RDB RWANDA DEVELOPMENT BOARD

ICT SKILLS SNAPSHOT

April 2022

SKILLS RWANDA

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1. Overview of the Sector

The Government of Rwanda considers the ICT sector among the emerging sectors that are key economic drivers with the potential to contribute significantly to job creation and productive employment (NST1). Rwanda has put much effort into putting ICT infrastructure across the country, technologies, and ensuring a growing qualified workforce to position Rwanda as an ICT hub by 2024.

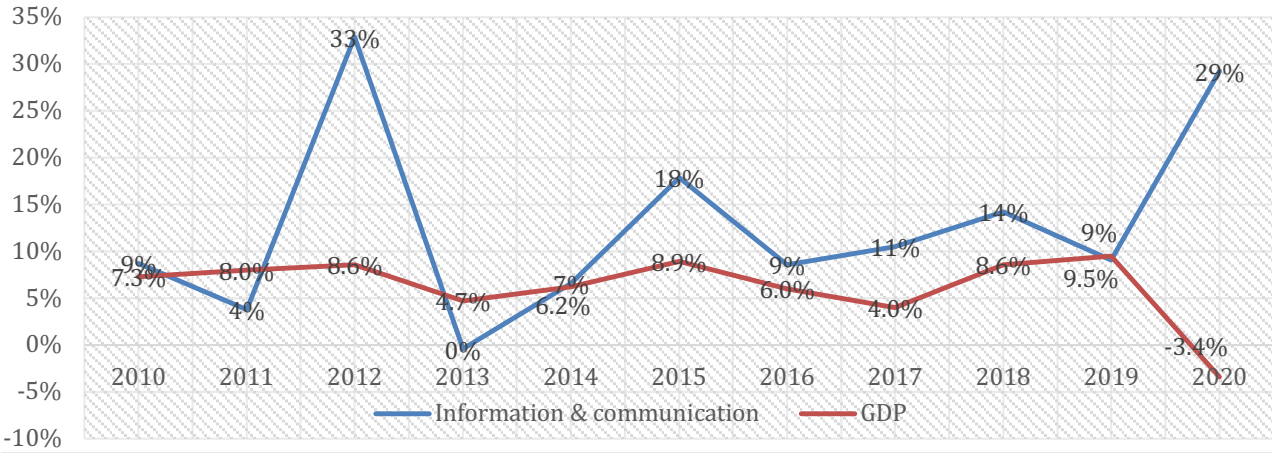
ICT is among the key sectors changing due to technological advancements. These changes impact the demand for skills in the sector, with some becoming obsolete while others grow rapidly. This snapshot contains an analysis of trends in ICT skills and employment. It can assist those who need to manage the rapid changes associated with the supply and demand of ICT skills.

As of 2020, the ICT sector contributed 2% of GDP and employed around 8,962 workers (0.26% of employment). The country has an ambitious goal of increasing ICT's contribution to GDP to approximately 5% by 2024. The ICT Gross Value Addition (GVA) for Rwanda's economy grew at an average of 21.1% annually over the period 2000 to 2015, a much faster pace than other major sectors in the economy. Within the ICT sector, telecommunications remain the largest contributor (75%), but since 2006, the growth rate of ICT services has been faster than telecommunications. Looking ahead, in less than 5 years, the ICT sector is expected to contribute to 7% of Rwanda's exports, as compared to 0% in 2018.

2. Sectoral performance

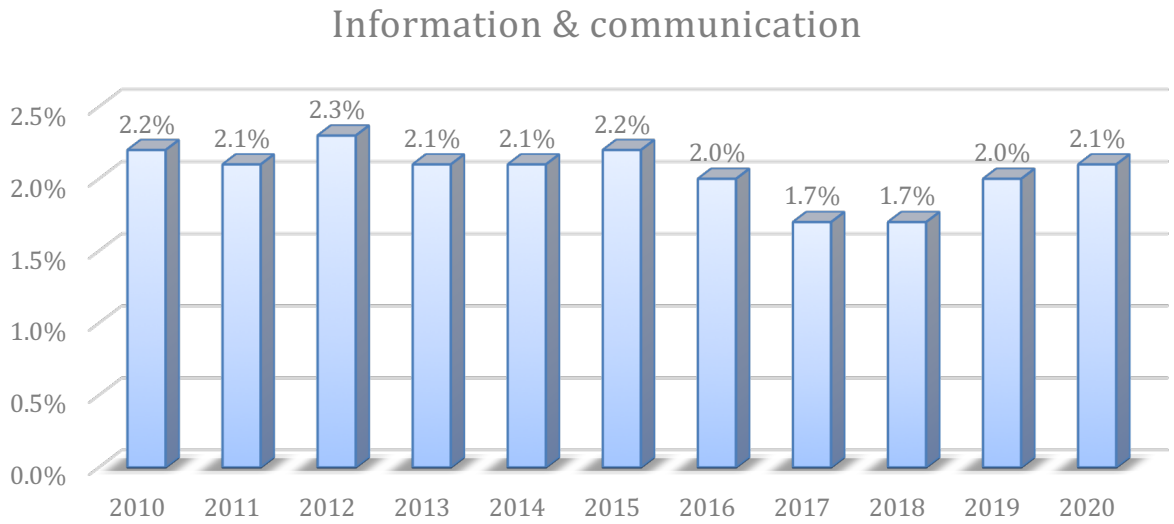
In 2020, the share of information and communication technology to GDP grew by 29 per cent, while overall, Rwanda's gross domestic product (GDP) contracted by 3.4 per cent in the year 2020. The statistics show that the ICT sector was one of the few sectors that registered a positive trend during the COVID-19 pandemic. However, these changes have not been reflected in a larger share of ICT to total GDP in 2020 since the contribution of ICT to GDP remains around 2%. For the future, the projections seem more favourable, as the FDI stock in ICT is the highest and ICT figures as the second sector in FDI flow in the latest measurement.

Figure 2.1: Growth and contribution of the ICT sector to Rwanda's GDP



Source: Gross Domestic Product, NISR, 2021

Figure 2.2 Share of ICT in total GDP (current prices)



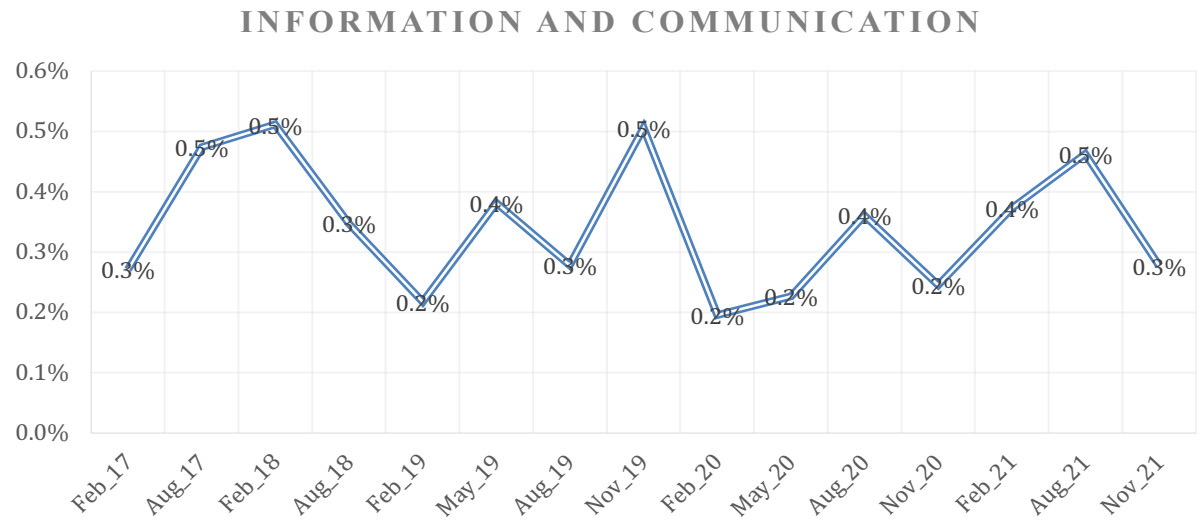
Source: Gross Domestic Product, NISR, 2021

3. Employment Dynamics

3.1. Share of ICT in total employment

The proportion of people employed in ICT has changed over the past four years. ICT workers account for 0.2 to 0.5 per cent of total employment. The share of ICT professionals remains relatively small. However, given the current and future growth prospects, the ICT sector still offers employment opportunities, especially for young graduates with market-relevant skills.

Figure 3.1 Share of ICT in total Employment

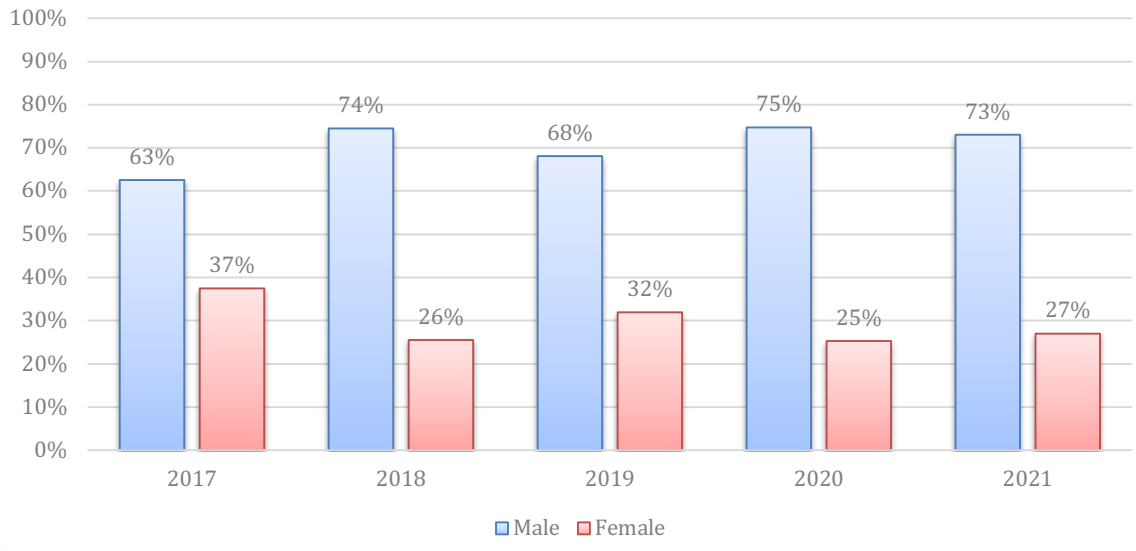


Source: Rounds of LFS 2017-2021, NISR

3.2. Employment by Gender

There is a gender disparity among people employed in the ICT sector. Males represent a large proportion compared to females. Despite the fluctuation over the last four years, the proportion of males employed in ICT has been consistently higher than that of females.

Figure 3.2 ICT Employment by Gender

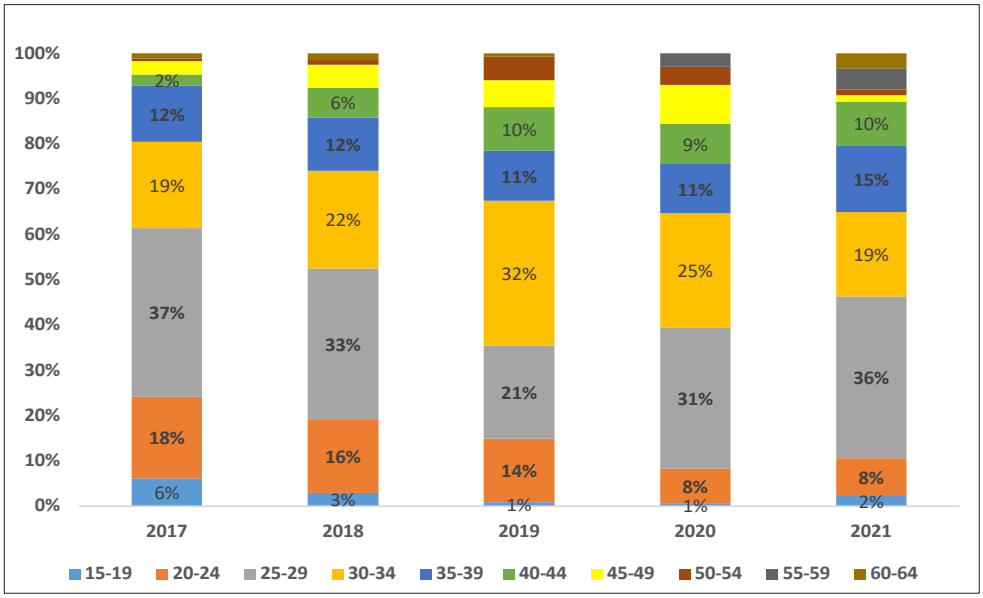


Source: Annual LFS 2017-2021, NISR

3.3. Employment by age group

Over the past four years, a large proportion of people employed in the ICT sector were young people. The data from the rounds of labour force surveys 2017–2021 has consistently shown that the largest proportion of ICT workers was aged between 15 and 29 years (youth) and between 30 and 39 years, respectively. As people age, the number of employed people in the ICT sector decreases.

Figure 3.3 Employment by age group

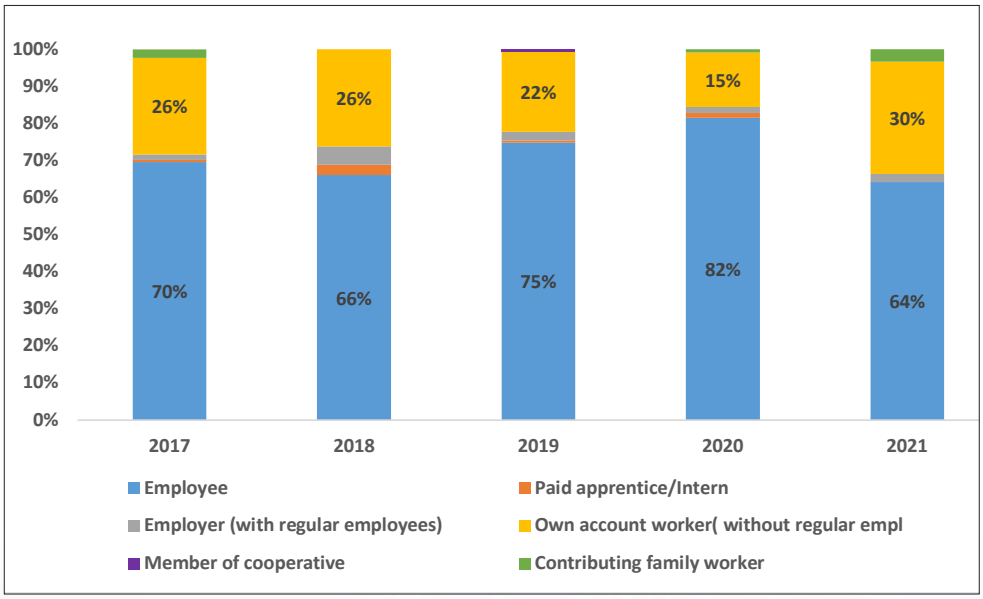


Source: Annual LFS 2017-2021, NISR

3.4. Status in employment

Figure 3.4 below represents the share of the employed people according to the status of employment. As the figure shows, employees account for a large share of people employed in the ICT sector, followed by their account workers. This possibly means that the share of vulnerable jobs is relatively small in the ICT sector.

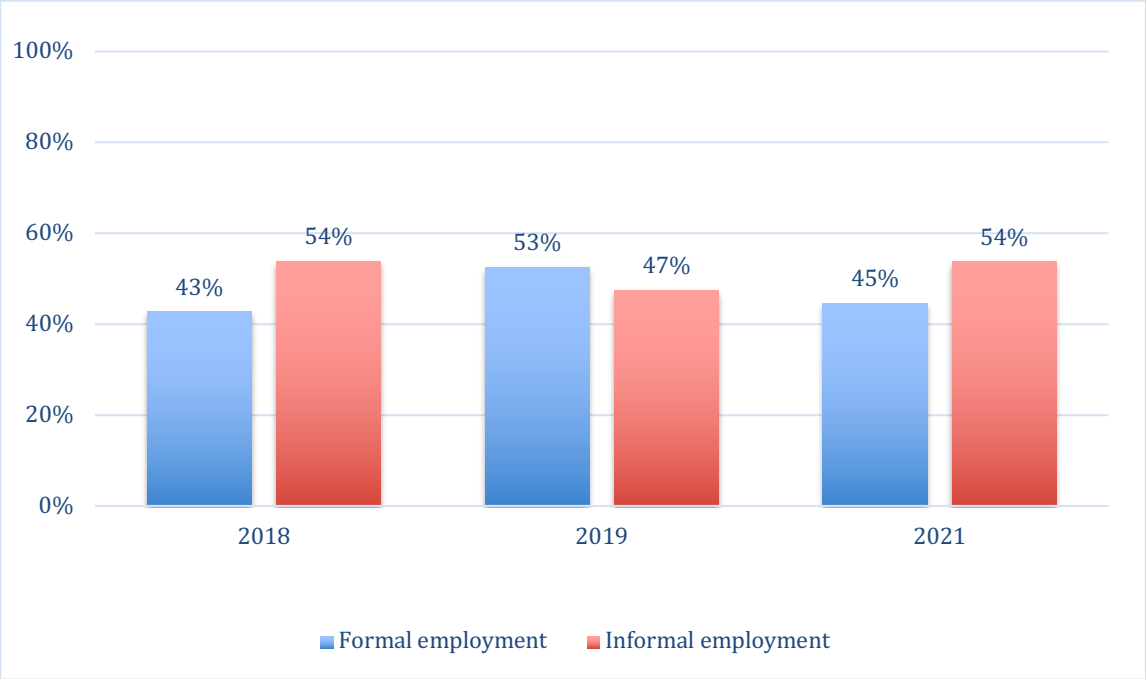
Figure 3.4 Status in employment



Source: Annual LFS 2017-2021, NISR

3.5 Nature of employment

Figure 3.5 below represents the natural employment of people employed in the ICT sector. Less than a half of the people employed in the ICT sector are formally employed. Put differently, more than half of the people employed in the ICT sector either do not have a formal contract or are not entitled to medical insurance and annual and incidental leave.



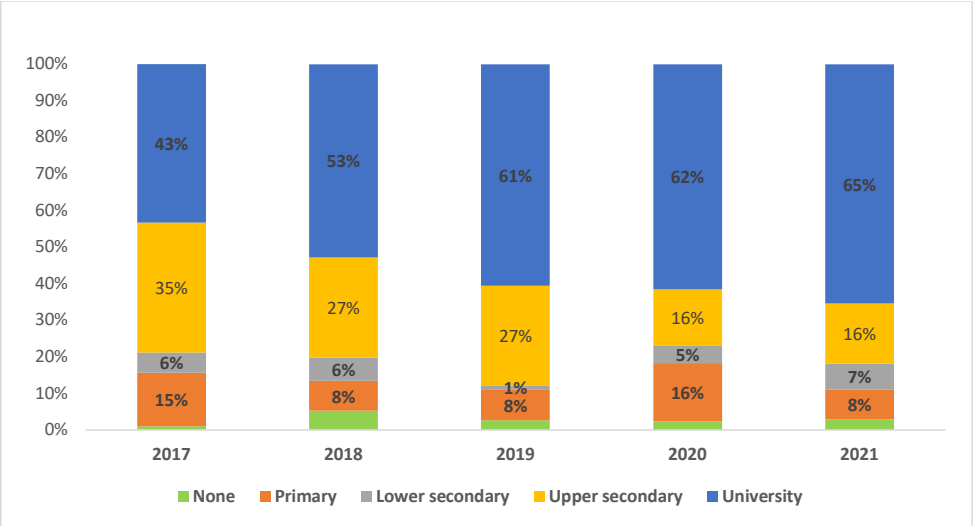
Source: Annual LFS 2017-2021, NISR

4. Skills in ICT Sector

4.1. Level of education

ICT is among the economic sectors that require middle-to-high-level skills. As shown in Figure 4.1, more than 80% of those employed in the ICT sector have at least a secondary level certificate. According to the RDB Talent Insight Report 2020, the majority of IT professionals have at least a bachelor's degree. Among this talent pool, there is an almost equal distribution between Master's and Bachelor's holders. The share of Master's degree holders is higher for new graduates. Only 3% hold a PhD.

Figure 4.1 Level of education

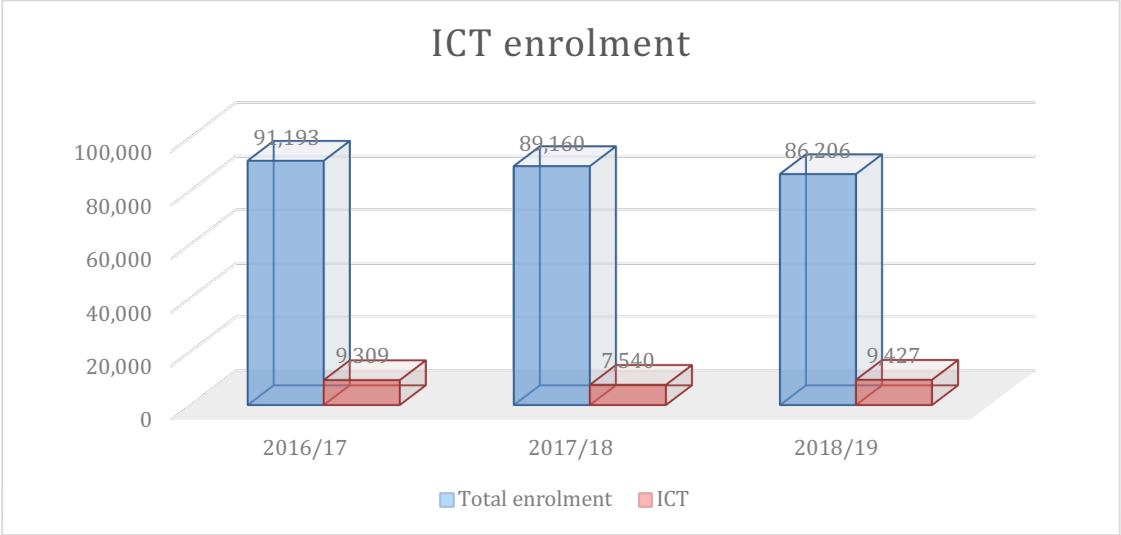


Source: Rounds of LFS 2017-2021, NISR

4.2 ICT enrolment

According to the education statistics in figure 4.2 below, the share of students enrolled in information and communication technology was equal to 10% of all students enrolled in private and public universities over three academic years (2016/17–2018/19).

Figure 4.2 ICT enrolment

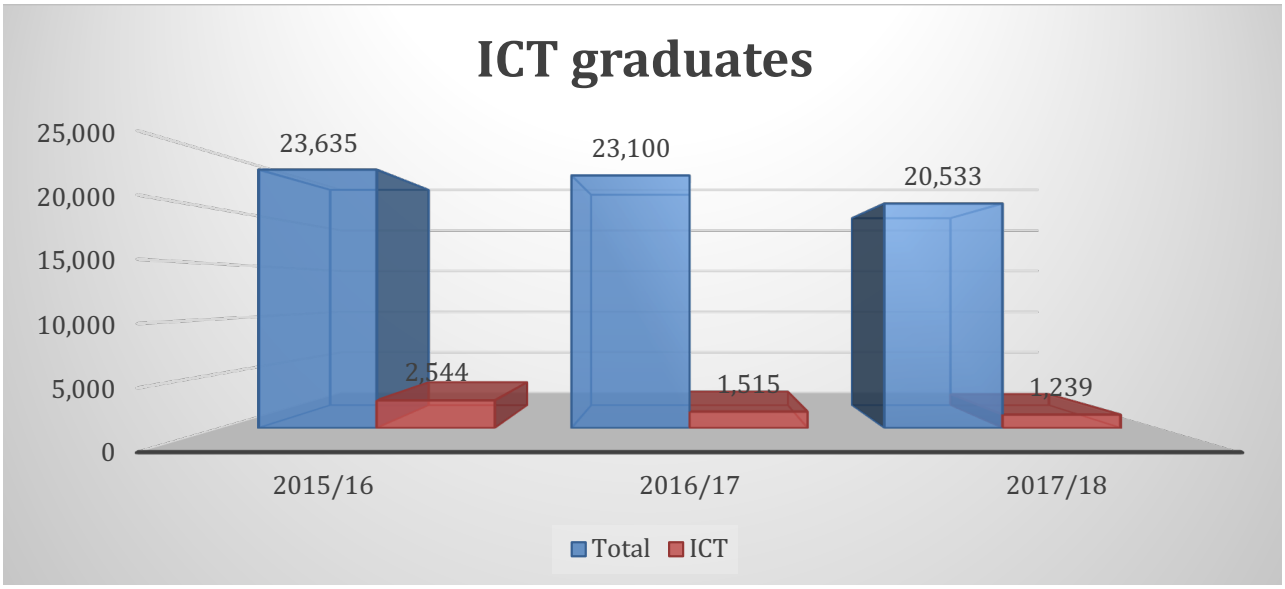


Source: Education statistics yearbook, 2019

4.3 ICT graduates

According to the education statistics in Figure 4.3 below, the number of graduates in ICT from both private and public universities in Rwanda was 2,544 in 2015/16, 1,515 in 2016/17, and 1,239 in 2017/2018. According to these figures, the proportion of ICT graduates in total graduates ranged between 6 and 10% from 2015/16 to 2017/18.

Figure 4.3 ICT graduates

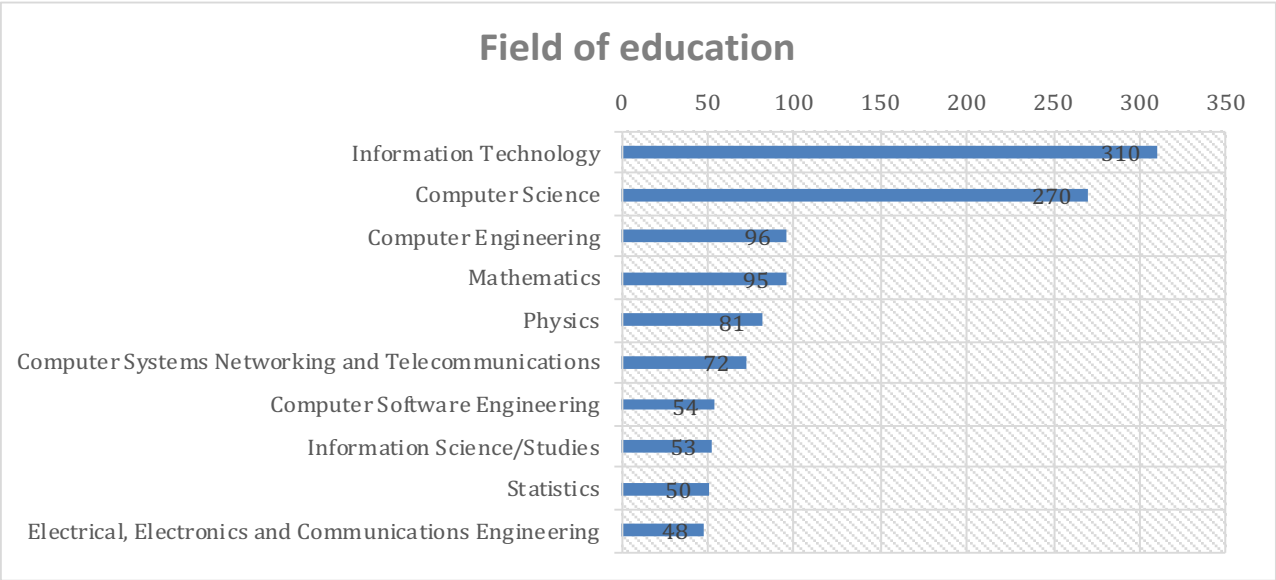


Source: Education statistics yearbook, 2019

4.4 Fields of education of ICT professionals

The majority of the IT professionals have an education background in IT (310), followed by Computer Science (270) and Computer Engineering (96). There is also a large number of graduates with STEM degrees. [1]

4.4 Fields of education of ICT professionals



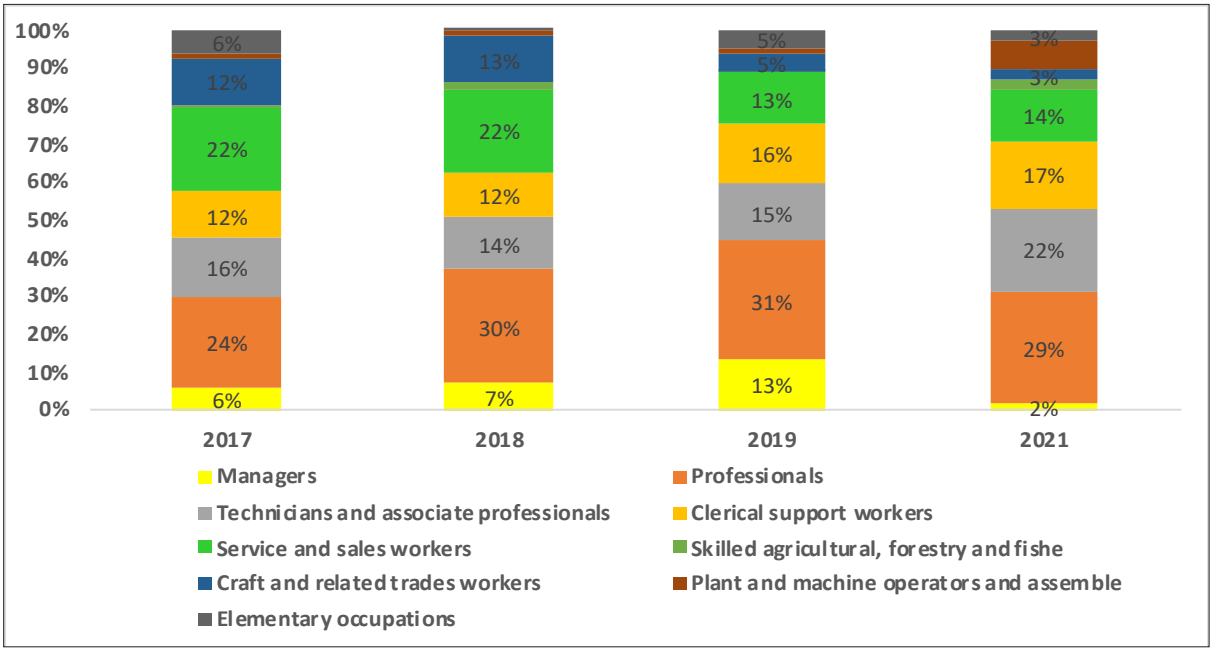
Source: RDB Talent insight report, 2020

1 This data only represents professionals with active LinkedIn accounts. This number does not, in reality represent the total education levels or fields of study.

4.5 Occupations and skills level in the ICT sector

The International Classification of Occupations (ISCO-08) links occupations with broad skills levels that are required to perform the activities involved in any occupation. Figure 4.5 below shows that the occupations in the ICT sector are dominated by professionals, technicians, and associate professionals, which are classified as high-level skills occupations as per ISCO-08. The proportion of elementary workers classified as low-skilled is relatively very small compared to other occupations.

Figure 4.5 Occupations in the ICT sector

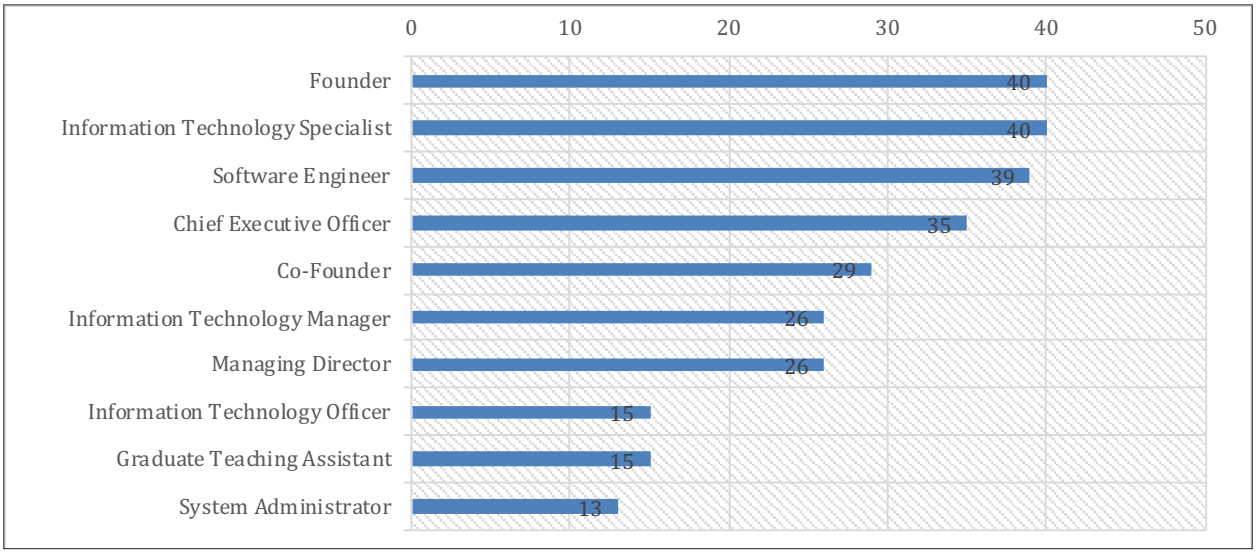


Source: Annual LFS 2017-2021, NISR

4.6 Common job titles in ICT related occupations

The most common job titles in the ICT talent pool are founder (40), information technology specialist (40), and software engineer (39). [2]

Figure 4.6 Common job titles in ICT related occupations



Source: RDB Talent insight report, 2020

2 This data only represents professionals with active LinkedIn accounts. This number does not, in reality represent the total education levels or fields of study.

4.7 Frequency of ICT professionals for different sets of skills

The most common skills among ICT professionals are Network security (459), Information technology (376) and Software development (279). In addition, the fastest-growing skills, added by this talent pool include data Analytics, data visualization and artificial intelligence. [3]

Figure 4.7 Frequency of ICT professionals for different sets of skills

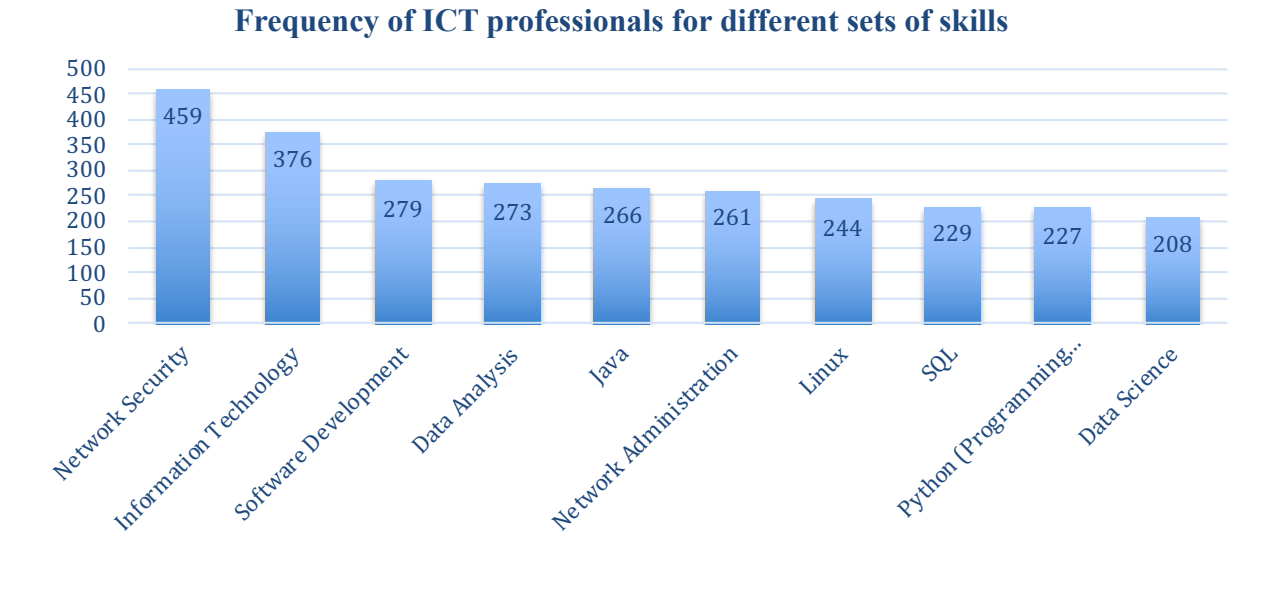


Table 4.1 Key Skills Identified by Subsector (ISIC)

ISIC Code	Subsector	Skills Required
620	Information technology service activities	Customer Service; Technical Support; Computer Hardware
631	Web portals, data processing, hosting and related activities	Web Application; HTML/ CSS / Javascript / PI/SQL; Data entry; Database
632	Other information service activities	Customer Service; Data Entry; Infrastructure; Computer Hardware
26	ICT Manufacturing Industries (Computer, electronic and optical products)	Product Development; Process Improvement; Test Procedures; Technical Support
582	Software publishing	Adobe Photoshop; Web Application
61	Telecommunications	Fibre Optic; Telephone Systems; PBX; VOIP

3 This data only represents professionals with active LinkedIn accounts. This number does not, in reality represent the total education levels or fields of study.

Table 4.2 Education and Experience Profile by Major Occupations in ICT Sector (ISCO)

ISCO Code	Name	Technical Skills	Education Profile	Experience
133	ICT Service managers	Service Delivery Project Management Itil	Graduate/Masters/ Advanced Course in Computer Science	Over 8 years
251	Software and multimedia developers and analysts	Web Application Pl/SQL Database	Diploma/Advanced Course in Software Engineering, Computer Science or related fields	2-5 years
252	Database specialists and systems administrators	Database Pl/SQL Data Warehouse Data Analysis	Diploma/Graduate/ Advanced Course in Data Science, Mathematics or related field	2-5 years
351	ICT operations and user support technicians	Use of desktop and laptop Customer Service	High School / TVET in Information and Communication	0-3 years
352	Communications technicians	Telephone Systems Customer Service	High School / TVET in Information and Communication	0-3 years

Table 4.3 Available public and private Degree/Diploma courses relevant to the ICT sector

Area	Degree/Diploma Courses (number of institutions that offer the courses)
Information Technology	• Bachelor of Science in Information Technology (5) • Bachelor of Business in Information Technology (3); • Bachelor of Education in Information Technology (1); • Diploma in Information Technology (1) • Master of Science in Information Technology (4)
Computer Science	• Bachelor of Science in Computer Science (5); • Bachelor of Education in Computer Science (2) • Master of Science in Electrical and Computer Engineering (1)
Information Management	Bachelor of Science in Information Management (1)
Information Security	Bachelor of Science in Information Security (1)
Information System and Management	• Bachelor of Science in Information System and Management (3) • Master of Science in Information System and Management (1)
Software Engineering	Bachelor of Science in Software Engineering (2)

5. Ongoing skills development in ICT

The following initiatives have been put in place by the Government of Rwanda to ensure the promotion of ICT and enhance innovative skills needed in the labour market:

i) Establishment of centres of excellence:

- Carnegie Mellon University- Africa, a world-class university was officially launched in 2012;
- African Institute of Mathematical sciences –Pan African Center of Excellence was established in 2016;
- Africa Centre of excellence for Data Sciences was established at the University of Rwanda in 2016;
- The Center of Excellence in the Internet of Things (IoT) was established at the University of Rwanda in 2016;
- An Information Access Center was launched in 2017 with the support of KOICA;
- Establishment of a Center of Excellence for Biomedical sciences and e-Health at the University of Rwanda;
- The establishment of an ITU Cyber security Centre of excellence is currently underway.

ii) Digital Ambassadors Program (DAP): The Digital Ambassadors Program (DAP) was initiated by the Ministry of ICT and Innovation (MINICT) to increase the number of digitally literate citizens and their use of e-Government and e-Business services.

In alignment with the Rwanda Digital Talent Policy, DAP is expected to mobilize young ambassadors to transform the lives of citizens through digital skills trainings and the adoption of e-Services, driving inclusion and growth. According to the NST1, DAP is expected to achieve the following targets by 2024:

- Mobilize 4900 digital ambassadors, and deploy them in all cells across the country.
- Train 5,000,000 (five million) citizens by 2024, and hence reach the 60% target of digital literacy for adults and youth to be trained as per the NST-1 target.

iii) Digital Literacy for Workforce (DLW): The Ministry of ICT developed a digital literacy for workforce project that aims at training government employees in digital literacy. By 2024 DAP is expected to achieve the following targets:

- 100,000 public servants to be trained and internationally certified in digital literacy
- Teachers to be trained in ICT Essentials for teachers
- Digital literacy trainings to be introduced in Higher Learning Institutions, High Schools and Primary Schools.

iv) Andela Project: In May 2020, The Government of Rwanda, represented by the Ministry of ICT and Rwanda Development Board, signed an agreement to train 100 Rwandans in software development and engineering over 12 months and this runs as a pilot project.

The Government of Rwanda will fund Andela Rwanda to complete the ongoing April-July 2020 trainings initiated under the previous implementation agreement.

v) Rwanda Coding Academy (RCA): Rwanda Coding Academy (RCA) is a special model school incepted by the Government of Rwanda. It is a hybrid of both general education and TVET that deals with Software Development, Embedded Systems Programming, and Cyber-Security.

vi) Attracting BPOs/ITO companies to invest in Rwanda (beneficial to graduates and Rwandans with IT skills, soft skills). In 2021, more than 8 BPO/ITO companies have been registered with a plan to employ 3600 Rwandans with a plan to attract more BPO/ITO Companies;

vii) Skills development training opportunities conducted including among others:

- ☑ Data analytics trainings and links to job opportunities offered by 10 Academy from Germany;
- ☑ HP online trainings to the private sector and public servants on entrepreneurship skills development;
- ☑ Training by Google Africa to upskilling developers and digital ambassadors, supporting SMBs to go online. Training will be provided through Kigali Innovation City;

viii) Kigali Innovation City (KIC) was launched to create a hi-tech ecosystem centered around innovation and talent.

Key areas of focus to ensure skills relevant to the labour market during the post-covid-19 period:

- ☑ Promote online learning: Promotion of e-learning platforms for both public and private sectors (Coursera, Udemy, Google, Education First etc.);
- ☑ Continue attracting centres of excellence and big education brands: Assess the areas that need skills and attract centres of excellence and big education brands;
- ☑ Ensure digital skills matching: operationalization of existing online matching tools like internship system, Kora job portal, LMIS, and LinkedIn project among others.

6. Employment trends and future occupation demand

To position Rwanda as an ICT Hub in Africa through a knowledge-based economy, the ICT sector is expected to double the number of people employed in the sector by 2024. The share of employed people in ICT will change from 0.5 per cent to 1%[4]. 100,000[5] jobs are expected to be created in the ICT sector. Other targets related to skills and employment are summarized in the table below:

Table 6.1 Employment trends and future occupation demand

Targets	21/22	22/23	23/24
ICT jobs as % of formal total employment	3%	4%	5%
Number of jobs created through BPO (business processing outsourcing)	15,500	16,000	17,000
Number of Elite IT professionals	9,000	10,500	12,000
% graduates with ICT professional certificates by the female gender	35%	40%	50%
ICT Labor productivity (Frw/hr)	5,100	5,300	5,500
Number of high skilled people in cyber-security	160	200	300

Source: ICT Sector Strategic Plan (2018-2024)

4 Revised National Employment Policy, 2019
5 ICT Sector Strategic Plan (2018-2024)

7. Forecasting the contribution of the ICT sector to job creation.

The expected contribution of the transport and logistics sector to job creation is estimated using multiple linear regression (MLR), also known as multiple regression. This is a statistical technique that predicts the outcome of a response variable using several explanatory variables.

Multiple linear regression attempts to model the linear relationship between explanatory (independent) and response (dependent) variables. Multiple regression is essentially an extension of ordinary least-squares (OLS) regression in that it involves more than one explanatory variable.

Linear regression equation

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \ldots + \beta_n X_n$$

β_0 Is the intercept, are coefficients, and Xs are predictor variables. The dependent variable used is the number of people employed in different economic sectors, while different predictors used in the model include dummy variables to capture the contribution of different economic sectors to job creation, and trend variables to capture the effect of time on job creation in various economic sectors

As the results of multiple regression in the table below show, all the economic activities are statistically significant and the R-squared is 0.974, which means that the variables used can explain 97 per cent of the variation.

The performance of all economic activities is compared to that of the transport sector, which was taken as a reference category. The contribution of the ICT sector is expected to be lower than that of the transport sector by 131966 jobs.

Other sectors that are expected to employ more people than the ICT sector include sectors such as agriculture, forest and fishing, wholesale and retail trade, repair of motor vehicles, motorcycles, construction and manufacturing. However, the evidence shows that the ICT sector offers opportunities for more secure jobs than other sectors. Moreover, the majority of occupations in the ICT sector require middle-to-high-level skills.

Another important factor that appears to have a major impact is time. It captures the effects of different periods or seasons on job creation.

Table 7.1 Forecasting the contribution of the ICT sector to job creation.

Employed	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Agriculture Forestry and fishing	1,175,582.10	16,384.38	71.75	0.00	1,143,352.90	1,207,811.30	***
Mining and quarrying	(87,388.16)	16,384.14	(5.33)	0.00	(119,616.93)	(55,159.40)	***
Manufacturing	40,726.97	16,383.94	2.49	0.01	8,498.61	72,955.34	**
Electricity, gas, steam and air conditioning supply	(135,264.52)	16,383.77	(8.26)	0.00	(167,492.56)	(103,036.48)	***

Table 7.1 Forecasting the contribution of the ICT sector to job creation continued

Employed	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Water supply, sewerage and waste management	(135,726.92)	16,383.64	(8.28)	0.00	(167,954.70)	(103,499.14)	***
Construction	195,340.25	16,383.55	11.92	0.00	163,112.65	227,567.86	***
Wholesale, retail trade, repair of motor vehicles, motorcycles	298,620.97	16,383.50	18.23	0.00	266,393.48	330,848.47	***
Accommodation and food service activities	(67,414.11)	16,383.50	(4.11)	0.00	(99,641.60)	(35,186.61)	***
Information and communication	(131,966.06)	16,383.55	(8.05)	0.00	(164,193.66)	(99,738.45)	***
Financial and insurance activities	(112,948.96)	16,383.64	(6.89)	0.00	(145,176.75)	(80,721.18)	***
Real estate activities	(140,069.81)	16,383.77	(8.55)	0.00	(172,297.85)	(107,841.77)	***
Professional, scientific and technical activities	(121,710.53)	16,383.94	(7.43)	0.00	(153,938.89)	(89,482.16)	***
Administrative and support service activities	(87,429.23)	16,384.14	(5.34)	0.00	(119,657.99)	(55,200.46)	***
Public administration and defence	(78,952.47)	16,384.38	(4.82)	0.00	(111,181.71)	(46,723.24)	***
Education	(35,257.09)	16,384.66	(2.15)	0.03	(67,486.87)	(3,027.31)	**
Human health and social work activities	(93,583.66)	16,384.97	(5.71)	0.00	(125,814.05)	(61,353.27)	***
Arts, entertainment and recreation	(135,201.49)	16,385.32	(8.25)	0.00	(167,432.57)	(102,970.40)	***
Other service activities	(66,721.91)	16,385.71	(4.07)	0.00	(98,953.76)	(34,490.07)	***
Activities of households as employers	36,102.72	16,386.13	2.20	0.03	3,870.04	68,335.39	**

Table 7.1 Forecasting the contribution of the ICT sector to job creation continued

Employed	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Activities of extraterritorial organizations and bodies	(133,056.57)	16,386.59	(8.12)	0.00	(165,290.15)	(100,822.99)	***
t	66.48	24.57	2.71	0.01	18.15	114.82	***
Constant	131,431.11	12,365.81	10.63	0.00	107,106.68	155,755.54	***

Mean dependent var	152,078.10	SD dependent var	287,620.33
R-squared	0.97	Number of obs	357.00
F-test	598.71	Prob > F	0.00
Akaike crit. (AIC)	8,727.10	Bayesian crit. (BIC)	8,812.41

*** p<.01, ** p<.05, * p<.1

8. RECOMMENDATIONS

To address the skills gaps in ICT and build a qualified workforce available for the ICT sector, the following recommendations are proposed:

- Upskill the workforce by anticipating the right ICT skills for the future and providing the training responding to the needs of the labour market. This can be done by increasing the enrolment of trainees pursuing ICT professional courses to make them more competitive in the global labour market.

- Increase the market relevance of ICT professionals through strengthening industry-academic -linkage for the effective implementation of specialized upskilling or reskilling programs in ICT. The operationalization of the ICT sector skills council will play an essential role to coordinate the exercise to address skills gaps in the ICT sector.

- Strengthen industry-academic linkage for the effective implementation of internships and apprenticeships in the ICT related training programmes.

- Conduct regular skills assessments to analyze labour market dynamics in the ICT sectors and identify the skills requirements to meet the changing demand in the sector.

- Ongoing ICT initiatives need to be monitored and evaluated to ensure they are yielding expected results.

SKILLS RWANDA

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