Perspectives of UC Students on the Impacts of
the Coming 4th Industrial Revolution on
Cambodian Workers

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Abstract
This research studied the impacts of the upcoming 4th Industrial Revolution on Cambodian workers. Our research attempts to know what are the benefits and negative impacts of the 4th industrial revolution toward Cambodian workers and what are UC students’ perspectives on this issue. We gave one hundred questionnaires to university students. Moreover, our research showed that people believe that the upcoming 4th Industrial Revolution has helped improve technical and professional skills for workers and it has also helped increase productivity and revenue growth. We also found that many people think that the upcoming 4th Industrial Revolution may impact the labor force in the market. Furthermore, the complexity of artificial intelligence (AI) software and hardware brings even more challenges to Cambodian workers, and it may demand workers have more skills.

I. Introduction

1. Background of the study
The origin of the industrial revolution dated back from the 18th century when the very first industrial revolution began in the United Kingdom when the steam engine was introduced. The three past industrial revolutions provided the world with rapid growth in economics. The current ongoing industrial revolution is the Fourth Industrial Revolution, where Artificial Intelligence (AI) plays a significant role.

Industrial 4.0 is known as smart manufacturing and was introduced in 2011 at the Hannover Messe trade fair by the German government. Industry 4.0 marks the technological transformation from embedded systems to cyber-physical systems, connecting embedded production technologies and smart production
processes. It goes beyond the simple connection of a manufacturing system and its objects, transferring physical information into the digital realm, then further communicating, analyzing and using that information to lead intelligent action back into the physical world to perform “a physical-to-digital to physical transition” (Sniderman, Mahto, & Cotteleer, 2016).

The Fourth Industrial Revolution describes a global transformation characterized by the convergence of digital, physical, and biological technologies. These technologies are influencing societies, economies, and individuals in ways that are changing not just the world around us but the very idea of what it means to be human. The resulting transformation is historic in terms of its size, speed, and scope. This transformation is not defined by any particular set of emerging technologies, but rather by a transition to new systems entirely that are being built on the infrastructure of the digital revolution (World Economic Forum, 2016).

The Fourth Industrial Revolution represents the advent of “cyber-physical systems” involving entirely new capabilities for people and machines. While these capabilities are reliant on the technologies and infrastructure of the Third Industrial Revolution, the Fourth Industrial Revolution represents entirely new ways in which technology becomes embedded within societies and even our human bodies (Davis, 2016).

2. Significance of the research
As we mentioned before, AI plays a major role in this Fourth Industrial Revolution. However, it could potentially be threatening to the human labor market. Cambodia is a developing country, and the labor market is very important to its economy. We noticed that the majority of Cambodians, including the younger generation, is not aware of the industrial revolution is at all. Therefore, this research study will serve as a measurement of the Cambodians awareness and help make sure that we are ready for this revolution.

3. Research questions
To conduct the research, the following questions need to be addressed:

1. According to students of The University of Cambodia, what are the benefits of industry 4.0 for Cambodian workers?
2. According to students of The University of Cambodia, what are the disadvantages of industry 4.0 for Cambodian workers?
4. Research objectives
The objectives of this research paper are:
- To see what are the benefits on the upcoming of the 4th Industrial Revolution toward Cambodian workers
- To see what are the negative impacts on the upcoming of the 4th Industrial Revolution toward Cambodian workers
- To investigate UC students` perspectives on the upcoming of the 4th Industrial Revolution on Cambodian workers

5. Scope and limitations
This research paper will investigate the advantages and disadvantages of the upcoming of the 4th Industrial Revolution toward Cambodian workers based on the student’s perspective. The data of research is covered only in 2019. The sample size of this research was 100 people, and all of our respondents were university students from The University of Cambodia. We decided to choose only the student from The University of Cambodia as our respondents for our convenience. The University of Cambodia has many colleges, thus based on their majors, their perspectives would be different from one college to another college and the first year to the second, which will add more value to the data.

II. Literature Review

1. Negative impacts
1.1. Reduction of the labor force in the market
The most pressing issue for a country that heavily relies on agriculture like Cambodia is the reduction on the labor force. An article from the Phnom Penh Post shows that many experts had pointed out that the lack of human resources in this country will bring a devastating effect to the nation’s economy. Economists have warned of the potential increase of unemployment in low-skilled jobs, where workers are losing the competition against machines and computers in accomplishing repetitive and routine tasks.

Even cognitive jobs that involve subtle judgments are facing challenges from automation (Frey & Osborne, 2015). 85%-90% of future jobs will require ICT skills by 2020, estimated by the European Centre for the Development of Vocational Training (EU Science Hub, 2013). The threat is of a jobless future of an economy characterized by tremendous productivity gains but requiring ever fewer workers (Ford, 2015). The new technologies can indeed bring about a radical change in the economy, creating jobs, but at the same time
unemployment in the less- or medium-skilled occupations that can be replaced by algorithms and robots (including, for example, driving a car or cooking) (Brynjolfsson, & McAfee, 2011).

1.2. The complexity of Artificial Intelligence (AI) on software and hardware
Technological advancement has been happening in recent years. “The study of the verification of the behavior of software systems is challenging and critical, and much progress has been made. However, the growing complexity of AI systems and their enlistment in high-stakes roles, such as controlling automobiles, surgical robots, and weapons systems, means that we must redouble our efforts in software quality.” (Dietterich and Horvitz 2015). On the other hand, the combination of hardware and software such as the internet of things (IoT), cloud computing, big data analytics (BDA), and information and communications technology (ICT) into smart embedded systems will be greatly resting in Artificial Intelligence applications. (Dopico et al, n.d).

As the IoT is the technology of an inter-networking world in which various objects are embedded with electronic sensors, actuators, or other digital devices so that they can be networked and connected to collect and exchange data whereas cloud computing is a delivery of computational services through visualized and scalable resources over the Internet. Therefore, it will be hard to adapt to and understand these various technological systems. (Zhong et al, 2017)

1.3. Impact on jobs and skills
Modern technologies have increased economic growth and changed the way we communicate, transport, live and work. With the coming of the 4th Industrial Revolution, new technologies such as the Internet of Things, Artificial Intelligence, autonomous vehicles, and 3D printing are becoming embedded into everyday life and adopted in the industrial sector. The emerging technologies in the 4th Industrial Revolution have rapidly transformed the way individuals live and work, and will revolutionize industrial sectors and services. Technology innovations are developing at an unprecedented speed, as Klaus Schwab, founder and executive chairman of the World Economic Forum describes, “when compared with previous Industrial Revolutions, the Fourth Industrial Revolution is evolving at an exponential rather than a linear pace” (Schwab, 2016). According to the UNCTAD Information Economy Report, digitalization is also leading to changes in the job market and future employment: while new jobs are created
and ways of working are transformed, basic and advanced digital skills are also required (UNCTAD, 2017).

The development of robotics can also produce negative effects because many workers will lose their jobs if they are replaced by robots. Robots are becoming more autonomous, flexible, and cooperative day by day and at certain they will interact with one another and work safely side by side with humans and learn from them. An autonomous robot is used to perform autonomous production methods more precisely and also work in places where human workers are restricted to work. Autonomous robots can complete given tasks precisely and intelligently within the given time limit and also focus on safety, flexibility, versatility and collaboratively. (Vaidya, Ambad, & Bhosle, 2018). The artificial intelligence (AI) and robotics revolution will not only affect jobs of workers who have low digital skills but also some highly skilled workers if their tasks are repetitive and mundane. Thus, the lack of literacy on digital competencies, or familiarity with technologies, on the other hand, will hamper individual and economic development (UNCTAD, 2017).

2. Positive impacts
2.1. The improvements of the technical and professional skills
Prime Minister Hun Sen called the 4th Industrial Revolution as a “Double edged sword”. He pointed out about the need of training among the young people. Technical and professional skills are needed for the operation of industrial technologies. For example, they must know how to install and operate industrial robots, or how to interpret received codes on the interface display. While the future workforce needs to take related trainings to be able to acquire professional skills, current workers can also learn about professional skills on the job. Workers who are facing being replaced by industrial robots could update their skillsets by taking on-the-job training and eventually become human operators or supervisors of industrial robots. Workers who are equipped with technical backgrounds in training programs understand how robots work and have the skills to train robots to accomplish tasks, to detect systematic errors or to facilitate inter-departmental collaborations (UNCTAD, 2017). Therefore, different skills will be required. In the short term, the trend toward greater automation will displace some of the often low-skilled laborers who perform simple, repetitive tasks.

At the same time, the growing use of software, connectivity, and analytics will increase the demand for employees with competencies in software
development and IT technologies, such as mechanical experts with software skills (Rubmann et al, 2015). Under-secretary of State at the Ministry of Labor and Vocational Training, Pheng Sokham, said “Industry 4.0 requires Cambodia to set up new policies and strategies to cope with challenges and take advantage of current technological developments.” He said human resource development is crucial for Cambodia’s economic growth. If Cambodia wants to be part of Industry 4.0, it must nurture its youth and help them become highly skilled workers. Moreover, digital skills and competencies play key roles in maximizing the benefit of technologies in individual, organizational, and national development.

2.2. More productivity and growth of revenue

Industry 4.0 will also drive revenue growth. Manufacturers’ demand for enhanced equipment and new data applications, as well as consumer demands for a wider variety of increasingly customized products, will drive additional revenue growth of the economy for both the state and individuals. Furthermore, new technology such as robots is becoming more autonomous, flexible, and cooperative. They will interact with one another and work safely side by side with humans and provide a greater range of capabilities in producing goods to fulfill the increase of a large number of the customers’ demands (Rubmann et al, 2015).

According to Roubini (2015), in the years ahead, breakthroughs in robotics and automation will boost productivity and efficiency, which will translate into economic gains for manufacturers. ‘As technological innovation increases productivity and as the income for labor and capital rises over time so it is the force to develop workers’ living standard and social economy, greater demand for goods and services — both old and new — leads to an increase in demand for labor in the old and new sectors (Roubini, 2015).

III. Methodology

1. Research design

This research study used both quantitative and qualitative approaches in order to find the answer to our main research questions. Therefore, we used questionnaires as the research tool to help explore and find out the perspectives on the upcoming Fourth Industrial Revolution of the university students. There was a total of 16 questions, which included both closed-ended and open questions. It is crucial to note that the first part of our questionnaires
only asked about the basic background of the students, which included their gender, college and academic year. The second part of our questionnaire served as the important indicators for our research study since we looked at the various answers from their perspective toward the upcoming Industrial Revolution. The closed-ended questions aimed to focus on collecting quantitative data from the respondent, whereas the open question aimed to collect qualitative data by allowing the respondent to express their ideas and concerns regarding the upcoming of the 4th Industrial Revolution.

2. Data collection and sample size
For our quantitative research methods, we used the non-probability technique called convenience sampling to select our sample. The reason we used this method because it was easier for us to find students who are from The University of Cambodia and especially for B.A. students since we already knew their schedule at the university. Similarly, we used a purposive technique so we could determine if respondents’ background had any effects on their thoughts. We made 100 hard copies of the questionnaires and all of them submitted their questionnaire back to us. Furthermore, our questionnaire used the English language, so we only selected students who had taken up the International-Track to complete our questionnaires. That helped boost the speed of our research and eased up our data collection process.

3. Data analysis
For the data analysis method, we exclusively used Microsoft Excel to analyze the data that we collected from the questionnaire. With this tool, we distinguished between the respondents from the different colleges. More importantly, we were able to compare their responses to our questionnaire. We also sought to explore their perspectives on the upcoming Fourth Industrial Revolution for Cambodian workers, whether it would bring a more positive or negative impacts based on the groups of students that we differentiated accordingly. Notably, some students from a college provided the same answers with other students from a different college, while the students from the same college provided a different answer from the other students in the same college which indicates that different answers in both closed-ended and open questions were given with accordance to their personal opinions.

IV. Findings
In regards to the front page of the questionnaire which sought some background information from our respondents, it showed that 63% of our
respondents are female and the rest 37% are male. According to the data, 65% of the female respondents have heard about the 4th Industrial Revolution before, while 35% did not. 54% of male respondents have heard about this before. Thus, more female respondents are aware about the 4th Industrial Revolution than male.

Gender aside, 35% of our respondents are from the School of Foreign language (SFL), 21% from the Tony Fernandes School of Business (TFSB), 21% from College of Social Sciences (CoSS), 9% from College of Media and Communications, 8% from College of Art of Humanities (CoAH), 3% from College of Science and Technology (CoST), and the last 3% from College of Education (CoE). 21% of our respondents are freshman, 25% are sophomore, 45% juniors and 9% seniors.

Before getting to know their actual perspectives on the upcoming 4th Industrial Revolution for Cambodian workers, respondents were required to fill in the first four important questions at the beginning of the second part of our questionnaire. Of all the 100 respondents, 61% had heard about the 4th Industrial Revolution before. Surprisingly, in the second question of the second part, 52% of our respondents had responded that they have some understanding about what the 4th Industrial Revolution is, while only 18% responded that they fully understand what it is.

Among all 4 Industrial Revolutions, the most known Industrial Revolution is the 4th at 36% of our respondents and followed by the 3rd at 23%, the 2nd at 23% and the very first Industrial Revolution at 19%. When asking about the sources that provided them the information about the 4th Industrial Revolution, we have found that 23% have heard about it from TV and 65% heard from other various sources such as the internet, school, and their friends.

To gain a deeper understanding of their viewpoints on the effects of the upcoming 4th Industrial Revolution on the Cambodian workers, two scales which consisted of 8 statements in total about the possible positive effects and possible negative impacts were designed, requiring respondents to indicate their opinions on each statements, whether they agreed or not and how strong they agreed or disagreed.
Table 1: Number of responses on the scale and the average of the positive statements

<table>
<thead>
<tr>
<th>Positive impacts of the upcoming 4th Industrial Revolution toward Cambodian Workers</th>
<th>1*</th>
<th>2*</th>
<th>3*</th>
<th>4*</th>
<th>5*</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The 4th Industrial Revolution helps improving technical and professional skills to workers</td>
<td>1</td>
<td>10</td>
<td>21</td>
<td>48</td>
<td>20</td>
<td>3.76</td>
</tr>
<tr>
<td>2. It makes the worker understand and know the updated technologies</td>
<td>1</td>
<td>9</td>
<td>15</td>
<td>56</td>
<td>19</td>
<td>3.83</td>
</tr>
<tr>
<td>3. It helps workers to boost a large number of products</td>
<td>3</td>
<td>3</td>
<td>27</td>
<td>50</td>
<td>17</td>
<td>3.75</td>
</tr>
<tr>
<td>4. It provides the income for labor and capital rises overtime to workers</td>
<td>3</td>
<td>7</td>
<td>36</td>
<td>46</td>
<td>8</td>
<td>3.49</td>
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</tbody>
</table>

The possible positive effects of the 4th Industrial Revolution are included all questions from the first scale. The data shows that our respondents agreed with the positive statements, where the overall responses received an average of 3.69. Among the 4 statements, the 2nd statement had the highest average at 3.83. Thus, it can be understood that respondents “Agree” on the point that the 4th Industrial Revolution helps the workers understand and get familiar with the cutting edge technologies in the industry. The 2nd statement is followed by the 1st and 3rd statements, receiving an average of 3.75 and 3.76 respectively. 50 respondents also agreed that the 4th Industrial Revolution will help increase productivity. We have noticed that the responses from our respondents lean more towards the agree side. Each statement received more than 40 “Agree” responses, which equates to more than 40 percent of overall respondents.

Table 2: Number of responses on the scale and the average of the negative statements

<table>
<thead>
<tr>
<th>Negative impacts of the upcoming 4th Industrial Revolution toward Cambodian workers</th>
<th>1*</th>
<th>2*</th>
<th>3*</th>
<th>4*</th>
<th>5*</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The 4th Industrial Revolution reduces labor forces</td>
<td>1</td>
<td>12</td>
<td>34</td>
<td>33</td>
<td>20</td>
<td>3.59</td>
</tr>
<tr>
<td>2. It impacts on the worker’s job when they are replaced by robots</td>
<td>2</td>
<td>7</td>
<td>28</td>
<td>36</td>
<td>27</td>
<td>3.79</td>
</tr>
<tr>
<td>3. It demands workers for IT skills</td>
<td>1</td>
<td>11</td>
<td>27</td>
<td>46</td>
<td>15</td>
<td>3.63</td>
</tr>
<tr>
<td>4. The new various technological systems are hard for workers to adapt and understand</td>
<td>5</td>
<td>9</td>
<td>30</td>
<td>43</td>
<td>13</td>
<td>3.5</td>
</tr>
</tbody>
</table>

The four negative statements were placed on the second scale. The data shows that our respondents overall agreed about the negative impacts of the 4th Industrial Revolution. The second statement received the highest average at 3.79, while the fourth statement received the lowest average at 3.5. However,
when we look at the actual number of the respondents instead, we can see that among all the statements, the third statement is the most agreed one. Therefore, we can assume that the high demand for IT skills can give negative impacts on the workers.

Something is interesting about the data from the second scale. We have found that a good portion of respondents responded neutral. Neutral was the second-most-picked choice from our respondents and hence we can assume that a good majority of our respondents are not sure about the negative impacts of the 4th Industrial Revolution at all.

![Figure 1: The second scale, Negative impacts](image)

The scale alone cannot determine the entire viewpoints of the respondents; our questionnaire ended with one open-ended question asking about the concerns of our respondents. The results show that the major concern of our respondent on the upcoming of the 4th Industrial Revolution is about the increase of unemployment rates, which 30% of all respondents expressed. 20% of the respondents also pointed out about the reduction of the labor force. These top two concerns sound similar, but if we look further down, both are different in context.
The other 17% think that the new technologies might be hard for the workers and 10% said that it might be difficult for the workers to find a job in the future. Another 9% suggested that Cambodia is still a developing country and we have a lack of understanding with the new technologies. Another 8% mentioned the need for IT skills and the last 6% point out other various concerns.

![Figure 2: Concerns of UC students](image)

**V. Conclusion and Recommendations**

We were able to identify that most of our respondents agree that the 4th Industrial Revolution will get Cambodian workers involved with the new technologies, but at the same time, it will bring negative effects towards Cambodia’s labor market as well since there is a possibility that the robots will replace humans. Our single open question was able to point out that the respondents were most concerned with the potential increase in unemployment rate. We find it difficult to conclude but we are tempted to say that the level of the awareness of our respondents toward the 4th Industrial Revolution is still low.

The results show us that what we have discussed in literature reviews section was very similar to our findings. The concern on the lack of skills and complexity of the robots and AI was raised by our respondents just like we
expected. However, the fact that our respondents are not well-aware of this matter, we believe that the awareness about this Industrial Revolution needs to be raised further. Besides the education, important information related to this matter needs to be disseminated to all the Cambodian workers, so the preparation for this Industrial Revolution is on time which will minimize all the impacts toward our economy.

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References


Davis, N (2016), What is the fourth Industrial Revolution?. Retrieved on January 19th, 2016 from https://www.weforum.org/agenda/2016/01/what-is-the-fourth-industrial-revolution/


Dopico, M et al, (n.d). A vision of industry 4.0 from an artificial intelligence point of view.


Appendix A
Questionnaire

UC student’s perspective on the upcoming of the 4th Industrial Revolution for Cambodian workers

Dear respondents, we are students from the University of Cambodia; we are conducting research on the topic “UC students’ perspective on the upcoming of the 4th Industrial Revolution for Cambodian workers”. We would like to know your ideas by using this questionnaire.

The main purposes of conducting this survey are to collect data to see what are the positive and negative impacts of the 4th Industrial Revolution toward Cambodian workers, and to know UC students’ perspective on the upcoming of the 4th Industrial Revolution.

*** The honesty and accuracy of your responses is highly valuable, appreciated and encouraged. All your answers will be kept secret and anonymous.

Please answer the following questions with a few words or put a tick a (√) in the box.

Part 1: Personal information:

1. What is your gender?

☐ Male ☐ Female ☐ Other________
2. What is your college?
- SFL
- CoST
- CMC
- CoE
- CoSS
- TFSB
- CoAH
- Other

________________

3. What year are you in?
- Year 1
- Year 2
- Year 3
- Year 4

Part 2: Information about the upcoming of the 4th Industrial Revolution for Cambodian workers

The 4th Industrial Revolution has been known as smart manufacturing and an integration of the updated technologies that will be possible to gather and analyze data across machines, enabling faster, more flexible, and more efficient processes to produce higher-quality goods at reduced costs.

1. Have you heard of the 4th Industrial Revolution?
- Yes
- No

2. Do you understand what the 4th Industrial Revolution is?
- Yes
- Some
- No

3. Which Industrial Revolution have you known before?
- 1st Industrial Revolution
- 2nd Industrial Revolution
- 3rd Industrial Revolution
- 4th Industrial Revolution

4. How do you know about the upcoming of the 4th Industrial Revolution to Cambodia?
- TV
- Radio
- Newspapers
- Other

_________________________
Please circle the extent to which you agree or disagree with each statement below.

*Strongly Disagree (1)   Disagree (2)   Neutral (3)   Agree (4)   Strongly agree (5)*

A. Positive impacts on the upcoming of the 4th Industrial Revolution toward Cambodian workers

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<tr>
<td>1. The 4th Industrial Revolution helps improving technical and</td>
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<td>professional skills to workers.</td>
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<tr>
<td>2. It makes the workers understand and know the updated</td>
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<td>technologies.</td>
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<tr>
<td>3. It helps workers to boost the large number of products.</td>
<td>1</td>
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<tr>
<td>4. It provides the income for labor and capital rises over</td>
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<td>time to workers.</td>
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B. Negative impacts on the upcoming of the 4th Industrial Revolution toward Cambodian workers

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<tbody>
<tr>
<td>1. The 4th Industrial Revolution reduces labor forces.</td>
<td>1</td>
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<td>5</td>
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<tr>
<td>2. It impacts on workers` jobs when they are replaced by</td>
<td>1</td>
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<td>robots.</td>
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<tr>
<td>3. It demands workers for IT skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>4. The new various technological systems are hard for workers</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>to adapt and understand.</td>
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Part 3: Open Question

1. As a potential work force in the future, what are your concerns that you may have on the upcoming of the 4th Industrial Revolution?