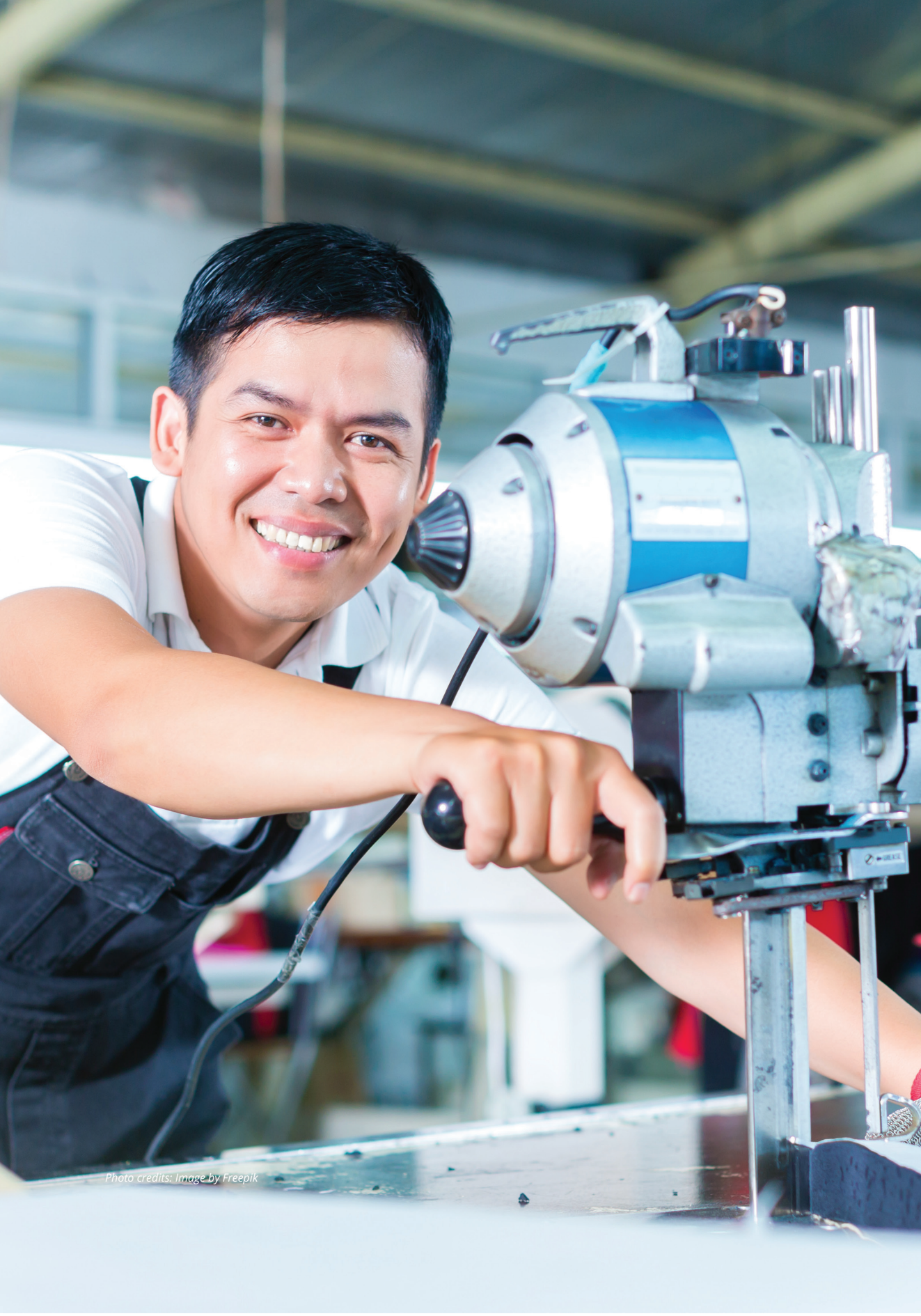


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Introduction

There are major innovations in the global economy which could change the face of industrial production forever. A term that embodies multiple new technologies in manufacturing is Industry 4.0. Highly developed countries have the necessary monetary, intellectual and industrial resources to embrace and shape this change, unlike developing countries which are still catching up economically. This is especially true when an economy is highly dependent on just one sector and its low labor costs, as is the case with Cambodia and its garment industry. The impact of digitalization on manufacturing will be significant. Low-skilled jobs could disappear on a large scale and there will be an urge to restructure. To get a better understanding of Cambodia's economy, this report asks the question: What impact does Industry 4.0 have on the garment sector in Cambodia? The first chapter will focus on global trends in manufacturing which are often described by the term Industry 4.0 and their impact on the garment sector. Afterwards, the report analyzes the risks stemming from these developments on the Cambodian economy in general and on the garment industry in particular, before finally finding and presenting approaches that policymakers could take in order to attain the most positive outcome for Cambodia.

Global Developments: Industry 4.0 and the Future of the Garment Sector

The Austrian economist Joseph Schumpeter created the term "creative destruction" in the 1940s to describe the way technological progress improves the lives of many, at the ex-

pense of a few. Creative destruction occurred during the industrial revolution when machinery and improvements to the manufacturing process such as the assembly line pushed out craft and artisan production. While the economy as a whole benefitted from such improvements, the jobs of those craftsmen never returned.² Innovation is a permanent trend in mankind that leads to disruption. That has always been the case. From simple early tools to today's smartphones, technology has changed what we make and how we make it. It has determined the path of economic growth, and shaped societal norms and behaviors.³ The first industrial revolution started in the garment industry. When James Hargreaves in 1764 constructed his "Spinning Jenny" baptized invention, he initiated a movement that fundamentally changed the lives of people worldwide. The Spinning Jenny was the first industrial spinning machine in the history of technology. With up to 100 spindles working simultaneously, it replaces eight spinners and one weaver, increasing the productivity and profitability of every facility that owns a model. The technology spread quickly throughout the textile industry during the first industrial revolution.⁴ Nowadays the fourth industrial revolution is approaching. Even though currently there are only few business cases in the garment sector (globally) to which the term Industry 4.0 really applies, the chances that the garment sector will feel its impact in the

2 Adam Hayes, 20 Industries Threatened by Tech Disruption, Investopedia, May 9, 2019, <https://www.investopedia.com/articles/investing/020615/20-industries-threatened-tech-disruption.asp>.

3 Reinventing Business through Disruptive Technologies, Sector Trends and Investment Opportunities for Firms in Emerging Markets, IFC, 2019, <https://www.ifc.org/wps/wcm/connect/8c67719a-2816-4694-9187-7de2ef5075bc/Reinventing-business-through-Disruptive-Tech-v1.pdf?MOD=AJPERES>.

4 Industrialisierung und Arbeiterbewegung, Zeit Online, <https://blog.zeit.de/schueler/2014/01/23/industrialisierung-geschichte-revolution>, Januar 23, 2014.

future are high.

It is difficult to predict how big this impact will be because it is hard to assess which specific technologies will dominate. The insurance company Deloitte foresees that almost every economic sector is affected. The question is just how fast the change will happen (short fuse vs. long fuse) and how big the impact will be (small bang vs. big bang).⁵ **Manufacturing** will have a long fuse and a big bang, meaning that there is still time for countries with a big manufacturing sector to prepare. The bad news is that the impact will be huge.⁶

For the German government, who coined the term **Industry 4.0**, it refers to the intelligent networking of machines and processes for industry with the help of information and communication technology.⁷ Since the 1970s, information technology has been incorporated into business. Desktop PCs, the use of office IT and the first computer-aided automation revolutionized the industry. For Industry 4.0, the core technology is not the computer, but the internet. Digitalizing production is gaining a new level of quality with global networking across corporate and national borders; the Internet of Things, Artificial Intelligence, edge computing (sensors), 5G connectivity, quantum computing power, robotics, automation, big data, machine-to-machine communication and manufacturing facilities that are becoming ever more intelligent are heralding a new

era, the fourth industrial revolution.⁸ Implementing Industry 4.0 is a complex project: all the processes companies digitalize must be connected. The main objective of process modelling, operational excellence and management is to reduce the amount of interfaces and to create a lean and slim management to increase efficiency. Uniform norms and standards for different industrial sectors, IT security and data protection play an equally central role as the legal framework, changes in education and jobs, the development of new business models and corresponding research.⁹

Industry 4.0 is the next step in the automation of factories, the so-called Smart Factory. Robots and machines are no longer just repeating a work step millions of times. Through the networking of all production processes they decide independently how each component should be used.¹⁰ The factory can thus produce unique pieces, because it decides by itself which component it uses, which way it takes and which machine it works with. The factory of the future can react flexibly and quickly. Through increased efficiency, goods are produced according to real needs. After all, no one else could reschedule so quickly, process so much information from so many different sites and make also the best possible decisions.¹¹

5 Digitalisierung: Assekuranz erwartet ein "big bang" April 14, 2015, <https://www.cash-online.de/versicherungen/2015/digitalisierung-assekuranz-erwartet-ein-big-bang/245217>.

6 Digitalisierung: Assekuranz erwartet ein "big bang" April 14, 2015, <https://www.cash-online.de/versicherungen/2015/digitalisierung-assekuranz-erwartet-ein-big-bang/245217>.

7 Plattform Industrie 4.0, Federal Ministry of Education and Research, <https://www.plattform-i40.de/PI40/Navigation/EN/Industrie40/WhatsIsIndustrie40/what-is-industrie40.html>, Accessed June 18, 2019.

8 Plattform Industrie 4.0, Federal Ministry of Education and Research, <https://www.plattform-i40.de/PI40/Navigation/EN/Industrie40/WhatsIsIndustrie40/what-is-industrie40.html>, Accessed June 18, 2019.

9 Plattform Industrie 4.0, Federal Ministry of Education and Research, <https://www.plattform-i40.de/PI40/Navigation/EN/Industrie40/WhatsIsIndustrie40/what-is-industrie40.html>, Accessed June 18, 2019.

10 Jann Ravling, Was ist Industrie 4.0? Die Definition von Digitalisierung, September 4, 2018, <https://www.wfb-bremen.de/de/page/stories/digitalisierung-industrie40/was-ist-industrie-40-eine-kurze-erklaerung>.

11 Jann Ravling, Was ist Industrie 4.0? Die Definition von Digitalisierung, September 4, 2018, <https://www.wfb-bremen.de/de/page/stories/digitalisierung-industrie40/was-ist-industrie-40-eine-kurze-erklaerung>.

Compared to car manufacturing for instance, the garment sector is more reluctant to technical innovations because the business model still mainly relies on cheap labor. Garment factories are still at the beginning of their digitalization journey both at the procurement stage and at the end-to-end product development process.¹² But this could change dramatically as the costs for technological investments are decreasing very quickly. Predictions show that the price for industrial robots declined from 131,433 USD in 1995 to 31,312 USD in 2015 and will further decline to 10,800 USD in 2025.¹³ Globally, the main technologies driving the developments in the garment sector are related to product customization technology such as additive manufacturing, body scanners and computer-aided design. Other advances impacting the sector include smart apparel, nanotechnology, automated sewing machines and robotic automation. Automated sewing and cutting machines are becoming widely available for garment manufacturing. These machines are able to automatically sew garments on a continuous basis without human operators.¹⁴ “We used to cut by hand. Now we use machines. You needed 15 people before. Now you need only two”.¹⁵ Those two remaining people need a higher skill level. The others have to look for a new job.

In the past decades, the default approach of garment buyers facing margin erosion and price increases has typically been to shift their sourcing to lower-cost countries considered to be the next stop of the garment caravan.¹⁶ Successful countries like China and Vietnam used the dramatic economic growth through the garment sector to invest in infrastructure, special economic zones, and, above all, human capital, which generated a high-quality labor force connected to the outside world.¹⁷ With textile companies under pressure to step up their agility, there is also new focus on proximity sourcing and reshoring. Meanwhile, factors other than price – including strategic collaboration with suppliers and end-to-end process management – are becoming increasingly important considerations for sourcing executives.¹⁸

For many companies in the garment sector automation is imminent. In a survey, more than 60% of apparel companies believed that automation, and not labor cost, will be the major drive for sourcing decisions before 2025. Nearly all the others believed it would happen by 2030. Most of the sourcing executives, suppliers, and academics do not see the future as an either-or decision between automation and labor cost. Instead, both models will co-exist in the medium term: labor-dependent, low-cost country sourcing will continue, while sourcing from (semi-)automated suppliers or from companies own automated factories will ramp up in parallel. This reflects the fact that adoption of automation is driven not just by technical feasibility but also by economic

12 Achim Berg et al., The apparel sourcing caravan's next stop: Digitization, McKinsey Apparel CPO Survey 2017.

13 Sam Korus, Industrial Robot Cost Decline, ARK Invest, <https://ark-invest.com/research/industrial-robot-costs>, August 7, 2017.

14 Jae-Hee, Chang, Phu Huynh, Gary Rynhart, ASEAN in transformation : textiles, clothing and footwear: refashioning the future, International Labour Office, Geneva 2016.

15 Chethiya Jayakody, Chief Cxecutive of Universal Menswear, in: Mitsuru Obe, Bangladesh fights for future of its garment industry, Nikkei Asian Review, <https://asia.nikkei.com/Business/Business-trends/Bangladesh-fights-for-future-of-its-garment-industry>, November 04, 2018

16 Achim Berg et al., The apparel sourcing caravan's next stop: Digitization, McKinsey Apparel CPO Survey 2017.

17 World Bank. 2019. World Development Report 2019: The Changing Nature of Work. Washington, DC: World Bank.

18 Achim Berg et al., The apparel sourcing caravan's next stop: Digitization, McKinsey Apparel CPO Survey 2017.

feasibility. So, even if the technology exists to enable automated production, its expected economic benefits may not outweigh its costs – and manual production in low cost countries may continue to be competitive. These findings suggest that automation of garment manufacturing has not yet reached the required benefits and return of investments to convince a large number of companies of its power as a trigger for re-shoring. Even pioneers in the field are skeptical, because the needed investment is still too high.¹⁹

Industry 4.0 will lead to Labor 4.0. Automation leads to less demand for manufacturing workers everywhere.

Automation also changes the overall relationship between industrial employment and labor costs because it occurs faster in locations with high labor costs, assuming the incentive to reduce labor costs trumps other differences between locations.²⁰

On the one hand, increasing networking and automation is replacing jobs with robots, artificial intelligence and new machinery. On the other hand, the demands on highly qualified, i.e. the people who create and operate the automation technology and their availability on the labor markets are increasing. New jobs are created through digitalization,²¹ but especially in the developing countries existing jobs are in danger. Digitally driven automation could cause up to two thirds of all jobs in developing countries to disappear.²² With the

digitalization of manufacturing developing countries lose their comparatively big advantage of cheap labor. If a product can be generated fully automatically by digitally controlled machines, there is no incentive to relocate production to low-wage countries anymore.²³ As the World Bank states: “When robots are cheaper than the existing manufacturing processes, firms become more amenable to relocating production closer to consumer markets”.²⁴ Workers undertaking routine tasks are the most vulnerable to replacement.²⁵ The demand for advanced cognitive skills and socio behavioral skills is increasing, whereas the demand for narrow job-specific skills is waning. Meanwhile, skills associated with “adaptability” are increasingly in demand. This combination of specific cognitive skills (critical thinking and problem-solving) and socio behavioral skills (creativity and curiosity) is transferable across jobs. How well countries cope with the demand for changing job skills depends on how quickly the supply of skills shifts. Education systems, however, tend to resist change.²⁶ A significant part of the readjustment in the supply of skills is happening outside of compulsory education and formal jobs, e.g. company training or professional courses. Early childhood learning, tertiary education, and adult learning sought outside the workplace are increasingly important in building the skills that will be highly valued in future labor markets.²⁷

19 Achim Berg et.al., The apparel sourcing caravan's next stop: Digitalization, McKinsey Apparel CPO Survey 2017.

20 World Bank. 2019. World Development Report 2019: The Changing Nature of Work. Washington, DC: World Bank.

21 Jann Ravling, Was ist Industrie 4.0? Die Definition von Digitalisierung, September 4, 2018, <https://www.wfb-bremen.de/de/page/stories/digitalisierung-industrie40/was-ist-industrie-40-eine-kurze-erklaerung>.

22 Silvan Rehfeld, Digitalisierung in der EZ: Historische Chance für die Nachhaltigkeitsziele, Januar 31, 2019, <http://blog.venro.org/digitalisierung-birgt-historische-chance-fuer-das-erreichen-der-nachhaltigkeitsziele>.

23 Ausarbeitung Digitalisierung und Entwicklungspolitik, Deutscher Bundestag 2017, <https://www.bundestag.de/resource/blob/525938/488ea79620fb0b4c452b42519f2afb37/wd-2-051-17-pdf-data.pdf>.

24 World Bank. 2019. World Development Report 2019: The Changing Nature of Work. Washington, DC: World Bank.

25 Ibid.

26 Ibid.

27 Ibid.

Risks for the Cambodian Garment Sector and its Impact on the Economy

Cambodia is an emerging economy with a growing manufacturing sector, which is predominantly driven by the garment industry (textiles, clothing and footwear) and the low wages in this sector.²⁸ After the disaster of the Khmer Rouge and along with it the destruction of the Cambodian economy and infrastructure between 1975 and 1979 and the ensuing Civil War that lasted until 1998 the Cambodian economy had to catch up. And it did so quite successfully. Due to steady economic growth and macroeconomic stability, the GDP per capita more than tripled since 2005. Today Cambodia is a Lower Middle Income Country with a GDP per capita of 1,384.4 USD in 2017. At the moment there is a continuous economic growth of approx. 7.0% annually.²⁹ The industry sector, which contributed 33% of the GDP in 2017, is dominated by textile and leather. 800,000 employees generate approx. 75% of all export earnings. The garment sector also contributed indirectly to employment generation in retail, trade and transportation. The exports are totaling 8 billion USD in 2017. This strong focus on garment carries a big future risk, as vulnerable people in particular are heavily dependent on it. With the increase in the minimum wage from 80 USD (2012) to 170 USD (2018) Cambodia's competitiveness in this sector is already declining with respect to Sri Lanka, Bangladesh and Myanmar.³⁰

The positive economic momentum does not carry over to the country's infrastructure which is mired in big problems. The degree of electrification is still low (60% in 2017). Cambodia already has some of the highest electricity rates in Southeast Asia, which makes industry, especially those in the electricity-dependent manufacturing sector, less competitive.³¹ The system is not reliable.³² Moreover, today's road infrastructure is still poor. Wide rural areas are barely reachable or difficult to access, especially during the rainy season. Therefore, these regions have a poor market connectivity and low development opportunities. The number of internet users per 1,000 inhabitants was 256 in the year 2016. The Population is steadily growing (1.5% in 2017). From the 16.0 million Cambodian in 2017 are 50% younger than 25 years. The Foreign Direct Investment was 2.0 billion USD in 2017, of which China has 70%. Cambodia still seems far away from the debt trap as there is a low government debt of approx. 36% of the GDP. The poor educational system leads to a lack of skilled workers.

Overall, the current Cambodian Economic Development shows a mixed picture: on the positive side are solid growth, declining absolute poverty, improved other social indicators, an economic friendly policy, the Dollar Economy, the Special Economic Zones, the macroeconomic stability and the demographic bonus. Nevertheless, there are still many problems: low level of development, weak economic infrastructure, poverty in rural areas, a high proportion of "near poor", high susceptibility to external interference especially the one-sided dependence on textile exports, and possible

28 ASEAN in Transformation, How Technology is Changing Jobs and Enterprises, Cambodia Country Brief, https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579672.pdf, April 2017.

29 World Bank, Data, https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=KH&name_desc=true, Accessed June 18, 2019.

30 Jochen Saleth, Zur wirtschaftlichen Lage in Kambodscha, März 2019.

31 David Hutt, Why Hun Sen can't keep the lights on, Asia Times, April 3, 2019 <https://www.asiatimes.com/2019/04/article/why-hun-sen-cant-keep-the-lights-on>.

32 Ibid.



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withdrawal of trade preferences.

According to the International Labour Organization 88% of jobs in the garment sector are at high risk of being automated. This could impact almost half a million sewing machine operators who primarily perform repetitive and manual tasks.³³ The ILO estimated that 57% of all Cambodian workers (or over 4 million jobs) face a high risk of automation.³⁴ It is likely that specific segments of workers will significantly feel the impact including women, young workers and primary school graduates. Cambodian women are 50% more likely to be employed in an occupation at high risk of automation compared to men. Young Cambodian workers aged 15 to 24 are 10% more likely to having an occupation at high risk relative to adult Cambodian workers. Moreover, pri-

³³ Jae-Hee Chang and Phu Huynh, ASEAN in transformation : the future of jobs at risk of automation, International Labour Office, Geneva 2016

³⁴ Ibid.

mary school graduates are 20% more likely to be in a high risk occupation than post-secondary graduates. Workers with lower education levels tend to perform manual and repetitive tasks that are automatable in nature; and just 89% of the Cambodian workforce completed primary schooling or less.³⁵

For Cambodian companies it seems difficult to upgrade their own technology to catch up with the developments. Around one in four enterprises in Cambodia cited high fixed capital costs as the leading obstacle. Critically, one in five Cambodian enterprises blamed the lack of skilled workers who can operate the technology as the second largest barrier. This finding highlights significant skills gaps in Cambodia resulting from low education levels among the Cambodian workforce. Enterprises in Cambodia also reported that technology did not need to be upgraded. This could be re-

³⁵ Ibid.

lated to the fact that wage levels in Cambodia are relatively low compared to other countries in the region, and technology is perceived as being expensive. These findings, however, could change in the near future as technology costs decline while labor costs increase.³⁶

Therefore, technology upgrade in the Cambodian garment sector is primarily occurring in enterprises that are connected to the global value chain, and work for big international retailers. Smaller and locally owned garment enterprises in Cambodia do not tend to engage in technology upgrade to the same extent as those fully integrated in the global value chain. Cambodia's labor productivity in the garment sector is among the lowest in ASEAN and represents only 22% of the level in Thailand's garment sector.³⁷ Garment production in Cambodia will be impacted by technology uptake both inside and outside Cambodia. Inside Cambodia, enterprises could automate labor-intensive production processes in order to raise labor productivity. Such increased automation will impact on more than 650,000 Cambodian workers whose jobs would be at high risk of automation. The majority of these workers would be young women with low education levels. In terms of skills requirements, growing automation would increase the demand for technicians and high-skilled workers who can operate new machinery.

Outside Cambodia, technology adoption by garment enterprises could reduce exports of the Cambodian garment sector. Main destination countries (such as the EU and the United States) and major regional competitors (including China) could increasingly incorporate automation into their most labor intensive

production processes. Besides labor costs, offshoring also entails costs in terms of shipping, duty and reputational risks. If the total cost of incorporating automated sewing machines to automate labor intensive tasks proves to be more efficient than offshoring, retailers may increasingly re-shore garment production from Cambodia to destination countries. Additionally, technology adoption in garment factories in other Asian countries would result in less relocation of garment production to Cambodia, reducing the competitiveness of the garment sector.³⁸ This will altogether lead to a situation in which shares of manufacturing would go back to developed countries. The garment sector is additionally volatile as Cambodia is producing for international brands and almost all the owners of the factories are foreign. Just 1.4% of the factories are owned by Cambodians. The existing ownership structure and the "footloose" characteristics of the industry mean that garment factories can be relocated relatively quickly from Cambodia to more attractive countries if the sector faces a squeeze in profit margins due to rising input costs, higher taxes, less favorable preferential trade treatment or an economic slowdown of key export markets.³⁹

The arguments combined with the level of automation and labor costs can be used to predict the future of the garment sector in Cambodia. There are four likely scenarios for the sector as the following graph shows.

³⁸ Ibid.

³⁹ World Bank, Cambodia Economic Update, Enhancing Export Competitiveness: The Key to Cambodia's Future Economic Success, October 2016.

³⁶ Ibid.

³⁷ Ibid.

Level of Automation	High	Scenario 3: Transition	Scenario 2: No Garment sector
	Low	Scenario 1: Status Quo	Scenario 4: High Tech with High Skills
		Low	High

Labor Costs

The first scenario reflects the status quo. This would imply that there is a future for the garment sector in Cambodia, thanks to the competitiveness through cheap labor. The investment in automation will be low. This would mean that wages are not getting higher in the future. Workers will keep their jobs, but without earning more money. However, because of global trends in the consumer market and on the production side of businesses this seems unrealistic. The contribution to Cambodia's wealth and growth will be limited.

In the second scenario there is a marginalized garment sector in Cambodia. Because of rising wages, a lack of automation and education, the Cambodian garment sector is losing its competitiveness and the garment production caravan is either moving to a country with cheaper labor or is fully automated and moving directly to customers in the developed countries. Just some small companies producing for local consumption will stay. There will be very limited contribution to the Cambodian GDP. The majority of the garment workers will lose their job.

The third scenario describes a crucial transition period. While wages are still comparably low, the investment in automation is already high. In this scenario the skills of the workers need to catch up quickly, because they have to be able to maintain the machines. In this scenario it is also possible that the whole sector is growing, as the competitiveness is very high.

The fourth scenario, a (fully) automated garment sector. The garment factories invest in automation as well as in the skills of their workers. The unqualified workers will lose their jobs, but the high qualified workers will have a much higher income. The contribution to the Cambodian GDP and wealth will be high. In this best case scenario there is also an opportunity for further growth, and more and better paid jobs in this sector if there is more investment in skills and infrastructure.

How to Get the Best Outcome?

As the garment sector is central to Cambodia's economy, this paper looks at it from the perspective of policymakers who have an interest to get the most positive outcome for the economy and the labor market of Cambodia. Policymakers can create the right framework for further investment and development in this sector to stop the garment production caravan from leaving the country.

Before potential ways forward are discussed another small elaboration is needed: How to answer to the pessimist's view that the garment sector is leaving Cambodia anyway as it happens in other countries, that it doesn't make sense to do anything to make them stay and instead focus on other sectors? Firstly, there is no immediate replacement for the low skilled jobs in the garment sector. Everything needs time: upgrading skills, building infrastructure, developing new business sectors. Secondly, strategic efforts to establish a (fully) automated garment sector will produce spillover effects on other sectors. The current obstacles are more or less the same for every industry in Cambodia: education, market access, infrastructure etc. Thirdly, the competitive advantage of cheap labor will not disappear overnight. Even if wages are increasing, it will take them a long time to match the high wages in developed countries. Maybe some production will be re-shored, but definitely not all of it. In the meantime, new markets, especially in ASEAN, could grow as well.

It is worth creating a competitive garment sector in Cambodia which will lead to an overall gain in the competitiveness of the Cambodian economy. As the Global Competitiveness Index shows there is huge potential for further

development as Cambodia ranks 110 out of 140 countries in 2019. There is room for improvement in all the measured fields.⁴⁰

The following are the best areas which policymakers can influence to nurture a more competitive garment sector in Cambodia:

Education is the key to have a chance on the future job market. Unfortunately, the quality of Cambodian schools and universities doesn't hold up to international standards; according to a study in 2013, approximately 48% of fresh ICT graduates didn't have the skills to work effectively.⁴¹ The Government of Cambodia seems to be aware of the need for better education, as a statement from Prime Minister Hun Sen in June 2019 shows: "The technological advancements of the Fourth Industrial Revolution will cause job losses but also create new ones. To retain their jobs, one needs to broaden technical knowledge and strengthen skills. (...) We have no choice but to boost capacity and skills in the workforce".⁴² There are several ways to achieve that. It starts with early education where the curricula have to be updated to catch up with the needed skills and more schools have to be build. Also the potential of Online Learning should be used more, especially in the rural areas.⁴³

An analysis of the current situation in higher education reveals an alarming mismatch between education and employment: the most popular areas of study among Cambodian

40 Klaus Schwab, The Global Competitiveness Report 2018, World Economic Forum, <http://www3.weforum.org/docs/GCR2018/05FullReport/TheGlobalCompetitivenessReport2018.pdf>

41 Pheakdey Heng, Preparing Cambodia's Workforce

42 Youn Dara, PM: Workers must train for Industry 4.0, Phnom Penh Post, June 14, 2019, <https://www.phnompenhpost.com/national/pm-workers-must-train-industry-40>.

43 Ausarbeitung Digitalisierung und Entwicklungspolitik.

university students are social sciences and business related majors. Only a small percentage of students are studying science, engineering and agriculture, which are considered to be key skills to foster the growth of the Cambodian economy.⁴⁴ In addition, an international accreditation of the bachelor and master programs is needed. There ought to be more international exchange of students and researchers. With higher automation in the garment sector newer skills are required in the factories as the tasks are getting more demanding. More engineers and IT-experts are needed. Also further vocational training in the garment sector is crucial to upgrade the skill level of the workers. There are already initiatives from garment associations like the Cambodian Garment Training Institute which focus on skills development for e.g. garment construction experts (pattern making and adaptation); garment production engineers (manufacturing processes); apparel merchandisers (garment designers); and quality assurance specialists (quality controllers).⁴⁵ The government could boost, these initiatives to educate more workers. There is a high potential in the cooperation with Development Partners like Germany which have a high-quality vocational training system.

Universities should move from being purely teaching institutions to research institutions that drive innovation. Inventiveness is needed for modern economic development and for the garment sector.⁴⁶ Improved and more focused Research and Development will lead to more efficient processes in the factories and could create more businesses around the sec-

tor. This in turn could bring more parts of the value chain into Cambodia. Product Design could be one target for R&D to create Cambodian brands, produced in Cambodia, by Cambodian owned factories.

The biggest challenge is that Cambodia still lags behind in its ICT infrastructure within education due to the lack of trainers, network infrastructure and technological equipment.

According to the Global Education Monitoring Report, only 8% of public primary and secondary schools have access to stable electricity in classrooms and only 7% were connected to the internet in 2014. Moreover, Cambodia also has a very low learner-to-computer ratio, where 500 or more secondary pupils shared one computer.⁴⁷ While higher education institutions are generally better equipped, the use of ICT tools in teaching and learning is still limited by regional standards.⁴⁸ In late 2015, the Cambodian government took its first steps in this direction when it piloted the New Generation School scheme – a program designed to advance STEM education. This initiative aims to help young Cambodian students build and improve their basic skills in relevant fields and to further prepare them for the newest waves of technology.⁴⁹

Even if many improvements have been achieved in **infrastructure**, there still are severe problems that hinder economic growth. In today's garment sector, roads, rails and ports are crucial for exporting the goods. To

44 Pheakdey Heng, Preparing Cambodia's Workforce.

45 World Bank, Cambodia Economic Update, Enhancing Export Competitiveness: The Key to Cambodia's Future Economic Success, October 2016.

46 Silvan Rehfeld, Digitalisierung in der EZ

47 Pheakdey Heng, Preparing Cambodia's Workforce for a Digital Economy, Phnom Penh 2019, <https://www.kas.de/documents/264850/264899/>

48 Ibid.

49 Top Proleong, Higher education divide and Industry 4.0: A blessing or a curse for Cambodia's rural graduates?, Khmer Times, <https://www.khmertimeskh.com/50620273/higher-education-divide-and-industry-4-0-a-blessing-or-a-curse-for-cambodias-rural-graduates>, July 3, 2019.



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facilitate further automation and Industry 4.0, fast internet (mobile and fixed broadband) and reliable, affordable and accessible energy will become increasingly important. A solid digital infrastructure is the backbone of Industry 4.0, which requires big data from machines in the manufacturing process to communicate and work in real time with each other, with logistics and with customers.⁵⁰ With a highly competitive market, Cambodia has achieved a high rate of Internet coverage and access to the cheapest mobile Internet prices in the world. Cambodia could even roll out the 5G technology much faster than its neighbor-

ing countries.⁵¹ However, there were just 117,049 fixed broadband subscriptions in June 2017. This is just over 1% of total Internet subscriptions in the country.⁵²

Automation technology will lead to a higher **energy** demand.⁵³ This is a competitive disadvantage for countries with high energy costs like Cambodia. To improve the situation, the energy market should be liberalized and decentralized to give private energy providers the opportunity to feed

into the grid and make the energy mix clean and sustainable. Large scale hydropower has been the focus for increasing generation capacity. However, an indefinite halt to starting construction on new hydropower projects has recently been implemented by the government due to the environmental and livelihood risks associated with large scale hydropower.⁵⁴ To use the potential of renewable energy

50 Reinventing Business through Disruptive Technologies, Sector Trends and Investment Opportunities for Firms in Emerging Markets, IFC, 2019, <https://www.ifc.org/wps/wcm/connect/8c67719a-2816-4694-9187-7de2ef5075bc/Reinventing-business-through-Disruptive-Tech-v1.pdf?MOD=AJPERES>.

51 Shaun Turton, Cambodia joins the 5G race despite concerns over cost and viability, Nikkei Asian Review, May 20, 2019, <https://asia.nikkei.com/Spotlight/5G-networks/Cambodia-joins-the-5G-race-despite-concerns-over-cost-and-viability>.

52 Leveraging Investments in Broadband for National Development.

53 Andreas Burkert, Wie die Digitalisierung den Stromverbrauch nach oben treibt, December 8, 2017, <https://www.springerprofessional.de/energiebereitstellung/industrie-4-0/wie-die-digitalisierung-den-stromverbrauch-nach-oben-treibt/15255816>

54 Pheakdey, Heng, Toward a low carbon

the grid has to be improved.⁵⁵ Unfortunately, Cambodia still lacks clear policies for the promotion and implementation of renewable energy and energy efficiency projects. The Cambodian government has acknowledged the importance of renewable energy in national development, but has yet to put in place the supportive policies needed to create the level playing field.⁵⁶

There is a huge potential for growth if Cambodia could bring more stages of the global **value chain** into the country. Nowadays Cambodia mainly assembles imported materials and parts into finished products for exports. Cambodia's domestic supply chain and supporting industries for the garment sector are either insufficient or completely missing. The industry therefore uses raw materials, fabric and other inputs imported mainly from China. **The focus on the cut-make-trim (CMT) stage of production is found to be financially and technologically undemanding and generally less profitable than other stages.⁵⁷ Cambodia needs the aforementioned improvements in skills and infrastructure plus the right fiscal, legal and political framework.** The government could introduce smart policies to set capital and fiscal incentives to attract further investment. This would need a strategic alignment and law adaptations. To reduce volatility in the sector it is crucial to attract more Cambodian investments. It is likely that Cambodian owned factories are not joining the garment production caravan that fast and easily. A key for success could be, for example, to

create local brands and designs in Cambodia and bring them to the market. Doing so could create a competitive edge instead of the high dependence on international brands. There should be a focus on educating designers and developing more creativity. This could lead to new market exploration and the development of new business models. This combined with the location of Cambodia in a growing region like ASEAN could also lead to new digitally enabled business models.

Access to markets and low tariffs for exports will be important as well. At the moment Cambodia is highly reliant on two markets: the USA and the EU. Therefore, Cambodia should not risk losing its trade preferences as a least developed country under the "Everything but Arms" scheme with the European Union, and even if the status will run out, in the long term perspective, as Cambodia is getting wealthier, it should already start to work on follow-up agreements, e.g. a free trade agreement like the one Vietnam signed with the EU in August 2018.⁵⁸ The impact of an EU-Vietnam FTA will be felt in Cambodia. The World Bank estimated in 2016 that the free trade deal could cost Cambodia \$350 million in exports due to a "level playing field" being established between the two neighbors. The potential loss of Cambodia's own EBA deal with the EU could further impact garments, footwear and rice exports by as much as \$650 million.⁵⁹ At the moment Cambodia profiteers from the "trade war" between the USA and China, because of the tariffs put on Chinese products by the

55 Bakovic, Tonci and Julia Heckmann. 2018. "IFC Thematic Brief 3: Disruption in Power." (Internal document), June. No.3, Page 3. Washington, DC: International Finance Corporation, World Bank Group.

56 Ibid.

57 World Bank, Cambodia Economic Update, Enhancing Export Competitiveness: The Key to Cambodia's Future Economic Success, October 2016.

58 European Commission, Vietnam, <http://ec.europa.eu/trade/policy/countries-and-regions/countries/vietnam/>, Accessed June 18, 2019.

59 Hun Sirivadh, Industries Further Jeopardized by EU-Vietnam Trade Deal, VOD, <https://en.vodhotnews.com/industries-further-jeopardized-by-eu-vietnam-trade-deal>, July 2, 2019.

USA. It could even further benefit as Chinese investors are looking for alternative countries for manufacturing.⁶⁰ But, like with the EBA, Cambodia should not risk its trade relations with the USA, because 38.2% of the exports go to the EU and 22.7% to the USA.⁶¹ Political tensions between Cambodia and USA and the fact that Chinese owned garment companies are relabeling Chinese goods with “Made in Cambodia” to avoid tariffs are a potential risk.⁶² There are also opportunities through the ASEAN Economic Community. Cambodia's trade increased exports to the ASEAN market to 10% in 2017. Although the percentage remains low, the ASEAN market holds great potential for Cambodian exporters since the region is booming.⁶³ With fast growing economies in the direct neighborhood, the potential new customers for the products of the garment sector are coming closer to Cambodia. This will also reduce transport and logistics costs.⁶⁴

In the long run Cambodia needs **diversification** to become less dependent on one sector. The Cambodian government is aware of this and aims to diversify towards the processing

industry, mainly employment-intensive light industries with export potential such as electronics and automotive parts. But the process is difficult due to, again, very high energy prices and the lack of skilled workers. Therefore, there is no short term solution other than to work in and around the garment sector. If Cambodia is successful in creating a (fully) automated garment sector, it can trigger many spillover effects on other sectors. This means making the garment sector more efficient, increasing the demand for skills and bringing more parts of the value chain into Cambodia. One factor that increases the spread of disruptive technologies is their ability to reduce costs. Many of today's disruptive technologies are not capital intensive, which lowers new firms' barriers to entry.⁶⁵

Finally, technology itself could bring new solutions to old problems in Cambodia e.g. curb corruption and its high economic and political costs. Paying bribes to authorities could be prevented if administrative matters are performed by the citizen on the internet, via text message or app.⁶⁶ **E-government** could be used to expand the value chain in Cambodia, attract new investments, diversify, improve access to markets by making admin processes easier for garment businesses and facilitating investment processes through apps or websites. But the development of e-government has stalled.⁶⁷ Digital technologies could provide and improve the **financial services**. Financial technology (or FinTech) can allow people, businesses, and governments to pay

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- 60 Hor Kimsay, US China trade war boosts Cambodian export products, Phnom Penh Post, November 7, 2018, <https://www.phnompenhpost.com/post-depth-business/us-china-trade-war-boosts-cambodian-export-products>.
- 61 European Commission, European Union, Trade in goods with Cambodia, https://webgate.ec.europa.eu/isdb_results/factsheets/country/details_cambodia_en.pdf, Accessed June 18, 2019.
- 62 US fines firms transshipping via Cambodia to dodge Trump's China tariffs, Bangkok Post, <https://www.bangkokpost.com/world/1697988/us-fines-firms-transshipping-via-cambodia-to-dodge-trumps-china-tariffs>, June 19, 2019.
- 63 ASEAN Statistical Highlights 2018, <https://www.aseanstats.org/wp-content/uploads/2018/10/ASEAN-Statistical-Highlights-2018.pdf>, Accessed June 18, 2019.
- 64 Chheang Vannarith, After 20 Years, Cambodia Has Reaped Benefits from ASEAN. Reporting Asean, Phnom Penh, January 3, 2019, <http://www.aseannews.net/20-years-cambodia-reaped-benefits-asean>.

65 Reinventing Business, 2019.

66 Ibid.

67 UN E-Government Knowledge DataBase, UN-DESA, <https://publicadministration.un.org/egovkb/Data-Center>.

and transact digitally⁶⁸ In addition to improving access to financial services and eliminating cash-related losses, this should also lead to greater transparency ensuring corruption is no longer possible.⁶⁹

Conclusion

The Cambodian garment sector is at high risk of disappearing in the future because of the negative side-effects of Industry 4.0. The consequences for the economy and the labor market will be severe. Many jobs will disappear in this sector. New jobs will need to be created. There is a lot of work to do, but there is no alternative. It will be crucial to focus on the improvement of the competitiveness of the garment sector and the whole economy. Luckily there is awareness of the risks to the Cambodian garment sector from technological disruption in the government. Considering that Cambodia is heavily reliant on this sector, it is important to keep the sector competitive to avoid significant setbacks in socio-economic development. Policymakers, employers and training institutions need to work together in order to improve the skills of the workforce.

Promoting academic pursuits in STEM will be vital in meeting the higher skill demands required to maintain and run automated machines, particularly among young women who would be greatly impacted by technology uptake in the Cambodian garment sector.

tor.⁷⁰ Education has always been crucial for innovation and economic development, as well as infrastructure. Transport routes like roads are still important, but things like fast glass fiber internet or a 5G mobile connection are additionally required to allow connected machines which need to transfer big amounts of data just in time. Also the value of each infrastructure might change. The reliability and the price for energy are already crucial today when it comes to global competition, but automation will provide even more benefits to those economies with the lowest energy costs. Digital transformation is a chance to catch up, but the old hard ingredients for economic success like education and infrastructure are still essential. Like industrialization or globalization, digitalization is a global process that is not consistent and produces different results under different circumstances. This applies to every area of business, industry, health and governance. Digitalization must be shaped politically to avoid the negative effects of disruption. How this happens and the implications of this are issues for which there can be no unequivocal, appropriate answer.⁷¹ If the goal is positive change, then there is no time to loose, because “in the new world it is not the big fish which eats the small fish, it’s the fast fish which eats the slow fish”.⁷²

⁶⁸ Reinventing Business, 2019.

⁶⁹ Ibid.

⁷⁰ ILO: ASEAN in transformation: Perspectives of enterprises and students on future work.

⁷¹ Ibid.

⁷² Ryan Clark, A Guide To Building A Serverless Platform, Forbes, October 31, 2018, <https://www.forbes.com/sites/forbestechcouncil/2018/10/31/a-guide-to-building-a-serverless-platform/#5a111eb42f10>.