Closing the skills gap -

A study of the ICT-sector and the higher education system in Mauritius

Laura Olsson Radda, Alicia Rydhem

Abstract

The Information and Communication Technology (ICT) sector is expanding rapidly in many parts of the world. In Mauritius, the demand for skilled labour in ICT exceeds the supply. This mismatch between supply and demand has given rise to a skills gap in the Mauritian labour market. The aim of this study is to depict the current skills gap between the demand of skilled labour from the ICT-sector and the supply of skilled labour from the higher education system. The main challenges in closing the skills gap between the ICT-sector and the higher education system will be examined further. The study was performed as a Minor Field Study (MFS) in Mauritius during April to June 2022. It consists of two parts, one qualitative part in which semi-structured interviews were conducted with ten relevant individuals from the ICT-field in Mauritius. The study also includes a quantitative part consisting of secondary data analysis used to depict the skills gap. The results from the data analysis indicate that there is a mismatch between demand in terms of vacancies in the ICT-sector and the supply of ICT graduates. Furthermore, the main challenges in closing the skills gap were identified from the interviews. The ICT-education being too theoretical and that the ICT-sector is changing rapidly, were found to be the most prominent challenges. As a result of these findings, the study concludes that the skills gap exists both in quantitative and in qualitative terms.

Keywords: ICT, Skills gap, Labour market, Education, Mauritius, Sub-Saharan Africa

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1. Introduction

Information and Communication Technology (ICT) is one of the most innovative fields of the economy and it has been a strong contributor to high growth in Europe and the United States. Although there does not exist a universal definition of the concept ICT, it can be described as the components and infrastructure that makes modern computing possible for people and organisations. There are numerous ICT components in the modern world, such as smartphones, computers, robots and different software (TechTarget, 2019). According to Statistics Mauritius (2021a) the ICT-sector includes services and manufacturing industries whose products transfer, capture or display information and data electronically.

The expansion of ICT is strongly linked to the creation of jobs, increasing productivity and high growth (Welfens, 2008). Since the late 20th century, investments in ICT have increased in many African countries, which UNDP (2001) asserted would grant economic and social development by promoting opportunities of the worldwide digital economy to the African nations. Mauritius is currently experiencing an expansion of ICT and as a result, the future economic prospect of the country is partly dependent on the ability to adapt to an economy that is more reliant on skilled workers. Therefore, it is of key importance to develop their workforce into being resilient toward changes in technology (HRDC, 2021). This rapid transformation towards a more knowledge-intensive economy in Mauritius has generated a rise in the demand for skilled workers that has not been matched by an equal increase in the supply of skilled workers, resulting in a skills gap (World Bank, 2019). When new technologies enter a sector, it causes a disruption that rapidly affects both the society and economy. As businesses and technological processes change at a fast pace, certain skills become obsolete (Bollou, 2006). An important characteristic of the workforce in an economy that is experiencing an ICT-expansion is therefore to be flexible and to possess transferable skills that makes it possible for them to meet new skills in demand.

1.1 Background

1.1.1 Mauritius

Mauritius is a Small Island Developing State (SIDS) located in the Indian Ocean with a population of approximately 1.3 million people. Mauritius is one of Africa's strongest economies and is classified as an upper middle-income country (World Bank, 2021). The country has moved from being an economy relying mostly on monocrop exports to a more versatile textile industry. Thereafter the tourism sector has emerged and now there is a current expansion in the ICT-sector. The expansion of the ICT-sector has contributed to Mauritius moving towards a more knowledge-based economy. The Mauritian economy has therefore gone from being composed mostly of traditional low-skill sectors to evolving towards a rapid rise in the demand for skilled workers (Ibid). One of the most prominent socio-economic problems in the country is unemployment, which was estimated to 9.1% in 2021 (Statistics Mauritius, 2022). Despite the high unemployment, there is a large number of foreign workers in the country, which implies a shortage of Mauritian people with the right experience, qualifications and skills (Roopchund & Ramlowat, 2019).

1.1.2 The ICT-sector in Mauritius

The importance of the ICT-sector in Mauritius has increased to a large extent during the last two decades. The Republic of Mauritius (2022) states that the development of emerging technologies have improved the quality of life for the inhabitants and have introduced a new development stage for the country. The government works to further develop a good climate for the sector to grow in and aims to have a growth rate of 10% in the sector in the coming years. Numerous initiatives have been taken to develop the ICT-sector and the most recent one is the *Digital Mauritius 2030 Strategic Plan.* The plan focuses on multiple aspects of technology as an attempt to be a driver of socio-economic growth, such as strengthening the education in science-, technology-, engineering- and math (STEM) subjects and to create a base for emerging technologies to develop in. Cyber security, digital government and ICT infrastructure are also some of the main areas of concern in the strategic plan (Ministry of Technology, Communication & Innovation, 2018).

The GDP contribution of the sector is rising rapidly, and ICT is now the third pillar of the Mauritian economy. ICT is one of the most knowledge-intensive industries of the economy and the sector is integrated into most functions of the society which makes it important also for the development of other sectors. The Global Innovation Index ranked Mauritius 51st among 132 countries and 1st among 27 economies in Sub-Saharan Africa in 2020 (World Intellectual Property Organization, 2021). The Global Innovation Index (GII) ranks countries according to their capability of innovation. Strengths that were highlighted for Mauritius are political stability, business environment and investment. Weaknesses that were mentioned are university-industry research and development collaborations, knowledge workers and high-tech manufacturing. It is of great importance for Mauritius to target these challenges in order to further develop the ICT-sector in the country (Ibid).

1.1.3 Skills gap

The occurrence of a skills gap generally refers to a lack of matching between the skills that are in supply in the labour market, and the skills that are in demand in the labour market. Skills shortages is a similar concept that has been noted in many parts of the world, which refers to a shortage of skilled labour on the supply side of the labour market. The issue of quality and quantity of skills have played a crucial role for countries going through high growth development in ICT (HRDC, 2012). The World Bank (2021) mentions closing the current skills gap in the labour market as one of the most prominent challenges for Mauritius. Human resources are the key factor behind success in the growing digital economy and a scarcity of relevant skills can therefore be a threat to the development of the ICT-sector. The Human Resource Development Council in Mauritius states that one of their most central objectives is to "*Provide the necessary human resource thrust for a successful transformation of the country's economy into a Knowledge Economy*" (HRDC, 2003). The sector is changing rapidly which puts pressure on the workforce to adapt quickly, consequently the skills of the labour force easily get outdated when new technologies enter the industry. The importance of higher education has therefore increased, not least in the ICT-sector (HRDC, 2012).

1.2 Aim and research questions

The general aim of this study is to gain a deeper understanding of Mauritius development towards a more knowledge-based economy and the implications that this development has on the labour market. More specifically, the research aims to depict the current skills gap between the demand of skilled labour from the ICT-sector and the supply of skilled labour from the higher education system in Mauritius. Furthermore, the main challenges in closing the skills gap between the ICT-sector and the higher education system will be examined. The following research questions will be answered:

1. How can the current skills gap between the demand for skilled labour from the ICT-sector and the supply of skilled labour from the higher education system in Mauritius be depicted?
2. What are the main challenges in closing the skills gap between the ICT-sector and the higher education system in Mauritius?

2. Literature review

The research on the concept of skills gap is broad and has been examined in different countries and labour markets over the world. There are different results that have been obtained. The existing literature mainly uses two different approaches to examine skills gaps, either in the labour market or at the firm level. Most studies examine skills gaps in developed countries, however there are a few studies that have explored skills gaps in Africa. In Mauritius, the literature regarding the skills gap in the ICT-sector is limited and focuses on the employer side of the sector. The objective of this study is to contribute with new knowledge on the concept of skills gaps by providing an in-depth analysis of this issue in Mauritius with emphasis on the higher education system.

2.1 The two main approaches

The first approach used in existing literature is to analyse skills gaps at the firm level, which is mostly examined by relating skills gaps to firms' economic performance. Mcguiness & Ortiz (2016) use data from the Irish National Employment Survey to examine skills gaps at the firm level. They found that skills gaps are a principal determinant of training investment, and that the existence of a skills gap had a negative impact on company performance. By utilising average labour cost models, their results show that shortages in the competencies of existing staff raises average labour costs by approximately 25%. Forth and Mason (2004) also use a firm level approach when assessing skills gaps in a sample of UK firms that employ ICT workers. In similarity with Mcguiness & Ortiz (2016), they find that ICT skills gaps have a negative effect on firms' economic performance.

The other approach, which closely relates to this study, is to consider skills gaps in the context of the labour market at large. Restuccia et al. (2018) map skills gap in the American labour market using a supply and demand model. This is done by relating supply, measured as the number of available workers, to demand which is measured as the number of vacancies. The authors find that fields requiring higher skilled workers often suffer from demand exceeding supply. In the ICT-field, there are 17% more job openings than available workers in the US labour market. In similarity with Restuccia et al. (2018), this thesis builds on the same approach of mapping the skills gap quantitatively by relating supply and demand. Another study that uses the supply and demand framework is conducted by Weaver (2017). Weaver suggests that reducing skills mismatches is a question of coordination between the supply and demand side of the labour market. The author points out that skills gaps are often a result of poor coordination, not low-quality workers.

The issue of skills gaps in the ICT workforce is further assessed in a paper by Suhaimi et al. (2012). The authors analyse ICT workforce employability in Malaysia, by revising existing reports and literature. The study uses a quality versus quantity perspective on skills gaps, meaning that both the quantity of ICT graduates and the quality of those graduates' skills are relevant in assessing the skills gap. The same approach is used in this study, where the skills

gap is depicted both quantitatively and qualitatively. Suhaimi et al. (2012) find that even though universities in Malaysia are producing a fair amount of ICT graduates per year, many graduates are lacking skills that are desired by the ICT industry. The authors emphasise that there is a mismatch between the higher education system and the industry since what the universities produce does not align with industry needs.

Haskel & Martin (2001) find evidence that technological progress tends to increase the demand for skilled labour. The study uses probit estimation models that provide econometric evidence that skill shortages are affected by technological progress. One main finding is that the high-tech sector of the economy suffers the most skill shortages. The results implies that as technological change continues, higher levels of skill shortages will occur in sectors that use advanced technology. Haskel & Martin emphasise that a solution would be to simultaneously increase the supply of skilled labour to meet the higher demand. Another study by Haskel & Martin (1993) accentuates that an economy that suffers from a shortage of skilled labour will need to increase their wages as a consequence of the competition of the scarce skilled labour supply. The UK suffered this problem in the late 20th century when their productivity levels could not meet European standards, and therefore the UK workforce required an upskilling.

Most studies mentioned find that skills gaps are a result of external factors in the labour market. Imbalances between supply and demand, shortages of skilled labour or rapid technological change are often found to cause skills gaps. There is however research that has a different standpoint. Weaver & Ostman (2013) examined skills gaps among US manufacturing companies and found that not all companies with high skill demand had problems with recruitment. The study shows that it is important to not only consider scarce labour supply as the cause of skills gaps. The authors emphasised that other factors, rather than a shortage of skilled workers in the external labour market, are causing skills gaps at the firm level. Factors such as lack of coordination and communication between firms and education institutions can complicate the interaction of supply and demand. The authors discuss that even if employers are willing to invest in higher skills and the higher education system is willing to offer training in these skills, a coordination failure can occur if the two sides do not communicate about their respective needs and constraints.

2.2 Studies in Africa

The previously mentioned studies examine skills gaps in developed countries. While the research on skills gaps in the African context is limited, there are a few studies that have explored the issue. A recent study by Morsy & Mukasa (2020) examines skill and educational mismatches using survey data of employed youths from 10 African countries. The likelihood of being job mismatched is measured by using multinomial logit estimates. The results suggest that underskilling and undereducation is more prevalent in Africa than in developed countries. 29% of employed youths in the sample are found to be underskilled, while 57% are undereducated. The findings can be understood in relation to labour market characteristics that are specific for African countries, such as high levels of inefficiency and informality in the labour market. That undereducation is more prevalent in developing countries is also supported

by Sparreboom & Staneva (2014). By using the ILO School to Work Transition Survey (SWTS) over 24 developing countries, they find a relatively high incidence of undereducation.

Kirlidog et al. (2016) analyse the reasons behind the ICT skills gap in South Africa. Similar to Mauritius, South Africa suffers from a skills gap since ICT graduates do not meet the ICT skills demand. The method in the study consisted of a survey among university students regarding their perceptions of the ICT-field. The findings showed that negative perceptions of university students about ICT was an essential reason for the skills gap. The authors suggest that the findings are relevant for other developing countries where negative perception of ICT might hinder enrolment in ICT-education. Brytenbach & De Villiers (2012) also explore the ICT skills gap in South Africa. Similar to the method used in this thesis and other studies mentioned, the authors relate supply of ICT graduates to demand measured as vacancies in the sector. The study contributes with new findings in the field by introducing the concept of supply elasticity in the skills gap analysis. The elasticity of supply within the South African labour market is assessed using economic theory. In this case, elasticity of supply refers to how sensitive the supply of ICT graduates is to a change in expected salary. The authors argue that an increase in education will stimulate capital investment, which will increase demand for ICT skills with a more elastic supply, meaning higher wages in the sector. Thus, Brytenbach and De Villiers suggest that increasing the elasticity of supply will make the market for graduates more attractive because of higher salaries. This will in turn move the labour market to a more efficient and competitive state.

2.3 Studies in Mauritius

In the Mauritian context, the literature regarding the skills gap in the ICT-sector is limited. There are however a few studies that have examined the issue during the last decade. The most extensive studies to date that assess the issue of the skills gap in the Mauritian ICT-sector are conducted by the Human Resource Development Council (HRDC) during 2012 and 2017. Both studies were based on enterprise surveys that were further complemented by qualitative data gathered from interviews with major employers. The results of the studies are similar, during both years it was found that enterprises active in the Mauritian ICT-sector suffer from labour shortages at various levels. One key issue emphasised by companies was the mismatch in the labour market. Even though ICT companies in Mauritius were willing to recruit, there were extensive difficulties in filling vacant positions for the ICT firms both in 2012 and 2017.

Teeroovengadum (2017) further assess the mismatch between higher education learning outcomes and job requirements in the Mauritian context. A sequential mixed methods approach was used, meaning that qualitative methods were subsequently followed by quantitative methods. Interviews were conducted with past business graduates from the University of Mauritius and with their employers. A survey among a sample of employed graduates and employers was further used. Even though the study involved business and not ICT graduates and employers, it still provides insights on the connection between higher education and the workplace in Mauritius. The author provides evidence that there is a mismatch between skills

attained at the university and skills that are in demand in the workplace. One key finding is that there exists a prominent mismatch when it comes to IT-skills. Many employers emphasised that business graduates have difficulties in using information technologies and intermediate to advanced IT tools in their work tasks.

The issue of graduates not being prepared to work in the ICT-sector and the higher education system being too academic in Mauritius is also addressed in a study by Roopchund & Ramlowat (2019). The paper examines two collaborative dual training programs between two universities and two companies in Mauritius. The study reviews how these dual programs may contribute to improved employability of graduates. Before the program was implemented the companies had problems recruiting people with the right requirements in the field of IT, even though Mauritius had a high unemployment rate. The main finding from the collaboration between the universities and companies was that it improved the employability substantially, as almost all students were employed after the program.

3. Theoretical framework

The objective of this section is to present the theoretical framework that will be used to further investigate the main challenges in closing the skills gap and to depict the skills gap in the Mauritian ICT-sector. First, human capital theory will be presented, followed by supply and demand in the labour market, skill-biased technological change and structural change. The theory behind supply and demand in the labour market is used to understand how the labour market functions. Human capital theory, skill-biased technological change and structural change is applied to our discussion about the skills gap in the Mauritian ICT-sector.

3.1 Human capital

When humans join the workforce, each person brings a different set of skills or abilities, i.e. human capital. According to human capital theory, education is a way for people to improve their future earnings. Most of the human capital is acquired through schooling or experience in the job market. However, when an individual finishes school and joins the workforce, the obtaining of skills does not stagnate. Human capital continues to add up during the work-life through experience, training and vocational programs (Borjas, 2016, p. 229).

Educational attainment is determined both by the institutional and financial limitations to education, and by the trade-off between earnings in the present and earnings in the future. One year spent in school is one year not attending the labour force, which creates an opportunity cost of the earnings that could have been made or saved by not attending school. Workers who invest in their human capital will therefore demand a higher wage in the future. When people attend school, they give up income today in exchange for higher returns in the future. The wages between workers will differ because jobs are different, and because the workers abilities are different. It is possible to choose which skills to acquire by different educational programs and these choices can have an impact on the evolution of a persons' wages during the working life (Borjas, 2016. pp. 229-230).

3.2 Supply and demand in the labour market

According to economic theory, the labour market functions through the interaction of workers and employers. Employers demand labour for payment, and workers offer labour in exchange for receiving wages. The supply and demand of labour is influenced by market dynamics in the domestic and international market, in addition to a number of other factors such as immigration, the age of the population and levels of education (Björklund et al. 2014, pp. 10-11). Companies prefer to employ at a low cost, and employees prefer to work at a high wage. When there is a scarce supply of labour, employers must raise their wages to attract workers. In a competitive market, the labour market is in equilibrium when the conflicting preferences are balanced out (Borjas, 2016, pp. 114-115).

3.3 Skill-biased technological change and structural change

Structural change is defined as the cause of economic development that leads to a vigorous shift in the way a market or industry functions. Structural change is currently taking place in Mauritius, by going from traditional low-skill sectors such as sugar- and textile industries to the current expansion in the ICT-sector. When there is a shift in the production technology that favours skilled labour over unskilled, it can be referred to as skill-biased technological change (Violante, 2008). During the last decades, the productivity of skilled workers has increased at a faster rate compared to the productivity of less skilled workers, leading to increased wage inequality (Weiss, 2008). Acemoglu (2002) argues that if the labour forces' wages are set according to their productivity, a change in relative productivity must lead to a change in relative wages.

The behaviour of wages and the returns to schooling over the last decades indicates that technical change has been skill-biased. In the late 20th century, skill-biased technological change was observed in the United States when the wages of college graduates relative to high school graduates increased by more than 25% between the years 1979 and 1995 (Acemoglu, 2002). This development is related to the fact that there have been rapid changes in technology and an extensive spread of technologies such as computers in both our daily-lives and working-lives (Ibid). Haskel & Martin (2001) use skill-biased technological change to argue that technical development has increased the demand for skilled labour. The authors emphasise that an economy that suffers from a shortage of skilled labour will need to increase their wages as a consequence of the competition of the scarce skilled labour supply (Haskel & Martin, 1993).

4. Method and data

In this field study, a mixed-methods design is adopted. Secondary analysis was used to answer the first research question, to depict the skills gap in the Mauritian ICT-sector in quantitative terms. Semi-structured interviews were then used as the main methodological approach in answering the second research question. The primary data was collected through interviews during a Minor Field Study (MFS) in Mauritius, April to June 2022. The aim with the qualitative part of the study is to answer the second research question, to identify the main challenges in closing the skills gap in the Mauritian ICT-sector.

4.1 Depicting the skills gap

4.1.1 Quantitative data description

Secondary data was gathered to depict the skills gap in the Mauritian ICT-sector. To map the skills gap we use vacancies in the ICT-sector as a measure of demand for skilled labour, and the number of ICT graduates as a measure of supply of skilled labour. The most central data for the study was vacancies from labour market surveys retrieved from the Ministry of Labour, and the number of graduates from ICT-education at tertiary level from the University of Mauritius, University of Technology and Université des Mascareignes. There are four public universities in Mauritius, out of which three of them offer education in ICT. The delimitation to the three universities mentioned was made since they are the public universities that provide education in ICT and contribute with the most ICT graduates in Mauritius (Statistics Mauritius, 2021b). Data on employment, value added, growth rate, number of establishments, real average monthly earnings and enrolment from Statistics Mauritius was also used. Furthermore, survey data over skills in demand in the ICT-sector was used in the empirical part of the study (HRDC, 2017).

4.1.2 Processing of data

The use of quantitative data in the study aims to answer the first research question. The statistical software STATA and Excel were used to make graphs and tables. The number of graduates from 2020 and 2021 was related to the number of vacancies retrieved from the labour market surveys for the same years. Several additional graphs and tables were further made to illustrate important concepts such as skills in demand, employment, enrolment, value added and real average earnings in the ICT-sector.

4.2 Qualitative interviews

4.2.1 Semi-structured interviews with the ICT-sector

Ten semi-structured interviews were conducted with relevant individuals in the ICT-field in Mauritius. To select respondents, a form of structured snowball sampling was used. Snowball sampling is a recruitment technique in which respondents with extensive knowledge about the subject is interviewed initially, who in turn can recommend other potential respondents that are suitable for the study (Johannessen et al. 2020, p.107). Prior to the interview process we had a clear view of what organizations and institutions we wanted to interview. Therefore, a more

structured form of snowball sampling was used, meaning that respondents that were interviewed early helped facilitate us in getting in touch with other potential interviewees at the organisations and institutions that we wanted to interview. This sampling method was appropriate for the study since we initially had few contacts in Mauritius, and it provided us with a broader network while being in the field in Mauritius. The respondents were representatives from public universities, large ICT-companies, and governmental institutions in Mauritius. More specifically the respondents consisted of; three representatives from different universities, three from large ICT-companies, four from governmental institutions of which two were from different ministries. Our aim was to interview individuals from different spheres of the sector to get a multifaceted view of the issue. This was especially important since we want to examine the connection between the higher education system and the ICT-industry. Thus, it was essential to interview relevant individuals from both industry and the education sector. Furthermore, the interviewees selected were individuals with extensive knowledge about the ICT-sector in Mauritius, which was necessary to be able to get a picture of the issue at hand through the interviews.

The interviews were semi-structured with open-ended questions, which gave the possibility to vary the order of questions in each interview. One advantage with semi-structured interviews is that they provide a systematic interview material while allowing more flexibility in the order of questions and themes (Eriksson & Kovalainen, 2010, p.82). However, a challenge with this form of interview is to make sure that all topics are covered while still allowing for more in-depth discussion. An interview guide, Appendix A, was followed in order to ensure that certain topics were discussed in all interviews. The respondents got to choose where they wanted to be interviewed. Thus, nine of the interviews took place at the respondents' place of work while one interview was held digitally via videocall on Zoom. The interviews were based on questions regarding the development of and challenges related to the ICT-sector in Mauritius. The interconnection between the higher education system and the sectors labour market was further emphasised.

4.2.2 Processing of the in-depth interviews

All ten interviews were audio recorded with the respondents' consent. The advantage of recordings is that it provides a more accurate rendition of the interviews (Yin, 2018, p. 118). All interviews were then transcribed. The audio recordings were transcribed according to the method of verbatim transcription, meaning that no parts of the audio were left out during the transcription. Verbatim records of the interviews are beneficial in facilitating the data analysis since it brings the researcher closer to the data (Halcomb & Davidson, 2006). However, a disadvantage with verbatim transcription is that it can be highly time-consuming (Bell et al. 2022, pp. 436-439). Transcription of the recordings was then followed by the process of condensing the interview material. For the empirical part, the most central issues discussed in the interviews were used to summarise the perceptions of the respondents. The perceptions of the respondents were then presented in the form of graphs which were made in Excel.

4.2.3 Ethical aspects related to the interviews

Ethical aspects were especially considered in relation to the interviews. Bryman's four ethical principles was followed; ensure informed consent, avoiding harm to participants, ensuring anonymity and avoiding deception (Bryman, 2012, pp. 131-132). Furthermore, the participation was completely voluntary and the respondents was informed of this prior to the interviews. The respondents could skip questions they did not wish to answer and could stop the interview at any time, which was also informed prior to the interviews.

4.3 Limitations

This field study has its limitations, and it is important to have a critical approach when assessing the method used and the results obtained. There are several challenges related to conducting a field study abroad in a developing country that can be difficult to prepare for in advance. The restrictions of a field study can be connected to factors such as cultural differences, as well as a limited timeframe and budget. With regards to the interviews, we encountered some difficulties in the contact with respondents that limited the effectiveness of the study due to the short timeframe. In Mauritius, arranging the interviews was often associated with a high level of bureaucracy. Even though we found people to be eager to help, arranging an interview was often the result of several days, or in some cases weeks, of phone calls and arrangements. However, communication became simpler over the course of our stay as we expanded our network in Mauritius.

With regards to the data analysis, there is always the question of which method to choose when measuring the supply and demand with the available data, and how close this method comes to depict the real skills gap. One limitation is how the supply of ICT graduates is measured. The goal was initially to include the number of graduates from vocational ICT education in Mauritius in 2020 and 2021 when relating the supply of graduates to the vacancies obtained from the labour market surveys. However, it was not possible to obtain data on the number of vocational ICT graduates in Mauritius. On the other hand, the vast majority of people employed by ICT companies in Mauritius are university degree holders according to the HRDC (2017). Therefore, this limitation might not have major implications for our measure of supply.

5. Results

In this part of the study, the results from the data analysis and the interviews will be presented. In the first section, the current skills gap in the ICT-sector in Mauritius will be depicted by relating the supply of skilled labour from the higher education system to the demand of skilled labour from the ICT-industry. Other important concepts including employment, enrolment, value added and real monthly earnings in the ICT-sector will be presented to depict the current skills gap. In the second part, the results from the interviews will be presented. Central issues from the interviews include hard to fill vacancies, fields with skill shortages, challenges in closing the skills gap and the role of the higher education system.

5.1 The skills gap in the ICT-sector

In the following section, the current skills gap in the ICT-sector in Mauritius will be depicted by relating the supply of skilled labour from the higher education system to the demand of skilled labour from the ICT-industry. This will be done for the years 2020 and 2021 by relating the number of graduates from the three largest public universities in Mauritius to vacancies in the ICT-sector obtained from labour market surveys. Furthermore, several graphs and tables is made to depict the skills gap in the ICT-sector. It is essential to examine enrolment, employment, value added and monthly earnings in the sector to illustrate the current skills gap in Mauritius.

5.1.1 Employment, establishments and value added

Table 1

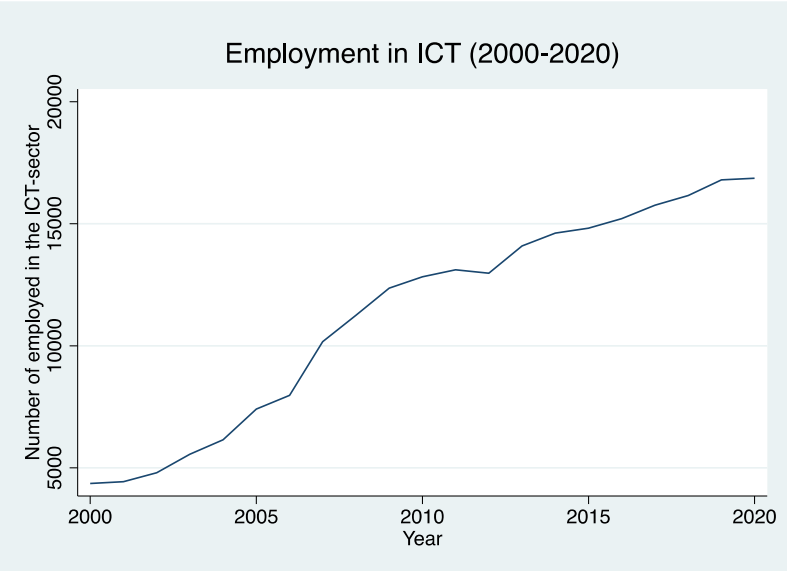
Employment, establishments and value added in the ICT-sector, (2000-2020)						
Year	**2000**	**2004**	**2008**	**2012**	**2016**	**2020**
Employment (number)	4360	6150	11250	12972	15211	16865
Male	2750	3740	5970	7068	7985	8780
Female	1610	2410	5280	5904	7226	8085
Employment in the ICT sector as a % of total employment	1.5%	2.1%	3.7%	4.3%	4.9%	5.2%
Number of establishments*	52	88	129	136	122	121
Value added in the ICT sector (Rs Million)	4490	7565	12994	19226	21970	26432
Value added in the ICT sector as a % of GDP	4.3%	5.0%	5.3%	6.4%	5.7%**	7.0%**
Growth rate in the ICT sector (%)	--	22.7%	13.2%	9.1%	5.4%	4.9%

** Establishments that is employing 10 or more persons*

*** For 2016 & 2020, gross value added at current basic prices as a % of GVA*

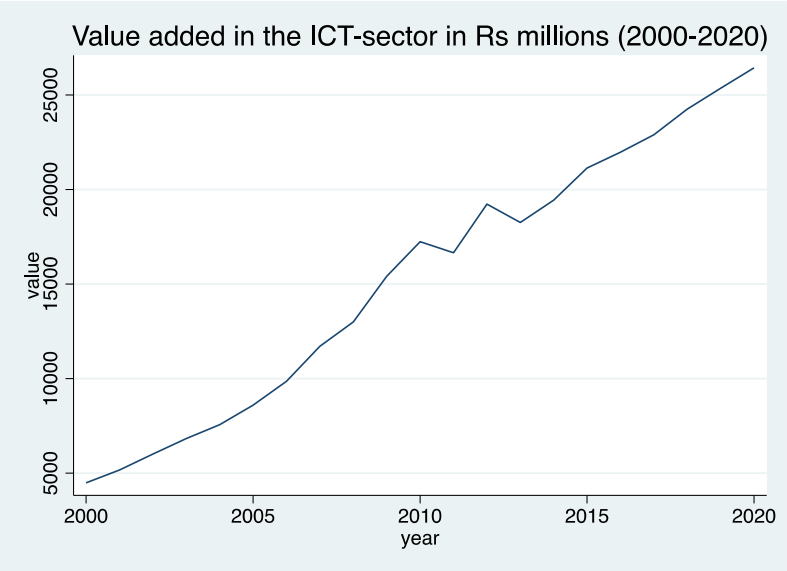
Source: Statistics Mauritius

Figure 1



Source: Statistics Mauritius

Figure 2

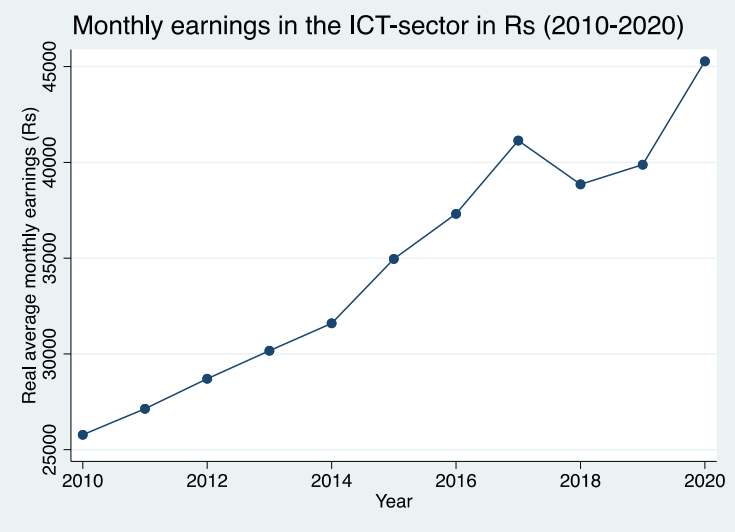


Source: Statistics Mauritius

Table 1 shows that there has been a noticeable change in the number of people employed in the ICT-sector during the last 20 years, from 4,360 people employed in 2000 to 16,865 people employed in 2020. This is an increase of approximately 287%, which is illustrated in Figure 1. The employment in ICT has increased for both males and females. The employment in the sector as a percentage of total employment has increased significantly from 1.5% in 2000 to 5.2% in 2020. The number of establishments employing 10 or more persons in the ICT-sector has increased over the years in Mauritius, from 52 establishments in 2000 to 121 establishments in 2020. The number of establishments was at its highest in 2012 with 136 establishments. Value added in the ICT-sector in Mauritian rupees (Rs) has also increased considerably from 2000 to 2020, which is illustrated in Figure 2. The growth rate in the ICT-sector was 22.7% in 2004 and has thereafter decreased to 4.9% in 2020.

5.1.2 Monthly earnings

Figure 3



Source: Statistics Mauritius

The development of real average monthly earnings in the ICT-sector over the time period 2010 to 2020 is shown in Figure 3. The real average wage in the sector has increased drastically over the last decade. In 2010 the average monthly earnings in the sector were 25,776 Mauritian rupees, while in 2020 it was considerably higher at 45,279 Mauritian rupees. This increase is displayed graphically in Figure 3 above.

5.1.3 Enrolment pattern

Table 2

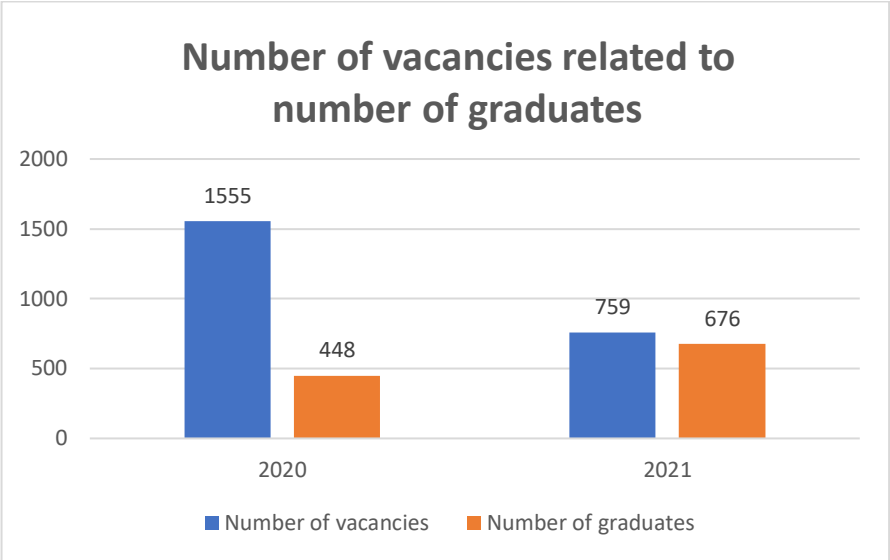
Enrolment in Tertiary education in the ICT-field (2008-2020)							
Year	**2008**	**2010**	**2012**	**2014**	**2016**	**2018**	**2020**
Number of students enrolled in ICT	3 448	3 694	3 520	4 051	3 866	3 438	4 022
Percentage of total enrolment	8.9%	8.3%	7.1%	8.0%	8.0%	7.3%	8.3%

Source: Statistics Mauritius

The enrolment pattern in higher education in the ICT-field reveals that there has not been a noticeable change of percentual enrolment. However, there has been a slight increase in the number of students enrolled. The number of students enrolled in ICT at tertiary level has increased marginally since 2008, from 3,448 in 2008 to 4,022 in 2020.

5.1.4 Vacancies related to graduates

Figure 4



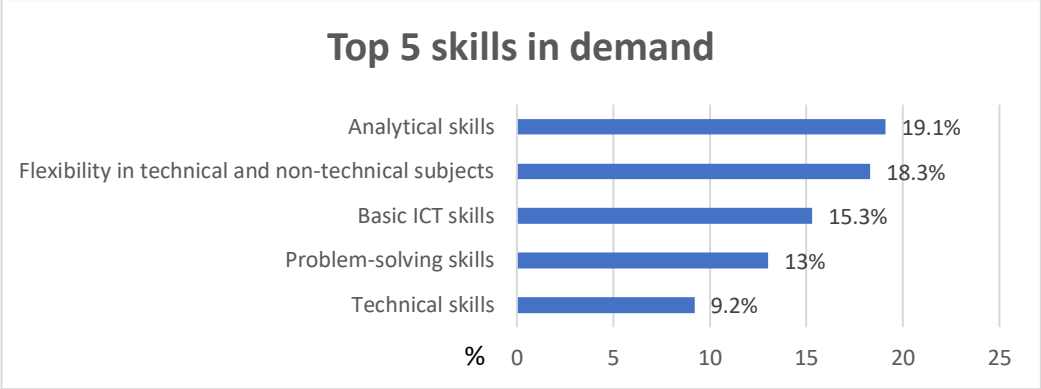
Source: Ministry of Labour, University of Mauritius[1], University of Technology[2], Université des Mascareignes[3]

To examine the current skills gap in the Mauritian ICT-sector, the number of graduates from the three largest public universities in Mauritius is related to vacancies in the sector. The vacancies are obtained from the two most current labour market surveys from 2020 and 2021. Relating the supply of graduates to vacancies in the sector is one way to quantitatively depict the current skills gap in Mauritius. The result shows that there is a discrepancy between the demand from the sector and the supply of skilled graduates. In 2020, 1555 vacancies were reported from 46 employers while only 448 students graduated from ICT-education at the major universities. During 2021, 31 employers reported 759 vacancies while the number of graduates were 676 in the same year. Taking into account that the surveys capture vacancies within a timeframe of 4 months, from 46 and 31 employers respectively, the result shows that the number of graduates are still less than the vacancies during this period. This indicates that there is a skills gap in quantitative terms, since the number of vacancies exceeds the supply of graduates in ICT.

[1] Kavi Kumar Khedo. University of Mauritius, 31st May 2022.
[2] Reshma Dabeedin , University of Technology, 23th May 2022.
[3] Farzana Antoaroo, Université des Mascareignes, 24th May 2022.

5.1.5 Skills in demand

Figure 5



Source: HRDC (2017)

There is also evidence of a skills gap between graduates' level of skills and the skills requirements from the ICT-sector. According to survey data from HRDC (2017), 67.1% of ICT enterprises find that university graduates are poorly prepared when they join the workforce. The top five skills in demand by ICT companies are listed in Figure 5. The skills that are most in demand are analytical skills, flexibility, basic ICT skills, problem-solving and technical skills. A majority of employers from the survey found these skills to be lacking in job applicants.

5.2 Interview results

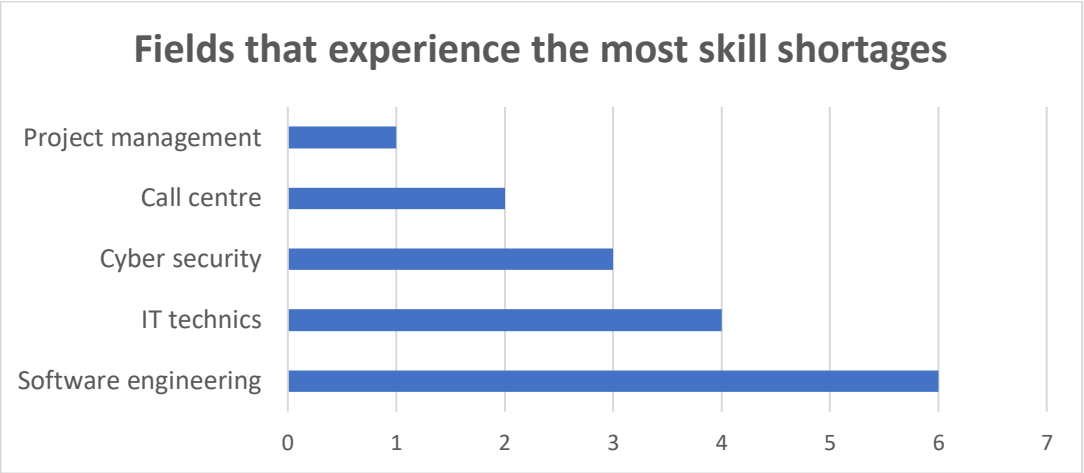
The following section outlines the results of the 10 interviews. Interviews were held with representatives from large ICT companies, universities and governmental institutions in Mauritius. An overview of the interview questions is presented in Appendix A. The most central issues discussed during the interviews have been used to summarise the perceptions of the respondents. Mauritius success in ICT, the fields with skill shortages, hard to fill vacancies, the role of the higher education system and the challenges in closing the skills gap will be addressed in the following section.

5.2.1 Mauritius success in ICT

The factors contributing to Mauritius success in ICT was discussed during the interviews. The fact that Mauritius is a bilingual country where most people speak French and English fluently was emphasised as one of the factors that makes the country successful in ICT. Attractive language skills have made Mauritius an attractive cost competitive destination for outsourcing. For example, many French companies use Mauritius as an outsourcing destination for their projects. In addition to language advantages, the time difference with Europe being only two or three hours was also accentuated as a contributing factor. Furthermore, Mauritius is a eurocentral country since it has had over 400 years of history with European presence in different sorts, which according to several interviewees makes it natural for European companies to set up their businesses in Mauritius.

5.2.3 Fields with skill shortages

Figure 6



In seven of the interviews, with exclusion of the three universities, the fields that experience the most skill shortages were discussed and there were several main areas that were identified. Six of the interviewees emphasised software engineering as one of the fields in the ICT-sector that experience the most skill shortages. It was expressed that the demand for software engineers has increased rapidly and will continue to do so in the near future. One of the interviewees mentioned that their company need to double the number of software engineers at the company, from 150 to 300, within the next couple of years. One issue that was brought to attention with regards to software engineering, is that software engineers are also needed in many areas outside the ICT-sector. There is a scarcity of software engineers across several industries including manufacturing, healthcare, retailing and management. The ministries interviewed expressed that the governmental sector is also looking for workers with skills in software engineering to enhance the automation process within the government.

Another field that experiences skill shortages is IT-technics. A majority of the interviewees accentuated that there is a need for more highly skilled IT specialists in the sector. One main concern is that many IT profiles lack relevant skills in coding. Another key area of concern that was identified is cyber security, which has become increasingly important. It was mentioned that cyber security will continue to expand in the future.

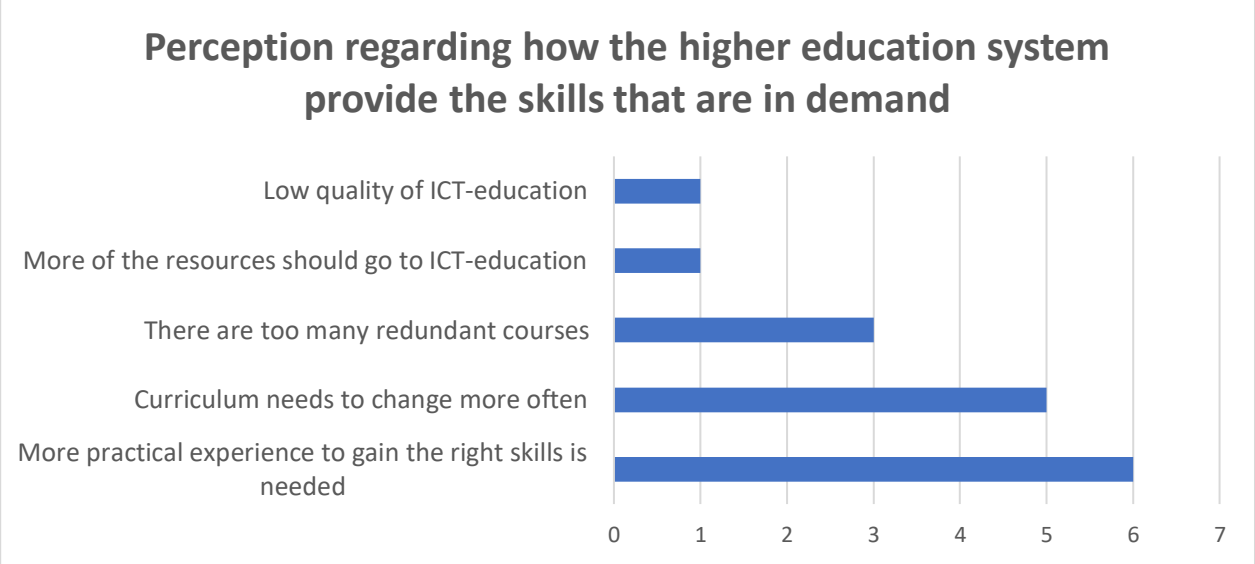
Two of the interviewees highlighted that there is also a scarcity of call centre agents. This is an area in which Mauritius have moved up the value chain and todays call centre agents are providing more high-end technical advisory, which has increased the need for call centre agents with technical skills. Many of the interviewees also emphasised that there is a move towards a multidisciplinary scarcity in general within the ICT-sector. There are many different types of requirements and it is of great importance to have the right education and degree. However, it was mentioned that graduates also need to have a large set of different skills, not only a range of technical skills, but also multidisciplinary soft skills such as leadership and teamwork skills.

5.2.4 Hard to fill vacancies

The interviewees from the three large ICT companies stated that their respective companies had large difficulties with filling vacancies within the ICT-field. The issue with finding skilled employees has become increasingly difficult over the last 10 years and all the companies stated that they have increased their recruitment from other countries. The companies expressed that the lack of skilled job candidates has resulted in tougher competition and if it will continue to be difficult to fill vacancies, more activity will have to move out from Mauritius to other countries in the future.

5.2.5 The role of the higher education system in providing the skills in demand

Figure 7

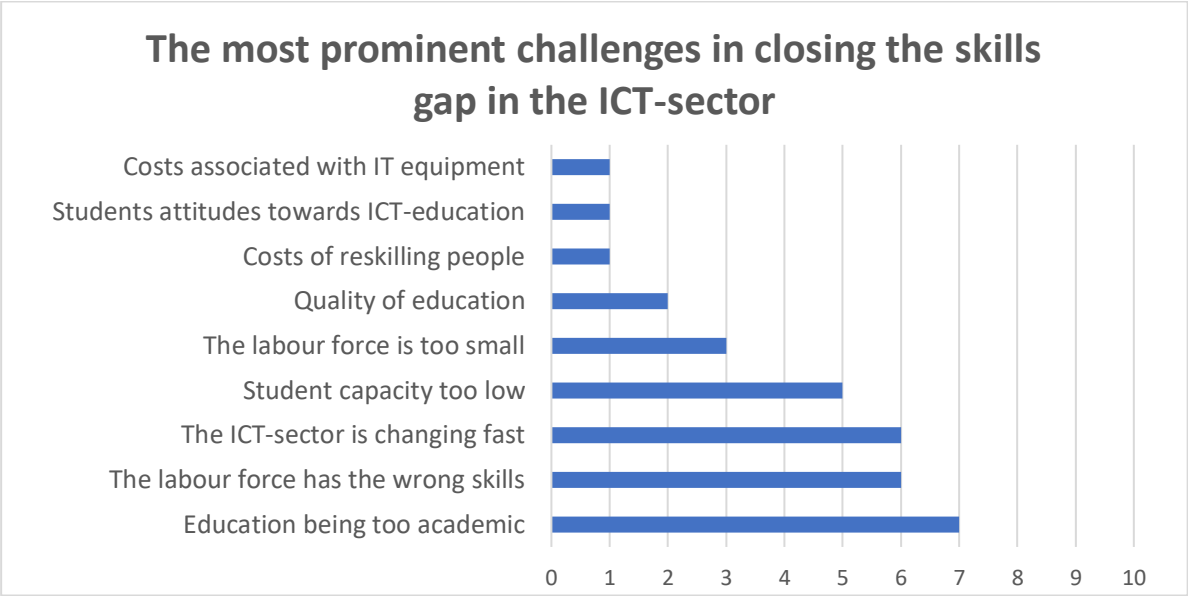


In terms of the higher education system, it was expressed that there is a gap between what skills the industry is demanding and what skills the education sector is producing. It was highlighted that the universities are working in collaboration with the industry to update their courses and programs in order to give students the right skills. The majority of the interviewees emphasised the need for more practical experience among graduates. The ICT-companies mentioned that they need to provide extensive training for newly hired graduates at the workplace. Internships was expressed as one way to help bridge the gap between education and industry by providing practical training based on industry needs.

Another issue emphasised in the interviews is that curriculums are not revised often enough. The companies expressed that they help gear the courses and programs at the public universities, but it is a problem that the curriculum is developed for a three-year period. One of the interviewees from a company stated that; *When the students start at year 1, they start with a curriculum, but when the three years have come to an end - everything has changed*. Furthermore, several interviewees mentioned that there is a need to reduce the number of redundant courses in other fields at the universities. It was also mentioned that more resources in general needs to go to the ICT-field and that the current ICT-education is lacking in terms of quality.

5.2.6 Challenges in closing the skills gap

Figure 8



Several challenges were emphasised with regards to closing the skills gap. The challenge that was highlighted the most was that the ICT-education is too academic. The challenge of the education being too academic is related to the issue of the labour force having the wrong skills. ICT-education being too academic was mentioned by all of the companies and organisations interviewed except one, while only one of the universities mentioned it as a challenge. The quality of education is another obstacle and the companies mentioned that they have noticed a drop in the quality of education over the last years and they are therefore unable to employ some of the graduates. It was expressed that there is a need for more work-experienced teachers to improve the education provided at the universities. Costs associated with IT equipment such as licenses for specific software was identified as another area of concern by one of the universities.

The ICT-sector is highly dynamic and changing rapidly which is highlighted as another challenge where the universities need to review and develop their curriculums more often according to the demand of the industry. The fast-changing pace of the ICT-sector was accentuated as a challenge by the companies, organisations and universities. Several interviewees expressed that when students start a 3-year program, their skills and knowledge are no longer valid after they graduate and join the workforce. The costs of reskilling people after they graduate is therefore another obstacle that was accentuated during the interviews. Another main challenge that was mentioned is that Mauritius is a small island with approximately 1.3 million inhabitants, meaning that the labour force is naturally limited in size. Mauritius also has a declining population trend which was stated as a large obstacle when it comes to their resources in human capital.

6. Analysis & Discussion

The aim of this study is to investigate the main challenges in closing the skills gap in the Mauritian ICT-sector, and to depict the skills gap quantitatively. In the following section, the findings are put in relation to the theoretical framework and previous research in the area. The discussion starts with an analysis of the depiction of the skills gap quantitatively and the development of the ICT-sector. It is followed by a discussion of the interview findings. In particular, the connection between the higher education system and the demand for skilled labour in the ICT-sector is discussed.

6.1 The skills gap in the ICT-sector

The results from the quantitative analysis imply that there is a gap between the supply and demand of skilled labour. This is illustrated in Figure 4, where the demand in terms of vacancies exceeds the number of graduates, both in 2020 and 2021. Restuccia et al. (2018) use a similar approach to map the skills gap in the American labour market, where the authors find that sectors that require high skilled workers more often suffer a shortage of labour. Since the ICT-sector is one of the most knowledge-intensive industries of the Mauritian economy, it is not surprising that the ICT-sector experiences a shortage of skilled labour. In a study by Haskel & Martin (2001), it is found that technological progress tends to increase the demand for skilled labour. The rapid development of the ICT-sector and the increasing wages for skilled workers in Mauritius indicate that the development has been skill-biased, which sequentially has increased the demand for a skilled labour force. According to Haskel & Martin (1993), the UK suffered from a similar problem with a skills gap such as Mauritius in the late 20th century. The productivity levels in the UK could not match the productivity levels in different parts of Europe, therefore the labour force in the UK required an upskilling. In order for the Mauritian labour supply to meet the demand of skilled labour, an upskilling of the labour force could be necessary.

The development of the ICT-sector in Mauritius has been positive in several ways. Since 2000, the value added in the sector has increased both in nominal terms and measured as a percentage, which is illustrated in Table 1. These results imply that the ICT-sector has grown to be a more substantial part of the Mauritian economy. The earnings in the sector have also increased substantially over the last decade, which could be a consequence of the skills gap. According to economic theory, earnings of the labour force will increase when there is a scarce supply of labour. When the demand exceeds supply, companies must increase their wages in order to be competitive against other employers. Therefore, the increasingly high wages in Mauritius indicate that there is a scarce supply of labour in the ICT-sector.

However, even if the earnings in the ICT-sector have increased, it does not seem like the number of people attending ICT-education have increased at the same pace. The enrolment pattern in ICT-education, which is displayed in Table 2, shows that there has been a slight increase in nominal terms, but not measured as percentage. Since the ICT-sector has become a more

substantial part of the Mauritian economy, it might be concerning that the enrolment has not increased more than it has. One reason to explain why there has not been a larger increase in students enrolling in ICT can be that universities have not increased their capacity as much as needed. Haskel & Martin (2001) emphasise that a solution to a skills gap would be to increase the supply of skilled labour to meet the higher demand, which for Mauritius could be done by increasing the capacity of tertiary education in ICT.

6.2 Fields with skill shortages

One important finding from the interviews is the identification of fields that experience the most skill shortages. Software engineering, IT-technics, cyber security, call centres and project management were the areas identified. Representatives from the large IT companies stated that they had difficulties filling job vacancies within these fields. The results are similar to the findings of HRDCs (2012, 2017) studies, who also found that ICT companies in Mauritius had large difficulties filling vacancies. Since finding skilled employees has become more difficult, the companies interviewed have increased their recruitment from abroad. The lack of skilled job candidates has also resulted in tougher competition for employers in Mauritius. According to the findings, more activity in the sector might have to move out of Mauritius if the difficulties with filling vacancies remain.

6.3 Main challenges in closing the skills gap

The main findings from the in-depth interviews are the identification of the main challenges in closing the skills gap in the Mauritian ICT-sector. The findings suggest that the skills gap exists both in quantitative and in qualitative terms. In qualitative terms, challenges related to the higher education system were highlighted as the most prominent. Most respondents emphasised the ICT-education being too academic as a major concern. It was expressed that the university courses in ICT needs to be more practice oriented and more in line with the skills that are demanded from the industry. Roopchund & Ramlowat (2019) also found that the higher education system in Mauritius is too academic, leading to employability issues of graduates.

According to human capital theory, education is one way for workers to acquire skills. The education provided at the universities plays a crucial role in this by providing the supply of ICT graduates. The findings from the interviews show that there seems to be a gap between what skills the industry is demanding and what skills the education sector is producing. The results imply that the labour force tends to lack certain skills, which puts a constraint on the development of the ICT-sector at large in Mauritius. Suhaimi et al. (2012) came to a similar result and found that even though universities in Malaysia are producing a fair amount of ICT graduates per year, many graduates are lacking the skills that are desired by the ICT industry. In another study by Morsy & Mokasa (2020), it was found that underskilling and undereducation is more prevalent in Africa compared to other developed countries, which could contribute to the explanation of why Mauritius suffers from a skills gap. The ICT-companies interviewed in this study mentioned that they need to provide extensive training for newly hired

graduates at the workplace since they often lack the right skills. A possible solution would be to increase collaborations between universities and industry. Evolving courses and programs to be more aligned with industry needs is also necessary for the labour force to get the relevant skills required.

The ICT-sector changing rapidly was another main challenge identified from the interviews. The theory of skill-biased technological change can be used to understand the implications of the rapid development in the Mauritian ICT-sector. As mentioned in the theory section, skill-biased technological change refers to a situation where the production technology favours skilled labour over unskilled (Violante, 2008). This is the case in the ICT-sector, where high-skilled labour is required. Findings from the study by Haskel and Martin (2001) suggests that higher levels of skill shortages will occur because of skill-biased technological change. Parallels can be drawn to the development in Mauritius, where the high levels of skill shortages can be understood as a result of technological change in the ICT-sector. Since the technical needs of the ICT industry changes rapidly, more agility in changing existing courses and curriculums is required to be aligned with industry needs.

Not only is there an issue in qualitative terms related to the skills the labour force possesses, the Mauritian labour force is also limited in quantitative terms. The fact that the Mauritian workforce is naturally limited in size, being a small island nation populated by approximately 1.3 million people, was emphasised as another main challenge in closing the skills gap. The capacity of universities offering ICT-education needs to increase to meet the demand, but since the student population is limited, it can be difficult to get a sufficient number of people encouraged to enrol in ICT-education. However, one way to increase the capacity that was mentioned during the interviews is to reduce the number of redundant courses in other fields at the universities. This can liberate resources which can go to increase the student capacity in ICT-fields. Rearranging the faculties can therefore be one way to increase the number of ICT students.

Another important aspect when examining the results is to be critical to whom the results come from. In particular, the responses from the universities to explain which challenges that are the most prominent differ. The challenge of education being too academic was mentioned by several companies and organisations, whilst only one of the universities mentioned this as a challenge. When reviewing the skills that are in demand, there exists a trade-off between the demand of a flexibility of skills and the need for specific skills. It can be difficult to achieve both properties from an employee at the same time. Different companies demand different skills, therefore it might be non-achievable to be producing perfectly trained graduates to employ right after graduation. The flexibility of skills might originate from a longer academic education, whilst specific skills often come from short courses. Therefore, it can be hard to achieve both the flexibility and the possession of specific skills immediately after graduation.

7. Conclusion

The aim of this study was to depict the skills gap in the Mauritian ICT-sector and to identify the main challenges in closing it. In order to answer these questions, we conducted a Minor Field Study (MFS) in Mauritius where semi-structured interviews were held with relevant individuals in the ICT-sector. This part of the research was complemented with data analysis that was used to depict the skills gap quantitatively.

The findings suggest that the skills gap exists both in quantitative and in qualitative terms. The results from the quantitative data analysis imply that there is a gap between the supply and demand of skilled labour. By relating the number of vacancies to the number of graduates, it was found that demand in terms of vacancies exceeds the supply of graduates, both in 2020 and 2021. Furthermore, the increasing wages and rapid development of the ICT-sector in Mauritius indicate that the development has been skill-biased, which offers an explanation to the increased demand for skilled labour in the sector. However, it is concerning that enrolment in ICT-education has not increased at the same pace as the sector at large. The higher education system plays a large role in this, and one way to help bridge the skills gap could be to increase the student capacity at the universities.

Through the interviews, the main challenges in closing the skills gap were identified. One conclusion is that the ICT-education is too theoretical, contributing to a more qualitative gap between the skills that the industry is demanding and the skills that the education sector is producing. The results suggest that the university courses in ICT needs to be more practice oriented and more in line with the skills that are demanded from the industry. Another main challenge is the fact that the ICT-sector is changing rapidly. Since the technical skills that are required in the ICT-sector changes continuously, this puts pressure on the universities to constantly develop the education provided. Increasing collaborations between universities and industry, and more agility in changing existing courses and curriculums are possible solutions to help bridge the gap between universities and industry. Finally, it is concluded that another challenge is the fact that the Mauritian labour force is limited in size. To meet demand the capacity of universities would need to increase, but it might be a challenge to get enough people enrolled in ICT-education as a result of the limited population.

This paper gives a deeper understanding of the skills gap in the ICT-sector and the connection between the labour market and the higher education system in Mauritius. The objective of the study was to contribute with knowledge on the concept of skills gaps by providing an in-depth analysis of this issue in Mauritius. As mentioned, the literature on the skills gap is limited in Mauritius. The most exhaustive studies by the HRDC (2012, 2017), have a major focus on the employer side of the ICT-sector. To contribute to existing literature, this paper has instead emphasised the connection between the higher education system and the labour market. After having performed this field study, we find that an interesting subject for further research would be to also examine the perceptions of ICT graduates in Mauritius. Measuring the extent of the mismatch through a survey of ICT graduates' skills and the skills in demand by the industry could provide meaningful insights to the field.

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9. Statistical data

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10. Appendix A

An overview of the questions that were discussed in all of the interviews. Beyond these questions, all respondents were asked background questions regarding their position at the organisation, institution or company.

- *How would you describe the development of the ICT-sector in Mauritius over time?*
- *Has there been a noticeable change over time, over the period you have worked in the sector?*
- *What is your perception regarding how the higher education systems provide the necessary skills that are in demand?*
- *What would you say are the most prominent challenges in closing the skills gap in the ICT-sector?*

Additional questions that were discussed with the universities.

- *How has the development of the ICT-sector in Mauritius affected the education provided at the university/institution?*
- *Have you noticed a change in the popularity of ICT education?*
- *If so: How have you noticed this change?*

Additional questions that were discussed with the ICT companies.

- *Would you say that your company has a problem to fill vacancies?*
- *In what fields do you experience the most skill shortages in the ICT-sector?*
- *Do you experience skill shortages in any specific type of jobs?*
- *Do you think there will be an increase of number of employees in your organization in the next few years?*