Analysis of Future Demand for Sri Lankan ICT Undergraduates in ICT Industry: Mapping the ACM/IEEE Computing Degrees with Emerging Technologies

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Abstract

Sri Lanka is famous for its agricultural economy, but in recent years it is slowly shifting towards a knowledge-based economy. In a knowledge-based economy, the Information and Communication Technology (ICT) industry plays a critical role in increasing productivity and economic growth. ICT includes communication technology, various multimedia applications, and services that enable users to access, retrieve, store, transmit and manipulate information in a digital form. This sector has generated numerous new job opportunities, led to increased export profits, and attracted international investors for investment. Present Sri Lankan ICT industry consists of over 600 companies. According to reports from the Sri Lanka Association for Software and Services Companies, the demand for the ICT sector has increased in recent years. The increase in demand for the ICT sector led to the creation of many ICT job opportunities and open new ICT degree-awarding training institutes in Sri Lanka. Government universities, private degree awarding institutes, government vocational and tertiary training institutes, and private diploma and certificate awarding training institutes are major categories of them that offer various degree programs in ICT disciplines. As per SLASSCOM, there are fourteen job categories in the present-day ICT industry. Because of this reason undergraduates are unable to choose the most suitable ICT degree program according to the job demand. This research provides the solution for the above problem. The main objective of this research is to analyse the future demand for Sri Lankan ICT undergraduates in the ICT industry. Because of this study undergraduates can choose the ICT discipline according to the demand of the job market in the ICT industry. Association for Computing Machinery/Institute of Electrical and Electronics Engineers (ACM/IEEE) guidelines claims that all computing degrees are classified into seven major areas which are Computer Engineering, Computer Science, Cyber Security, Information System, Information Technology, Software Engineering and Data Science. The future demand for ICT graduates in the ICT industry is examined in this research based on these seven primary disciplines. The secondary data for this research were collected from the National IT-BPM workforce survey and the university grant commission website. According to the National IT-BPM workforce survey, cloud platform is the most demand technology in recent years. Finally, undergraduates can choose the best path in the ICT field by knowing the most demanding technologies in the ICT industry.

Keywords: Emerging Technology, ICT Industry, ICT Undergraduates, Sri Lanka Association for Software and Services Companies

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Introduction

Sri Lanka is famous for its agricultural economy, but in recent years it has shifted to an industrial economy. In a knowledge-based economy, the information and communication technology (ICT) industry play a critical role in increasing productivity and economic growth. Information and Communication Technology include all communication technology, other multimedia applications and services enabling users to access, retrieve, store, transmit and manipulate information in a digital form. This sector has generated several new job opportunities, led to increased export profits, and attracted international investors for investment. According to the Sri Lankan Export Development Board, ICT services are the 4th largest earner of Sri Lanka. Now, the Sri Lankan ICT industry represents over 600 companies. Communication, Apparel and Textiles, Banking, Financial Services, Healthcare, Manufacturing, Media, Retailing, Transportation, Travel and Leisure, and a variety of other industries are among them. The fig. 1 indicates the increasing total number of employed and fig. 2 indicates startups in the ICT sector in Sri Lanka in recent years (SLASSCOM, 2020).

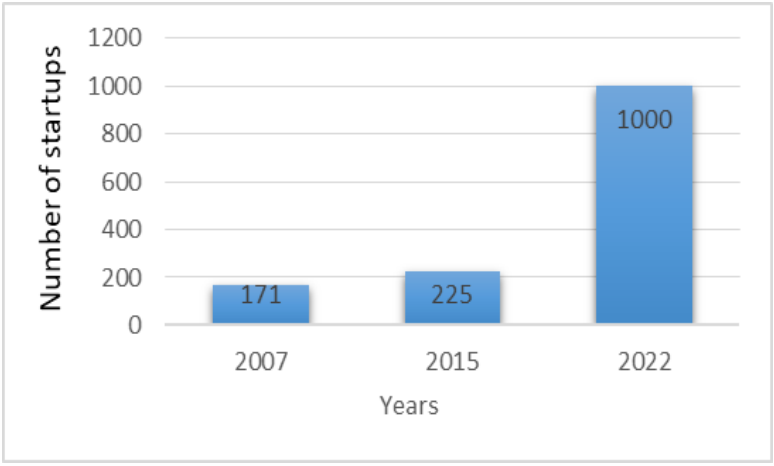

Fig. 1. Total number of employed in ICT industry last years

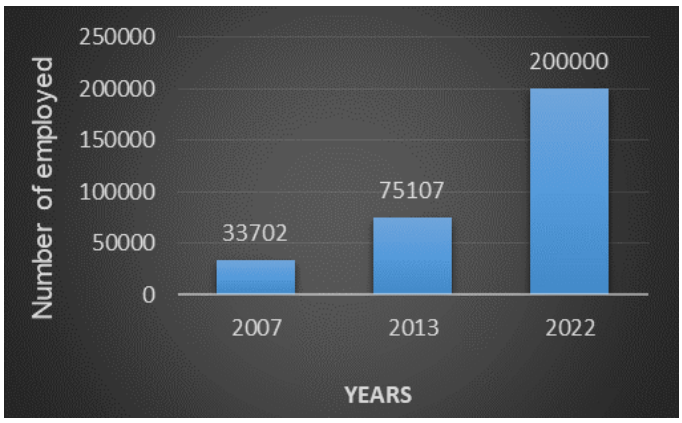

Fig. 2: Total number of startups in ICT industry last years

While the BPM workforce in the country has increased from 17,427 in 2014 to 25,510 in 2018 and the ICT workforce has grown by 42,019 employees since 2014 to 124,873 in 2018. This is a 50.7 growth, in 4 years. This indicates a considerable growth in the ICT workforce in Sri Lanka.

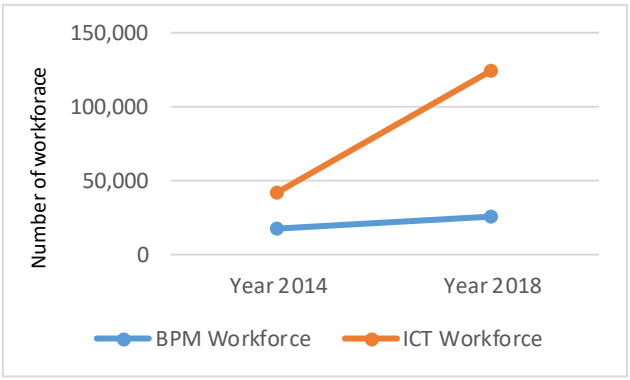

Fig. 3. The ICT Workforce Growth in Sri Lanka

Demand for graduates has increased from 6,246 in 2014 to 21,216 in 2019. ICT companies dominate with a demand for 14,898 graduates which amounts to 70.2 % of the total demand indicated in 2019. In addition, from 6,611 in 2014 to 9,076 in 2019, the overall number of graduates produced by training organizations grew. In 2019, the overall demand for and supply of ICT graduates in the country is depicted in the graph below. It demonstrates that demand outnumbers supply by a factor of 12,140. In 2013, the supply-demand imbalance was predicted to be 458 (ICTA, 2019). According to the findings of various surveys and reports, the demand for ICT graduates has increased in recent years.

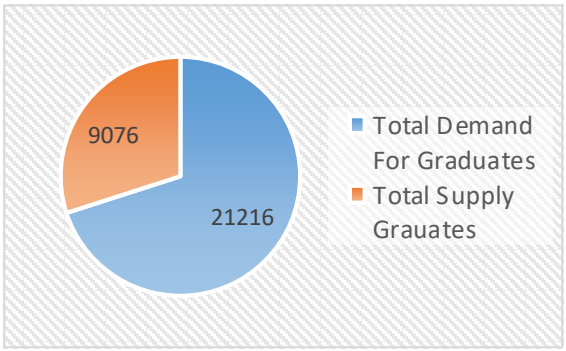

Fig. 4. Total number of demand and supply graduates in 2019

Most of the time, a bachelor's degree is required to work in the ICT industry but a diploma holder has the opportunity to work in the ICT industry. Because someone who wishes to work for an IT company has greater coding, communication, and marketing skills, they are getting higher demand compared to others. Government universities, private degree awarding institutes, government vocational and tertiary training institutes, and private diploma and certificate awarding training institutes are the four major categories of ICT training institutes in Sri Lanka. According to University Grant Commission (UGC) websites in 2019, 12 government universities produced 1,210 computer science and information technology graduates. Government universities have 26 faculties (29 departments and schools) that provide computer science and information technology degree programs (UGC, 2019). In addition, 494 IT graduates graduated from open university in 2019. Private degree awarding institutes include seventeen UGC recognized institutes of which eight institutes offer degree and postgraduate courses on ICT and computer science. There are also several other institutes affiliated with foreign universities that provide degrees in ICT-related disciplines. These courses can be taken in Sri Lanka or at affiliate institutions throughout the world. Furthermore, there are a large network of government vocational and tertiary education institutes that provide IT diplomas and certificates courses. From 2006 to 2018, the total number of IT graduates produced by training organizations was shown in the graph below. The overall number of graduates generated by training organizations has increased in recent years, as seen in fig.5 graph.

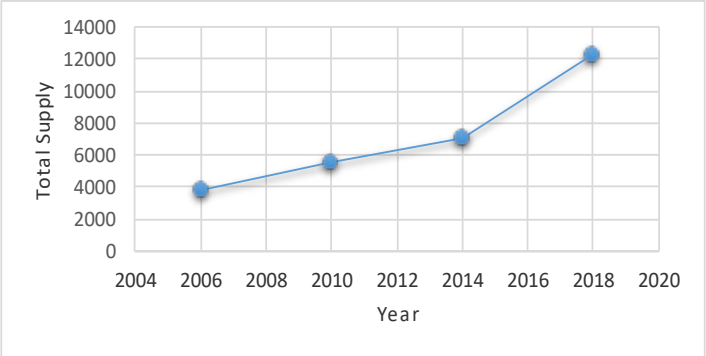

Fig. 5. Total number of graduates available in training institutions

Problem Statement

According to reports from the Sri Lanka Association for Software and Services Companies, the demand for the ICT sector has increased in recent years. The increased demand for ICT has resulted in the creation of numerous ICT job possibilities as well as the establishment of new ICT degree awarding training institutes in Sri Lanka. As a result, undergraduates are unable to select the most appropriate ICT degree program based on job demand. The solution to this difficulty can be found in this study. The primary goal of this research is to analyse the future demand for Sri Lankan ICT undergraduates in the ICT industry. Because of this study undergraduates can choose the ICT discipline according to the most demand of the job category in the ICT industry.

Methodology

Employers who create job opportunities for ICT workers can be divided into three categories. They are Suppliers of ICT products (ICT companies), IT-enabled services (BPM companies) and Major users of ICT products and services (non-ICT private companies and government organizations). ICT companies offer a wide range of products for both the domestic and international ICT markets, and some examples of these products are included below.

Big data solutions

Business solutions and MIS

Client-server architecture

Cloud services

E-business development

ERP software

ICT infrastructure and services

IoT

IT education and training

Mobile application development

Payment processors

Real-time systems

Software development

Systems integration

Web development

Marketing

ICT companies demand a bachelor's degree as the entry-level qualification for most job categories. The following are some of the computing degrees that are required for entry into ICT organizations.

BSc (Hons) in Mathematics and Statistics with Computer Science

BSc (Special) in Statistics with Computer Science

BSc (Special) in Computer Engineering

BSc (Special) in Computer Science

BSc Honours in Information Technology

Bachelor of Information Technology Degree (BIT)

BSc Honours in Software Engineering

BSc Honours in Computer Networks

BSc Engineering (Hons)in Computer System Engineering

Bachelor of Information Technology Honours in Networking and Mobile computing

BSc Honours in Data Science

BSc Honours in Cloud Computing

BSc Honours in Cyber Security

BSc Honours in Engineering in Information and Communication Engineering

BSc Honours in Informatics

Bachelor of Computing and Mathematical Sciences

BSc in Computational Engineering

BSc in Web and Mobile Computing

BSc in Applied Computing

According to the Association for Computing Machinery/Institute of Electrical and Electronics Engineers (ACM/IEEE) guideline, all computing degrees are classified into seven major areas as mentioned below ((IEEE-CS) A. C., 2021).

Computer Engineering

Computer Science

Cyber Security

Information System

Information Technology

Software Engineering

Data Science

At its 992-meeting, the UGC decided to update Commission Circular No. 995 to implement the recommendations of the standing committee on computing, which calls for all computer degrees to be aligned with the ACM/IEEE international guidelines. The future demand for IT graduates in the ICT industry is examined in this research based on these seven primary disciplines.

The secondary data was collected from the National IT-BPM workforce survey, SLASSCOM Employability Skills Development Programme reports and university grant commission website. The future demand of ICT undergraduates was analysed based on previous data. The emerging technologies having upwards of seven computer degrees were mapped using the computing ACM/IEEE curriculum 2020 report.

Result

Table I represents the job categories in the ICT industry, as well as the ICT graduate's composition of each job type in 2019 which total 14,898 graduates.

According to the national IT-BPM workforce analysis Cloud platform and technologies and Mobility platforms and applications are the most demanding technologies in the future.

The entire demand for new technologies was estimated to be 5,323, contributing to 25.1% of all graduate demand in 2019. Table II illustrates the demand for emerging technology.

Table I. Graduate's composition of job type

Job categories	Percentage of graduate's composition (%)
Database DevOps & Admin	2.16
User interface Engineering	2.62
Business Analysis	6.4
Network Engineering	4.96
Software Engineering	44.55
Software Project Manager	4.63
Software Quality Assurance	17.25
Client Support	6.55
Business Development	1.48
IT & Technical Support	4.19
Innovators & Research	1.98
IT Management	1.73
Data Scientists	0.31
IT Services	1.19

Table II. Deamand for emerging technology

Technology	Percentage of demand (%)
Cloud platform and technologies	25.1
Mobility platform and applications	14.0
Workflow management (BPM) Technology	12.8
Internet of Things	9.5
Big data flatforms and processing	9.4
Robotic processing and automation	7.0
Analytics platform and application	4.47
Conversation platform/virtual assistant/chatbots	3.3
Machine Learning/AI-neural nets related	3.3
Block chain	3.0
Machine Learning/AI-non neural nets related	2.81
Computer games, animation, and simulation	1.72
Computer vision	1.16
3D printing	0.93
Processing mining	0.9
Immersive technologies (AR/MR/VR)	0.22

Mapping Emerging Thchnologies with Computing Disciplines

A. Computer Engineering (CE)

CE combines computing and electrical engineering to represent the science and technology of designing, building, implementing, and maintaining software and hardware components of modern computing systems, computer-controlled devices, and intelligent device networks. IoT, 3D printing, Robotic processing and machine learning are the demand technology in CE.

B. Computer Science (CS)

Among the computing disciplines, CS has a greater theoretical focus, and its connection to theoretical mathematics is still strong ((IEEE-CS) A. C., 2021). CS include Algorithms and complexity, programming languages, software development principles and software engineering concepts. Could computing , Mobility platform, blockchain, big data flatforms and processing, computer games, Processing mining and computer vision are the emerging technologies in CS disciplines.

C. Cyber Security (CSEC)

CSEC is a highly interdisciplinary field of computing disciplines. This discipline covers a range of application areas such as public policy, procurement, operations management, risk management, research, software development, IT security operations, and enterprise architecture.

D. Information systems (IS)

IS is a discipline that focuses on information, including information capture, storage, processing, and analysis/interpretation in ways that enable decision making. The discipline emphasizes the importance of constructing system solutions, which should ideally be able to be enhanced through time. Coursework and other educational experiences in computing and information technology are always included in information systems degree programs, as well as coverage of an IS environment such as business.

E. Information Technology (IT)

The study of systemic approaches to selecting, developing, applying, integrating, and administering safe computer systems to enable users to achieve their personal, organizational, and societal goals (IEEE-CS) A. f., 2017). The focus of the IT graduate profile specification is on problem analysis and user needs, computer requirements specification and creation of computing-based solutions. BPM Technology helps organizations enable business agility via process automation and optimization. BPM technology is related to both IT and Management.

F. Software Engineering (SE)

SE is a branch of engineering that focuses on the creation and application of rigorous methodologies for designing and building software products that consistently execute defined tasks. SE includes professional knowledge, technical knowledge, teamwork, end-user awareness, design solutions in context, performance trade-offs, and continuing professional development. Cloud computing, mobile development, big data, machine learning, computer games, conversation platform are the demand filed in SE (university, n.d.).

G. Data Science (DS)

Data science (DS) is a new area of computing that is closely related to the fields of data analytics and data engineering. Data science is defined as a set of fundamental principles that drive the extraction of information from data, including principles, procedures, and tools for understanding events through data analysis. Cloud computing is the most demanding technology in DS.

Limitation

In the world, emerging technologies include a variety of technologies such as educational technology, information technology, nanotechnology, biotechnology, cognitive science, Quantum Computing robotics, and artificial intelligence [9]. Due to the arrival of new technologies, considered emerged technologies in the study may differ with the time as well as results may differ related to the world context due to some existing technologies in the world which not taken into consideration within the study. This paper does not examine the demand for non-ICT sectors in Sri Lanka because there are several sectors in non-ICT.

Contclusion

The primary goal of this study is to give a realistic picture of the demand for ICT undergraduates and assist students in making better career opportunities that will lead to future job opportunities in the field of information technology. Many ICT jobs have been shifted to lower-cost countries and may soon migrate onwards to regions offering even cheaper labor. As a result, it is difficult to predict exactly if the demand for Sri Lankan ICT undergraduates will increase in the future. Further studies can be done on how changes of labor cost will impact the ICT sector and the job market in the future.

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