

# ANNUAL SURVEY ON INFOCOMM MEDIA MANPOWER 2018

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# **PART I: SURVEY COVERAGE AND METHODOLOGY**

# 1. INTRODUCTION

This is the second cycle of Annual Survey on Infocomm Media (ICM) Manpower conducted since the formation of IMDA in October 2016. This survey's predecessor is the Annual Survey on Infocomm (ICT) Manpower, which had been conducted for 17 cycles since 1999.

## Definition of Infocomm Media Professional<sup>1</sup>

An infocomm professional is a person engaged primarily in infocomm-related work, including infocomm data analytics, either in an IT or telecommunication equipment and/or services provider, or user organisation (such as in a bank). The scope of work may include the development, distribution, implementation, support, operation, sales or marketing of telecommunication, computer hardware/software, IT services or multimedia contents. Examples include software developer, software product manager and computer system administrator.

A media professional is a person with specific media content job roles employed in a company across sectors including relevant media ones. Media content job roles cover development, production, operation, distribution, sales and/or marketing of media content. Examples include editor, writer, games designer or games artist, and technical crew.

He/She must be employed by a Singapore-based enterprise on a full time/part-time/casual/temporary basis either as a permanent or direct contract staff to work in Singapore or overseas.

# 2. SURVEY OBJECTIVES

The objective of the Survey is to assess the profile of infocomm media professionals in Singapore as at 1<sup>st</sup> June 2017.

# 3. METHODOLOGY

The survey covers both private sector enterprises and agencies from the public sector. The sample for private sector enterprises, covering all industrial sectors, was selected from the Establishment Sampling Frame maintained by the Department of

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<sup>1</sup> Respondents were requested to exclude infocomm media manpower hired through third-party recruitment agencies, to avoid possible double counting errors as recruitment agencies are also part of the survey sample coverage.

Statistics. The sample was stratified by the Singapore Standard Industrial Classification (SSIC). Data collection (via self-administered questionnaires by mail/email/Internet submission) and processing for the Survey was carried out from March 2018 to June 2018.

#### **4. NOTES ON THE DATA**

Past years' data were included for comparison where available. Due to the rounding of figures, the sum of individual figures may not add up to the total or 100%.

## **PART II: SURVEY FINDINGS**

# 1. OVERVIEW

## (A) Infocomm Media professionals

- An infocomm media professional refers to a person engaged in infocomm-related work or a person with specific media content job roles employed in a company across sectors.
- The number of infocomm media professionals employed was 210,100 in 2017. Together with 14,700 infocomm media job vacancies, the total demand<sup>2</sup> of Infocomm media professionals was 224,700 in 2017. Demand for infocomm media professionals is projected to grow by another 35,800 in the next three years (2018 – 2020).

### ***Singapore Residents formed majority of Infocomm media professionals***

- Infocomm media professionals constituted predominantly Singapore Residents<sup>3</sup> (70%), males (68%) and those who were at least tertiary educated<sup>4</sup> (83%).

## (B) Infocomm professionals

- The number of infocomm professionals employed grew by 5.2% from 180,000 in 2016 to reach 189,400 in 2017. Together with 13,200 infocomm job vacancies, total demand of infocomm professionals increased by 2.2% to reach 202,600 in 2017. Enterprises have projected the demand for infocomm professionals to grow by another 28,500 in the next three years (2018 – 2020).

### ***Technical IT specialists accounted for more than 2 in 3 infocomm jobs in 2017***

- Technical IT specialists in the following areas - IT Development, Network & Infrastructure, Data Analytics, Cyber Security & Infocomm Research and Development - were *most in demand* and expected to grow by about 20,100 in the next three years.

#### **i. IT Development roles**

- a. IT Development roles include *Software & application manager; Software/application developer (excluding website, games, mobile & social media; Multimedia & games developer; Website, mobile & social media software/app developer (excluding games); User Interface (UI) User Experience (UX) designer; Enterprise/Systems Architect, IT*

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<sup>2</sup> Total demand refers to the sum of employed manpower and vacancies.

<sup>3</sup> Singapore residents comprise of Singapore Citizens and Permanent Residents.

<sup>4</sup> Tertiary educated Infocomm media manpower refers to manpower having at least diploma qualifications.

*business analyst; Systems analyst; IT business process engineers; Database administrator; IT service manager/IT project manager; IT/Software product manager and IT testing/quality assurance specialist/IT auditor.*

- b. Accounted for 43% of the total demand for infocomm professionals, with software development job roles being the most in demand.
- c. As at 1<sup>st</sup> Jun 2017, about 80,100 professionals were employed in IT Development roles and 7,700 roles remained vacant.
- d. **Enterprises have projected the demand for IT Development roles to grow by 13,100 in the next three years (2018 – 2020).**

**ii. Network & Infrastructure related job roles**

- a. Network & Systems related roles include *Network & communications manager/IT infrastructure manager; Network, servers & computer systems administrator; Network engineer/Telecommunications engineer; Virtualisation specialist/cloud operations specialist.*
- b. Accounted for 17% of the total demand for infocomm professionals.
- c. As at 1<sup>st</sup> Jun 2017, about 32,300 professionals were employed in such roles and 1,300 roles remained vacant.
- d. **Enterprises have projected the demand for Networks & Infrastructure-related roles to grow by another 2,300 in the next three years (2018 – 2020).**

**iii. Other Critical Emerging Tech specialists**

- a. Other Critical Emerging Tech specialist roles include *Data analysts/Data scientists, Machine Learning/Artificial Intelligence Engineer, IT Security specialists, IT Security Operations Analysts/Engineers, Infocomm R&D, Internet of Things (IoT) Engineer, Embedded Systems/Firmware Developers, IoT Solution Architect*
- b. Accounted for 8% of total demand for infocomm professionals.
- c. As at 1<sup>st</sup> Jun 2017, about 14,200 professionals were employed in such roles and an additional 1,300 roles remained vacant.
- d. **Enterprises have projected the demand to grow by another 4,700 headcounts in the next three years (2018 – 2020).**



## (C) Media professionals

- The number of media professionals employed grew by 4.6% from 19,800 in 2016 to 20,700 in 2017. Together with 1,500 media job vacancies, total demand for media professionals was 22,100 in 2017. Demand for media professionals is projected to grow by another 7,300 in the next 3 years (2018 – 2020).

### i. Creative Media specialists

- Creative roles include Writer; Director; Editor; Artist; Modeller; Visual Effects Designer; Games Designer; Online Video Content Creator; Audio/ Sound Designer and Production Designer for Film/TV.*
- Accounted for 44% of the total demand for media professionals, with writer job roles being the most in demand.
- As at 1<sup>st</sup> Jun 2017, about 9,600 professionals were employed in creative roles and 100 roles remained vacant.
- Enterprises have projected the demand for Creative Media specialists to grow by another 4,700 in the next three years (2018 – 2020).**

### ii. Business Roles

- Business roles include Executive Producer, Producer, Advertising Account Executive/Manager; Marketing and Publicity Executive of Media IP; Sales and Distribution Executive/Manager of Media IP and Advertising Inventory*
- Accounted for 26% of total demand for media professionals.
- As at 1<sup>st</sup> Jun 2017, about 4,900 professionals were employed in such roles and an additional 800 roles remained vacant.
- Enterprises have projected demand to increase by 2,100 headcounts in the next three years (2018 – 2020).**

### iii. Operation Roles

- Operation roles include Project Managers of Media IP and Production Crew*
- Accounted for 23% of total demand for media professionals.
- As at 1<sup>st</sup> Jun 2017, about 4,600 professionals were employed in such roles and an additional 500 roles remained vacant.
- Enterprises have projected demand to increase by 300 headcounts in the next three years (2018 – 2020).**

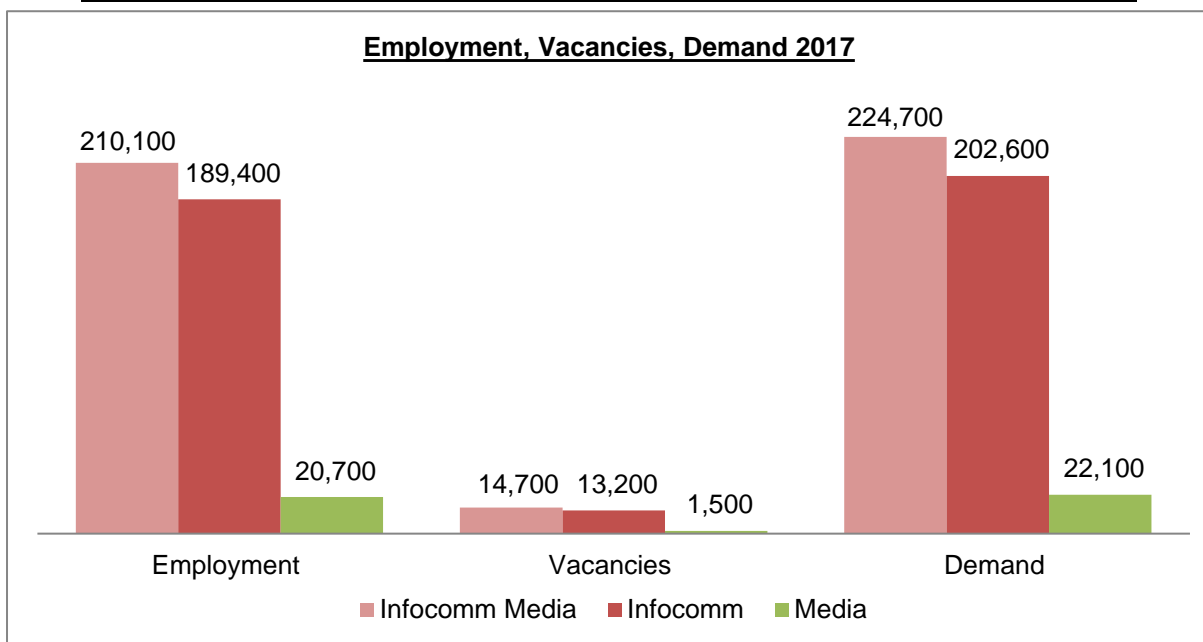
## 2. EMPLOYMENT

### A. AN OVERVIEW OF 2017 INFOCOMM MEDIA MANPOWER DEMAND

#### *Infocomm professionals made up 90% of Infocomm Media employment*

Total employment for infocomm media professionals was 210,100, of which infocomm professionals made up 90% of Infocomm media manpower. Together with 14,700 infocomm media job vacancies, the total demand for Infocomm media professionals was 224,700 in 2017 ([Chart 1](#)).

**Chart 1: Infocomm Media Professionals Demand, Employment and Vacancies, 2017**

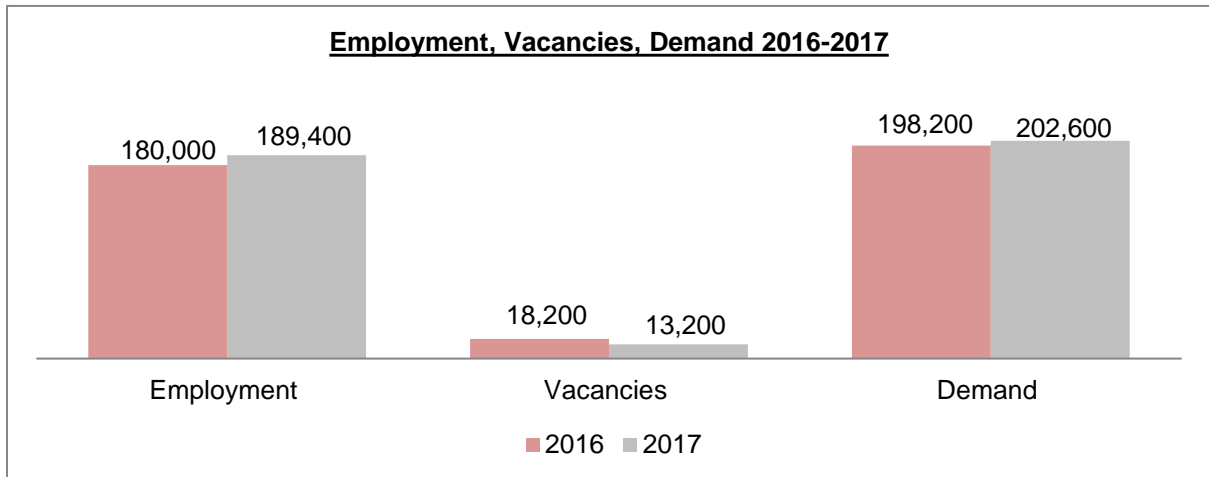


Notes:

- 1) Total infocomm media professionals refers to the sum of infocomm professionals and media professionals.
- 2) Total infocomm media demand refers to the sum of employed infocomm media professionals and vacancies. (Demand = Employment + Vacancies)

Total demand for infocomm professionals increased by 4,400 or 2.2% to 202,600 in 2017 ([Chart 2](#)). The growth in demand was supported by employment which grew by 5.2% from 180,000 in 2016 to 189,400 in 2017. Vacancies dropped by about 5,000 or 27% from 18,200 in 2016 to 13,200 in 2017.

**Chart 2: Infocomm Professionals Demand, Employment and Vacancies, 2016 – 2017**



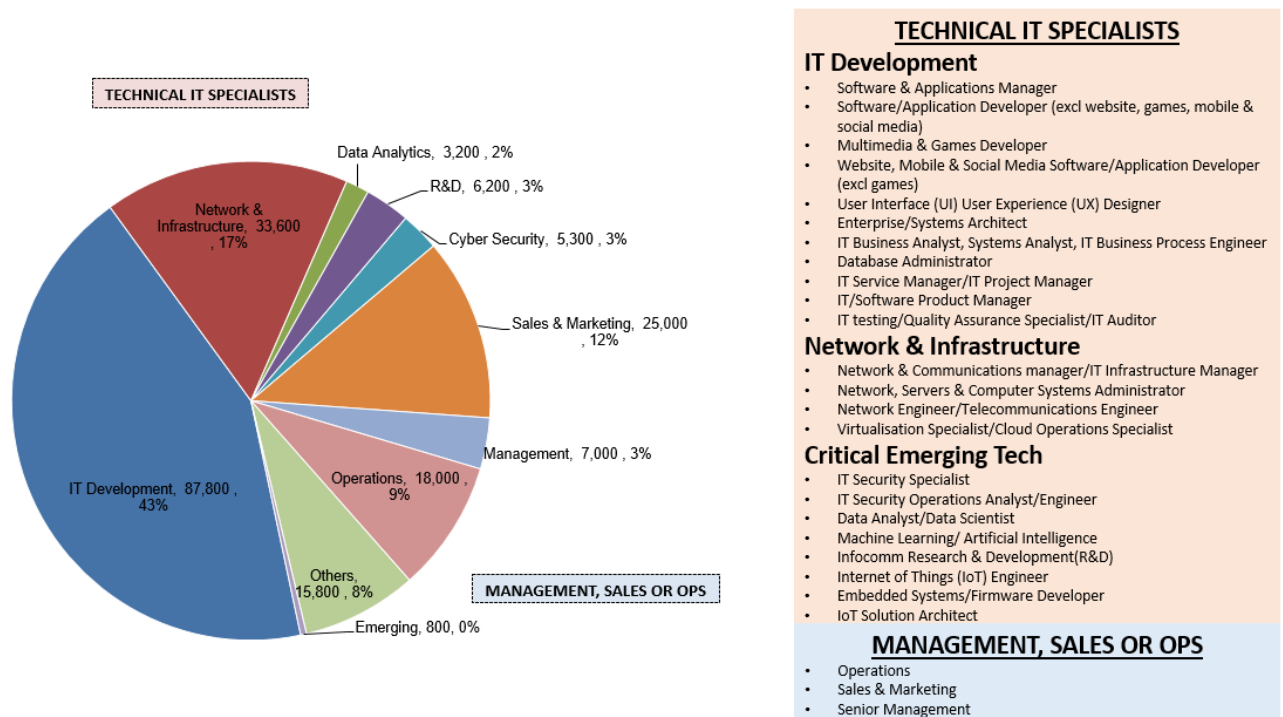
Note: Total infocomm demand refers to the sum of employed infocomm professionals and vacancies.  
(Demand = Employment + Vacancies)

## B. AN OVERVIEW OF TECHNICAL IT SPECIALISTS

***Demand for Technical IT specialists are expected to grow by 20,100 in the next 3 years (2018 – 2020)***

In total, technical IT specialists in areas such as *IT Development, Network & Infrastructure, Data Analytics, Infocomm R&D, Cyber Security and Internet of Things* accounted for 67% or 136,900 of the total infocomm professionals in demand in 2017 (Chart 3).

**Chart 3: Infocomm Professionals Demand as at June 2017**



### i. IT Development

- a. *IT Development* roles were the most in demand and accounted for 43% or 87,800 of the total demand for infocomm professionals (Chart 3).
- b. As at 1<sup>st</sup> Jun 2017, about 80,100 professionals were employed in IT Development roles and an additional 7,700 roles remained vacant.
- c. Enterprises have projected the demand for IT Development roles to grow by another 13,100 in the next three years (2018 – 2020) (Chart 4).

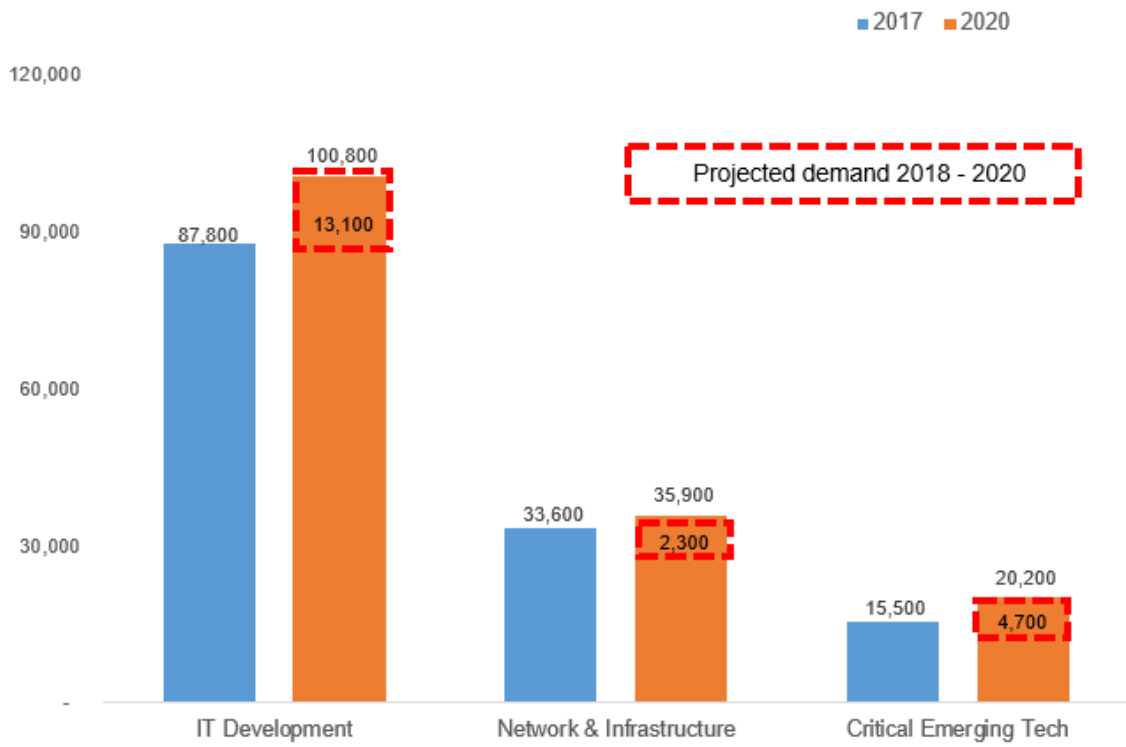
## ii. Network & Infrastructure

- a. The next most sought after group of professionals were those working in Network & Infrastructure related job roles. They accounted for 17% or 33,600 of the total demand for infocomm professionals ([Chart 3](#)).
- b. As at 1<sup>st</sup> Jun 2017, about 32,300 professionals were employed in the Network & Infrastructure roles and an additional 1,300 positions remained vacant.
- c. Enterprises have projected demand to increase by another 2,300 for these job roles in the next three years (2018 – 2020) ([Chart 4](#)).

## iii. Other Critical Emerging Tech specialists

- a. Other Critical Emerging Tech specialists in areas such as Data Analytics, Infocomm R&D, Cyber Security and Internet of Things accounted for 8% or 15,500 of total demand for infocomm professionals ([Chart 3](#)).
- b. As at 1st Jun 2017, about 14,200 critical emerging tech specialists were employed and an additional 1,300 positions remained vacant.
- c. Enterprises have projected demand to increase by another 4,700 for these job roles in the next three years (2018 – 2020) ([Chart 4](#)).

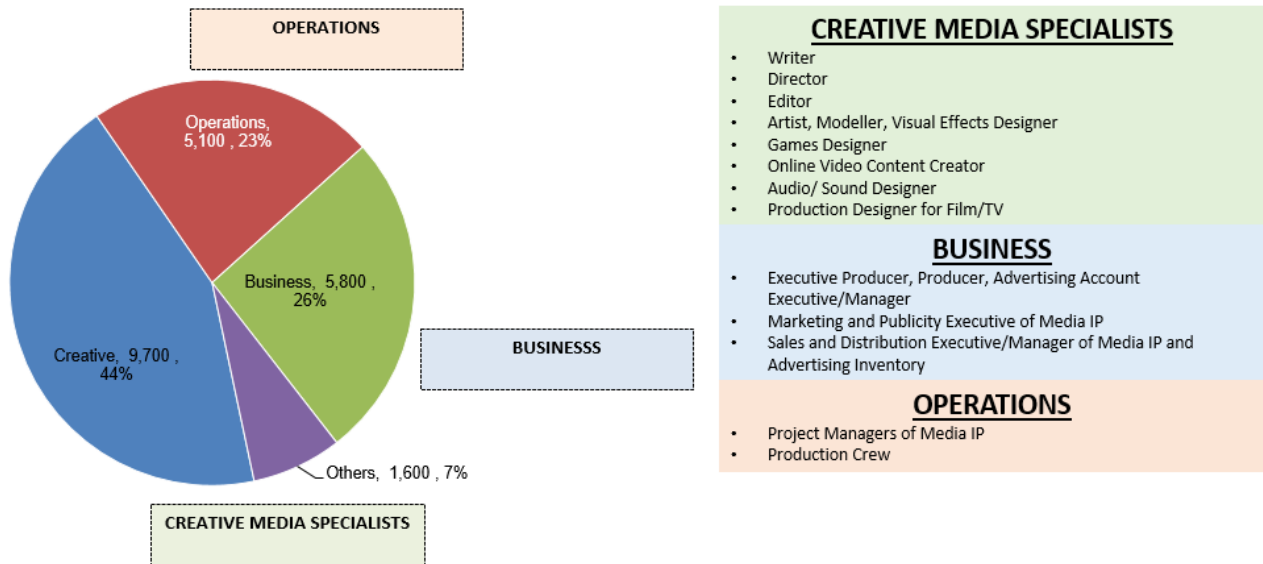
**Chart 4: Enterprises' current and projected demand for Infocomm Professionals in next three years**



## C. AN OVERVIEW OF MEDIA PROFESSIONALS

The number of media professionals employed was 20,700 in 2017. Together with 1,500 media job vacancies, total demand of media professionals was 22,100 in 2017. ([Chart 5](#))

**Chart 5: Media Professionals Demand as at June 2017**



### iv. Creative Media specialists

- Accounted for 44% of the total demand for media professionals, with writer job roles being the most in demand ([Chart 5](#)).
- As at 1<sup>st</sup> Jun 2017, about 9,600 professionals were employed in creative roles and 100 roles remained vacant.
- Enterprises have projected the demand for Creative Media specialists to grow by another 4,700 in the next three years (2018 – 2020) ([Chart 6](#)).

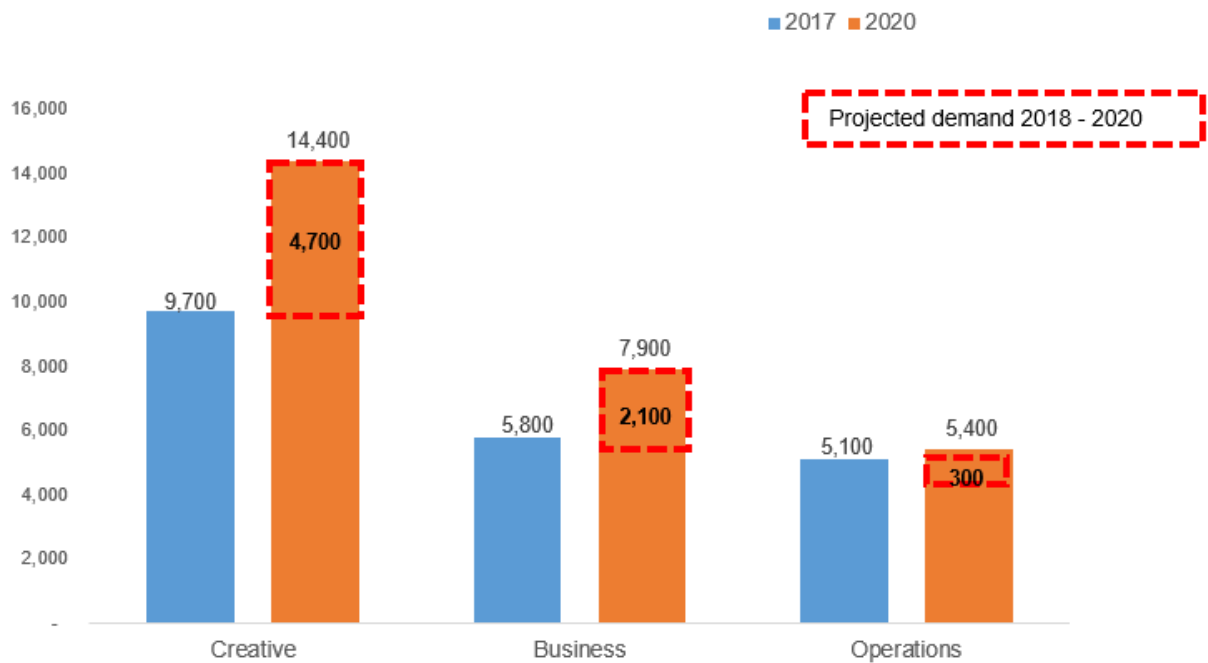
### v. Business Roles

- Accounted for 26% of total demand for media professionals ([Chart 5](#)).
- As at 1<sup>st</sup> Jun 2017, about 4,900 professionals were employed in such roles and an additional 800 roles remained vacant.
- Enterprises have projected demand to increase by 2,100 headcounts in the next three years (2018 – 2020) ([Chart 6](#)).

**vi. Operation Roles**

- a. Accounted for 23% of total demand for media professionals (Chart 5).
- b. As at 1<sup>st</sup> Jun 2017, about 4,600 professionals were employed in such roles and an additional 500 roles remained vacant.
- c. Enterprises have projected demand to increase by 300 headcounts in the next three years (2018 – 2020) (Chart 6).

**Chart 6: Enterprises' current and projected demand for Media Professionals in next three years**

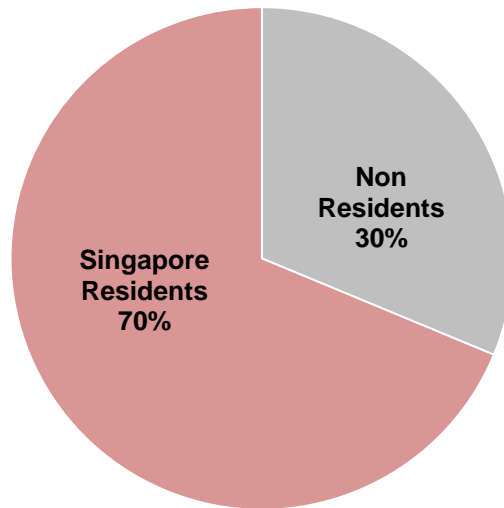




### 3. DEMOGRAPHIC PROFILE

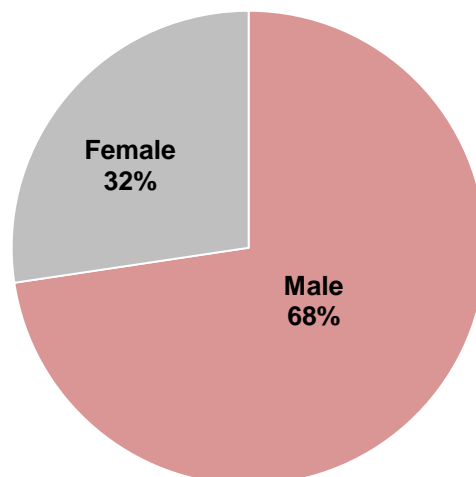
Singapore residents (Singapore citizens and permanent residents) continued to form majority of infocomm media professionals at about 70% in 2017 ([Chart 7](#)).

Chart 7: Infocomm Media Professionals by Residential Status, 2017



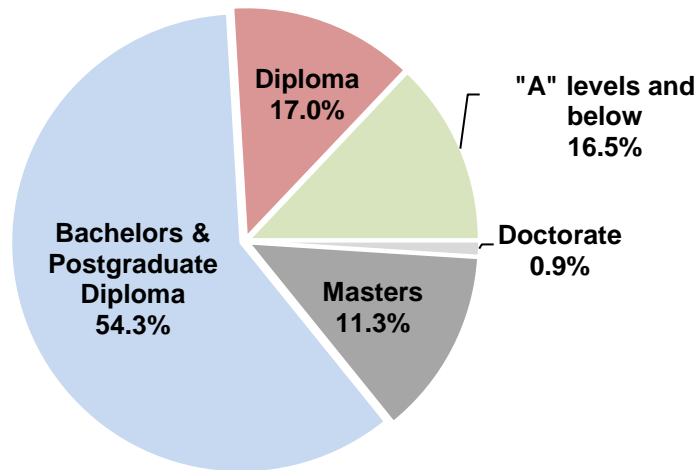
Males continued to outnumber females in 2017 with males making up 68% of infocomm media professionals ([Chart 8](#)).

Chart 8: Infocomm Media Professionals by Gender, 2017



More than 8 in 10 Infocomm media professionals were minimally tertiary educated in 2017 (i.e., had at least diploma qualifications) ([Chart 9](#)).

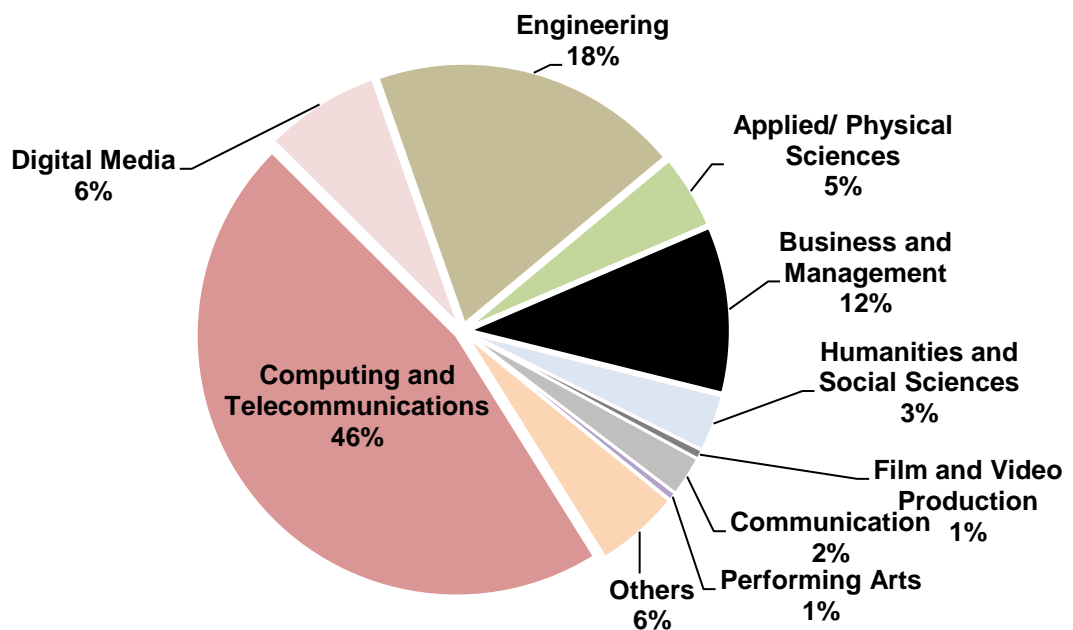
**Chart 9: Infocomm Media Professionals by Highest Qualification Attained, 2017**



More than 4 in 10 infocomm media professionals with tertiary education had computing-related qualifications.

Computing and Telecommunications was the dominant discipline of study among Infocomm media professionals with tertiary education in 2017 ([Chart 10](#)).

**Chart 10: Infocomm Media Professionals by Discipline of Study as at June 2017**



Base: Infocomm media professionals with tertiary education

## **PART III: ANNEX**

## Annex A: Description of Infocomm Media Job Roles (Table 1)

No.	Job role	Description
1.	Infocomm Senior Management Roles (E.g. CIOs, CTOs, Chief IT security officer, Chief Data Officer)	<p>They are members of the senior management/executive management team in an IT role, and with <u>at least three managers reporting to them</u>. They include the following roles:</p> <ul style="list-style-type: none"> <li>• Chief Information Officer (CIO) leads the Information Technology (IT) function in providing strategic directions, solutions and policies to support business goals.</li> <li>• Chief Technology Officer (CTO) is responsible for establishing the company's technical vision and leading all aspects of the company's technology development. He is the company's top technology executive, playing an integral role in the company's strategic direction, development, and future growth.</li> <li>• Chief IT Security Officer is responsible for the planning, development and implementation of security strategy and related policies.</li> <li>• Chief Data Officer is responsible for enterprise-wide governance and utilisation of information as an asset via data processing, analysis, data mining information trading and other means.</li> </ul>
2.	Infocomm Startup Founder	<p>They are the founding members of an information communications firm:</p> <ul style="list-style-type: none"> <li>• registered in Singapore in the past five years;</li> <li>• employs at least 1 full-time-equivalent worker;</li> <li>• majority owned by individual founders (i.e. individual founding members should own more than 50% of the company's shares in total);</li> <li>• involved in the creation of new information communications products/services (i.e. the company developed and owns the intellectual property rights for new products/services, it <u>should not</u> be a reseller/distributor of existing products and services from other companies).</li> </ul>
3.	Software & applications manager	<p>They are leading a team of developers on the analysis, development and deployment of business solutions and software applications. The manager will work with other teams to translate the clients' needs to technical specifications required for system development and deployment.</p>
4.	Software/application developer (excluding website, games, mobile and social media)	<p>They research, analyse and evaluate requirements for existing or new software. They also design, develop, test and maintain software to meet the requirements.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• researching, analysing and evaluating requirements for software</li> <li>• designing and developing computer software</li> <li>• consulting with engineering staff to evaluate interface between hardware and software</li> <li>• developing and directing software testing and validation procedures</li> <li>• modifying existing software to correct errors, to adapt it to new hardware or to upgrade interfaces and improve performance</li> <li>• directing software programming and development of documentation</li> <li>• assessing, developing, upgrading and documenting maintenance procedures for software</li> <li>• consulting with users concerning maintenance of software.</li> </ul>
5.	Multimedia & games developer	<p>They research, analyse and evaluate requirements for existing or new games and multimedia applications. They also design, develop, test and maintain games and multimedia solutions to meet requirement. They are responsible for establishing a link between the artistic vision of the game and its technical implementation. Thereafter they play-test the game in a systematic way, analysing the game's performance against the designer's intentions, identifying problems and suggesting improvements.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• Researching and identifying the purpose, functionalities and content of games and multimedia applications</li> <li>• Visualising, designing and codifying how systems work to run the game and multimedia applications, incorporating and adapting any ready-made code libraries and writing custom code as required</li> <li>• Designing and developing digital animations, imaging, presentations, games, audio and video clips and internet applications using multimedia software, tools and utilities, interactive graphics and programming languages</li> <li>• Testing the code and fix bugs, and also develop customised tools for use by other members of the development team.</li> <li>• Consulting with users concerning maintenance of games and multimedia applications</li> <li>• Assessing, developing, upgrading and documenting maintenance procedures for games and multimedia applications.</li> </ul>
6.	Website, mobile and social media software/app developers (excluding games)	<p>They research, analyse and evaluate requirements for existing or new websites and applications on social media and mobile platforms. They also design, develop, test and maintain websites, and applications on social media and mobile platforms to meet the requirements.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• researching and identifying the purpose, functionalities and content of the website, and applications on social media and mobile platforms.</li> <li>• consulting with users concerning maintenance of website, and applications on social media and mobile platforms</li> <li>• designing, coding and testing of website, and applications on social media and mobile platforms</li> <li>• assessing, developing, upgrading and documenting maintenance procedures for website, and applications on social media and mobile platforms.</li> </ul>

No.	Job role	Description
7.	User Interface (UI) User Experience (UX) Designer	The UI/UX Designer applies subject matter knowledge in the design, development, documentation, debugging and support of the user interface for a variety of applications (including Augmented reality/ virtual reality formats) to have best possible engaging user experiences. With clear understanding of business requirements and user needs, he/she articulates, develops and models the end user experience including the visual design of the applications, to make user interaction simple, efficient and consistent. He/she is involved in the development of process flows, wireframes, and prototypes as well as establish upward communication channels to effectively conceptualise and convey high-level design strategies within organisations. He/she assesses and optimises the performance of new and existing features by actively participating in usability testing and user research, and interpreting analytics data.
8.	Enterprise/S systems Architect	They define a high level enterprise-wide IT systems architecture focusing on the mapping of IT capabilities to business needs. Job scope: <ul style="list-style-type: none"> <li>• designing business, information, application and technology architecture which will address the needs of all departments in an organisation</li> <li>• articulating the solution and strategies to the top management to secure buy-in</li> <li>• planning enterprise systems architecture development</li> <li>• developing IT transition plan and preparing the organisation for any changes that may be associated with the implementation</li> <li>• designing IT governance.</li> </ul>
9.	IT business analyst, systems analyst, IT business process engineer	They conduct research, analyse and evaluate client business processes and requirements, information technology requirements, procedures or problems, and develop and implement proposals, recommendations, and plans to improve current or future information systems. Job scope: <ul style="list-style-type: none"> <li>• consulting with users to formulate and document requirements and with management to ensure agreement on systems principles</li> <li>• identifying and analysing business processes, procedures and work practices</li> <li>• identifying and evaluating inefficiencies and recommending optimal business practices, and system functionality and behaviour</li> <li>• taking responsibility for deploying functional solutions, such as creating, adopting and implementing system test plans</li> <li>• developing functional specifications for use by systems developers</li> <li>• expanding or modifying systems to improve work flow or serve new purposes</li> <li>• coordinating and linking the computer systems within an organisation to increase compatibility.</li> </ul>
10.	Database administrator	They develop, control, maintain and support the optimal performance and security of databases. Job scope: <ul style="list-style-type: none"> <li>• developing database architecture, data structures, tables, dictionaries and naming conventions for information systems projects</li> <li>• constructing, modifying, integrating, implementing and testing database management systems</li> <li>• conducting research and providing advice on the selection, application and implementation of database management tools</li> <li>• developing and implementing data administration policy, documentation, standards and models</li> <li>• developing policies and procedures for database access and usage and for the backup and recovery of data</li> <li>• performing the operational establishment and preventive maintenance of backups, recovery procedures, and enforcing security and integrity controls.</li> </ul>
11.	IT service manager/IT project manager	They plan, direct and coordinate information technology projects, and provisioning of IT services. Job scope: <ul style="list-style-type: none"> <li>• consulting with users, to assess computing needs and system requirements and specifying technology to meet those needs</li> <li>• formulating and directing infocomm strategies and plans</li> <li>• directing the selection and installation of infocomm resources and the provision of user training</li> <li>• directing infocomm operations, analysing workflow, establishing priorities, developing standards and setting deadlines</li> <li>• establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources</li> <li>• transitioning new services/projects into operation.</li> </ul>
12.	IT/Software product manager	They manage software that is built and implemented as a turnkey product. They will develop benchmark against competitors' product offering to improve product features, pricing plan and business processes for new and/or existing services to ensure market competitiveness.

No.	Job role	Description
13.	IT testing/quality assurance specialist/IT auditor	<p>They specialise in quality assurance including games and software testing.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• developing and documenting software testing plans</li> <li>• Play-testing games and report on its playability and programme bugs and identifying refinement areas</li> <li>• installing software and hardware and configuring operating system software in preparation for testing</li> <li>• verifying that programmes function according to user requirements, designer's intention and established guidelines</li> <li>• executing, analysing and documenting results of software application tests and information and telecommunication systems tests</li> <li>• developing and implementing software and information system testing policies, procedures and scripts.</li> </ul>
14.	Network & communications manager/IT infrastructure manager	<p>They are responsible for performing long-term strategic planning to ensure that network and IT infrastructure capacity meets current and future requirements. They are also responsible for developing, planning, and implementing the overall strategic goals of an organisation's network and communications system, and IT infrastructure.</p>
15.	Network, servers & computer systems administrator	<p>They develop, control, maintain and support the optimal performance and security of information technology systems.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• maintaining and administering computer networks and related computing environments including computer network, servers, systems software, applications software and all configurations</li> <li>• recommending changes to improve systems and network configurations, and determining hardware or software requirements related to such changes</li> <li>• diagnosing network and system problems</li> <li>• performing data backups and disaster recovery operations</li> <li>• operating master consoles to monitor the performance of servers, computer systems and networks, and to coordinate computer network access and use.</li> </ul>
16.	Network engineer/Telecommunications engineer	<p>They plan, manage and evaluate the technical planning and installation of LANs/WANs, and other telecommunication systems and equipment. They also manage, maintain and support the enterprise network, and other telecommunication systems and equipment, and ensure network availability, security and capacity monitoring.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• planning and designing communications networks based on wired, fibre optical and wireless communication media, evaluating and monitoring network infrastructure to ensure networks are configured to operate at optimal performance</li> <li>• researching, designing and advising on telecommunications equipment, and radio and television distribution systems, including both cable and over the air</li> <li>• specifying production or installation methods, materials, quality and safety standards and directing production or installation work of telecommunications products and systems</li> <li>• installing, configuring, testing, maintaining and administering new and upgraded networks, and other telecommunication systems and equipment</li> <li>• preparing and maintaining procedures and documentation for network inventory, and recording diagnosis and resolution of network faults, enhancements and modifications to networks, and maintenance instructions</li> <li>• monitoring network traffic, and activity, capacity and usage and recommending improvements to ensure continued integrity and optimal network performance</li> <li>• providing specialist skills in supporting and troubleshooting network problems and emergencies.</li> </ul>
17.	Virtualisation specialist/cloud operations specialist	<p>They are responsible for the administration of the virtualised environment or cloud environment including the design, installation, operation, deployment, automation, monitoring, troubleshooting, and its support. They also specialise in system storage, network, virtualisation and/or data centre automation solutions.</p>

No.	Job role	Description
18.	IT/Cyber security engineer/specialist	<p>They specialise in providing security assurance of information technology systems.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• developing plans to safeguard data and information against accidental or unauthorised modification, destruction, or disclosure</li> <li>• training users and promoting security awareness to ensure system security and to promote good security practices</li> <li>• conferring with users to discuss issues such as computer data access needs, security violations, and access control requirements</li> <li>• monitoring use of data files and regulate access to safeguard information in computer files</li> <li>• performing risk assessments and executing tests of data processing system to ensure functioning of data processing activities and security measures</li> <li>• encrypting data transmissions and erecting firewalls to conceal confidential information as it is being transmitted and to keep out tainted digital transfers</li> <li>• create good security policies so that the organisation can be adequately protected from any cyber security risks</li> <li>• respond to cyber security incidents, assess the damage done and quickly recover from it possess specialised skill sets like penetration testing, malware analysis, forensics</li> </ul>
19.	IT/Cyber security operations analyst/engineer	<p>They perform operational tasks for the processes and subordinate procedures of Security Operational Centres (SOCs).</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• monitor the SOC main channel for security events and close or escalate security events where necessary</li> <li>• monitor network traffic and web server logs to watch for any suspicious activities on the network</li> <li>• analyse and respond to security incidents detected in the network</li> </ul>
20.	Data analyst/Data scientist	<p>They apply computing and statistical research methods to analyse and model complex data to achieve business objectives (performance improvement, optimisation, cost cutting etc). They also conduct simulation and study of solutions, visualisation of large data sets and present them to management for further actions.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• parse and manipulate raw, complex data streams to prepare for loading into an analytical tool</li> <li>• data conditioning - transform data into a usable state using appropriate tools and techniques</li> <li>• data integration, combining different data sets to improve the usability and the quality of the data</li> <li>• evolve and enhance systems and tools for data analysis and visualisation</li> <li>• recommend and implement data models to enable or speed up the analysis of data, and query databases or data structures effectively to retrieve data for analysis</li> <li>• explore data sets to identify and understand patterns, develop hypotheses and verify them based on analysis of data, using statistical, algorithmic and other mathematical techniques for the purpose of describing a problem or predicting an outcome</li> <li>• research new ways for modelling and predicting behaviour of customers, urban systems, machine systems or any other domain</li> <li>• implement a set of techniques within computer code for the analysis of data, using relevant programming languages and processing techniques</li> <li>• work with IT teams to define the analytics environment to deliver relevant solutions for key business needs and growth</li> <li>• interpret and articulate findings in written, verbal, visual form or computer programs, so as to help internal and/or external stakeholders understand the insights from the data</li> <li>• translate data and findings into addressable info that can help businesses interpret sales trends, marketing intelligence, logistics info etc. to make better business decisions.</li> <li>• measure, observe and analyze the effects of implementation of prior analytics insights, and devise methods for the improvement of an analytical model.</li> </ul>

No.	Job role	Description
21.	Machine Learning/Artificial Intelligence (AI) Engineer	<p>Machine learning engineers are sophisticated programmers who develop machines and systems that can learn and apply knowledge without specific direction. Artificial intelligence is the goal of a machine learning engineer. They are computer programmers, but their focus goes beyond specifically programming machines to perform specific tasks. They create programs that will enable machines to take actions without being specifically directed to perform those tasks. An example of a system a machine learning engineer would work on is a self-driving car.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• planning, directing and coordinating infocomm research and development activities, in-house or commissioned from external research organisations</li> <li>• to develop new or improved technical processes, products or utilisation of materials.</li> <li>• apply machine learning, collaborative filtering, natural language processing, and deep learning methods to massive data sets</li> <li>• create machine learning models in situations where the data is sparse and high-dimensional; write and build modern machine learning data models, including neural networks to preserve and maintain conversational context and intent with a user</li> <li>• build data models and algorithms for entity extraction from unstructured natural language queries</li> <li>• develop normalization algorithms</li> <li>• drive the machine regression / classification and normalization pipeline</li> <li>• develop accurate visual search and recognition systems, leveraging deep learning and machine learning</li> <li>• analyze and improve the efficiency, scalability, and stability of various production systems</li> <li>• assist the implementation and deployment of systems used for natural language input and processing, data collection, machine learning model training, and deployment of machine learning models</li> <li>• deploy production grade Intent classifiers to classify multi-intent natural language queries and conversational input</li> <li>• patent drafting for the development of the technology</li> <li>• familiar with Agile methodology, project management principles and software development lifecycle practices</li> </ul>
22.	Infocomm research & development (R&D)	<p>They plan, direct and coordinate infocomm research and development activities of an enterprise or organisation or of enterprises that provide infocomm related services to other enterprises and organisations.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• planning, directing and coordinating infocomm research and development activities, in-house or commissioned from external research organisations</li> <li>• develop new or improved technical processes, products or utilisation of materials.</li> </ul>
23.	Infocomm marketing & sales manager	<p>They are responsible for meeting sales quota and developing sales strategies that maximise sales opportunities and achieve higher growth. They are also tasked with the critical role of overseeing the generation of sufficient leads to achieve sales goals and ensure desired outcomes. They are responsible for the overall resource management and deployment of the sales teams.</p>
24.	Infocomm marketing & sales representative	<p>They represent companies to sell various infocomm goods and services to businesses and other organisations and provide specific information as required.</p> <p>Job scope:</p> <ul style="list-style-type: none"> <li>• soliciting orders and selling goods to retail, industrial, wholesale and other establishments</li> <li>• selling equipment, supplies and related services to business establishments or individuals</li> <li>• obtaining and updating knowledge of market conditions and of employer's and competitors' goods and services</li> <li>• providing prospective customers with information about the characteristics and functions of the products and equipment for sale, and demonstrating its use or qualities</li> <li>• quoting prices and credit terms, recording orders and arranging deliveries</li> <li>• reporting customers' reactions and requirements to suppliers and manufacturers</li> <li>• following up with clients to ensure satisfaction with products purchased.</li> </ul>



No.	Job role	Description
25.	IoT Engineer (sensors, devices, gateways)	<p>Job scope:</p> <ul style="list-style-type: none"> <li>perform the mechanical and electrical design of the IoT sensor, devices, gateways.</li> <li>collaborate with the software team on the development of the firmware, OS and applications for the IOT sensors, devices and gateways.</li> <li>develop and interface IoT edge connectivity gateways to sensors, devices, machines, industrial programmable logic controllers and their respective network communications protocol of the IoT applications to a storage platform such as cloud based infrastructure</li> <li>perform IoT edge connectivity gateways hardware and software integration and testing.</li> <li>have knowledge on IOT communications protocols, such as Bluetooth/BLE, WiFi, Zigbee, 6LoPAN, LoRA, wirelessHART,</li> <li></li> </ul>
26.	Embedded Systems/Firmware Developers	<p>Job scope:</p> <ul style="list-style-type: none"> <li>develop firmware/embedded software including requirement definition, design, implementation, testing and documentation.</li> <li>develop and deploy end-to-end IOT solution which include interfacing the hardware (i.e. smart devices/sensors), gateways with software (platforms and applications) using IOT protocols such as ZigBee, Z-Wave, or BLE, CoAP, MQTT, OMA-LWM2M</li> <li>develop and manage APIs to interact/interface with various components of IOT solution, e.g. connecting smart devices to the cloud, exposing the data collected to the applications, interfacing legacy system to IOT services, etc.</li> <li>write, verify and optimize codes sets to control or use IOT devices and/or interface with IOT platform/back-end systems</li> <li>design, perform validation, prototyping and testing of embedded software or IOT solution</li> <li>write, verify and optimize codes sets to control or use IOT devices and/or interface with IOT platform/back-end systems</li> <li>design, perform validation, prototyping and testing of embedded software or IOT solution</li> </ul>
27.	IoT Solution Architect/IoT Architect	<p>Job scope:</p> <ul style="list-style-type: none"> <li>collaborate with business stakeholders and partners to analyse and determine their top business problems, propose, design or architect an IoT solution that will solve the problem/deliver value to the business, build a business case to justify the ROI, build an IoT solution prototype, select vendors, and finally, deploy the solution, at scale, across the enterprise.</li> <li>translate client's business requirements into specific IOT system applications, and process designs while developing functional requirements and solutions designs complete with appropriate TCO and ROI assessments.</li> </ul>
28.	Writer (e.g. Screenwriter, Copywriter, Author, Publishing/Advertising Editor)	<p>The Writer researches, fact-check and conceives original ideas for characters, content, and narratives which acts as the skeleton and blueprint of the creative vision for the story. He/she then develops their ideas into an outline, crafts dialogues and then a script. He/she may be involved in the editing and proofreading of content such as script, features, articles and copies for different platforms in alignment to the subject matter, writing style and content strategy.</p>
29.	Director (e.g. Film Director, Art Director, Creative Director, Director of Photography )	<p>The Director is responsible in setting and maintaining the style and creative structure of the media content and his/her role may differ in different capacities to make crucial decisions in accordance to the creative direction. The Film Director makes decision on the cast, crew, location as well as refining the script. During production and post-production, he/she then composes shots, directs rehearsals and the performances of the cast, leads the technical aspects such as camera, sound, special effects and video editing to ensure the look, sound and feel are faithful to the creative style and structure.</p> <p>The Director of Photography (DOP) creates the visual identity, or look, of the media content by working with the Director, camera crew, lighting department and production design department. He/she manages all aspects of filming: from deciding the equipment required, making decisions on lighting, framing and camera movement to reviewing and enhancing the footage.</p> <p>The Creative Director works closely with producers and designers to develop proof of concept and proposals to pitch for creative briefs. He/she also oversees the creative process which includes planning of advertising and promotion activities. The Art Director defines, guides and promotes the visual and artistic direction, keeping the consistency throughout the project, and works with the Creative Director to ensure the direction is aligned with client requirements.</p>

No.	Job role	Description
30.	Editor (e.g. Art Editor, Film or TV Editor)	The Editor (e.g. Art Editor, Film or TV Editor) is responsible for assembling recorded raw material to select the best takes, check for mistakes and edit into a finished product that is suitable for broadcasting. Material may include camera footage, dialogue, music, sound effects, graphics and special effects.
31.	Artist, Modeller, Visual Effects Designer, Animator (e.g. Game Artist, 3-D Modeller)	Artist, Modeller, Visual Effects Designer and Animator (e.g. Game Artist, 3-D Modeller) typically work in unison to create the visual elements (concept art, storyboards, prototypes, characters, objects, textures, environment, and game levels) in the development of screen media content. This illustrates the narrative, and forms the overall look and mood of the content. Modellers also create character skeletons, which animators then control. The role of a 3-D Modeller may occasionally extend beyond creating visual elements solely for games and animation.
32.	Games Designer	They devise what a game consists of and how it plays. They plan and define all the elements of a game: its setting; structure; rules; story flow; characters; the objects, props, vehicles, and devices available to the characters; interface design; and modes of play.
33.	Online Creator Online Video Content Creator	The Online Video Content Creator researches, conceptualises, produces and markets his/her original video content for consumption and distribution on digital platforms. He/she is able to take n different job tasks such as cinematography, production, directing and editing to take ownership of the content from beginning to completion of content creation. He/she connects with his/her fan base who regularly consumes their content on the digital platforms, and convey the narratives behind the brands/content they create and/or represent to the fan base and masses beyond.
34.	Audio/Sound Designer	The Audio/Sound Designer plans, acquires, chooses and provides the sound effects in the media content, including music, hence in charge of the soundscape of the content that changes, evolves and enhances the overall impact of the narratives. He/she work closely with the Director to align the soundscape to the style and creative structure of the content. He/she also work closely with the audio/sound crew who are in charge of the technical and mechanical aspects of music and sound, such as recording, mixing and reproducing.
35.	Production Designer for Film/TV	The Production Designer for Film/TV is responsible for the visual concept of a film or television production. He/she defines and manages the design style for sets, locations, graphics, props, lighting, camera angles and costumes, while working closely with the director and producer. He/she studies, recommends visual elements through idea boards, sketches and drawings to the relevant prop department, and assess whether special or visual effects should be used instead.
36.	Executive Producer, Producer, Advertising Account Executive/Manager	The Executive Producer/ Producer acts as project supervisors of the media content to ensure the project is completed on time and on budget. Their duties can range from administration for presales and distribution agreements, production scheduling, securing finances and rights to supervision and quality control of the content to meet industry and market specifications. The Advertising Account Executive/Manager develops, manages and expands businesses with his/ her portfolio of accounts, and seeks to achieve or over-achieve clients' objectives by monitoring sales forecasts, formulating holistic marketing plans and suggesting enhancements to existing advertising efforts. He/she oversees all aspects of the project flow, participate in strategy development and ensure smooth progress at every stage and that campaigns are delivered on brief and on time.
37.	Marketing and Publicity Executive/Manager of Media IP	The Marketing and Publicity Executive/Manager of Media IP is responsible for enhancing the media content's visibility and raising the public or target audience's awareness and demand of the content across different medium and platform, e.g. online/ social media. Taking consideration of the clients/distributors/partners' needs and requirements as well as markets' preferences, his/her duties includes analysis of market trends, planning and implementation of sales, marketing and product customisation plans/campaigns/activities, overseeing creation and delivery of press and publicity releases as well as marketing collaterals/assets.
38.	Sales and Distribution Executive/Manager of Media IP and Advertising Inventory	The Sales and Distribution Executive/Manager of Media IP and Advertising Inventory looks for distribution and marketing opportunities by developing plans, liaising and negotiating with sales and distribution agents or companies to expand the reach to more target audiences. He/she must provide regular financial evaluation and updates for their clients, including a breakdown of expenses, revenue forecast and breakdown for each media IP and advertising inventory.

No.	Job role	Description
39.	Infocomm operations roles	<p><b>Website administration</b>  They maintain, monitor and support the optimal functioning of Internet and Intranet website and web server hardware and software.  Job scope:</p> <ul style="list-style-type: none"> <li>• installing, monitoring and supporting the reliability and usability of Internet and Intranet websites or web server hardware or software</li> <li>• developing and maintaining documentation, policies and instructions, recording operational procedures and system logs</li> <li>• developing, coordinating, implementing and monitoring security measures</li> <li>• analysing and making recommendations to enhance performance, including upgrading and acquiring new systems</li> <li>• liaising with, and providing guidance to, clients and users</li> <li>• modifying web pages</li> <li>• performing web server backup and recovery operations.</li> </ul> <p><b>Computer systems operator</b>  They support the day-to-day processing, operation and monitoring of information and communications technology systems, including local and wide area networks (LANs and WANs), and hardware, software and related computer equipment to ensure optimal performance and identify any problems.  Job scope:</p> <ul style="list-style-type: none"> <li>• operating and controlling peripheral and related computer equipment</li> <li>• entering commands, using computer terminal, and activating controls on computer and peripheral equipment to integrate and operate equipment</li> <li>• monitoring systems for equipment failure or errors in performance</li> <li>• notifying supervisor or maintenance technicians of equipment malfunctions</li> <li>• responding to programme error messages by finding and correcting problems, escalating the problem to other staff or terminating the programme</li> <li>• reading job set-up instructions to determine equipment to be used, order of use, material such as disks and paper to be loaded, and control settings</li> <li>• retrieving, separating and sorting programme output as needed &amp; sending data to specified users</li> <li>• loading peripheral equipment, such as printers, with selected materials for operating runs, or oversee loading of peripheral equipment by peripheral equipment operators.</li> </ul> <p><b>Computer technician (including IT user helpdesk technician)</b>  They provide technical assistance to users, either directly or by telephone, e-mail or other electronic means, including diagnosing and resolving issues and problems with software, hardware, computer peripheral equipment, networks, databases and the Internet, and providing guidance and support in the deployment, installation and maintenance of systems.  Job scope:</p> <ul style="list-style-type: none"> <li>• answering user inquiries regarding software or hardware operation to resolve problems</li> <li>• entering commands and observing system functioning to verify correct operations &amp; detect errors</li> <li>• installing and performing minor repairs to hardware, software, or peripheral equipment, following design or installation specifications</li> <li>• overseeing the daily performance of communications and computer system</li> <li>• setting up equipment for employee use, performing or ensuring proper installation of cables, operating systems, or appropriate software</li> <li>• maintaining records of daily data communication transactions, problems and remedial actions taken, or installation activities</li> <li>• emulating or reproducing technical problems encountered by users</li> <li>• consulting user guides, technical manuals and other documents to research and implement solutions.</li> </ul> <p><b>Computer and related electronic equipment mechanic</b>  They install, repair and maintain telecommunications equipment, data transmission equipment, cables, antennae and conduits and repair, fit and maintain computers.  Job scope:</p> <ul style="list-style-type: none"> <li>• maintaining, troubleshooting, testing and repairing computers, data transmission equipment and computer peripherals</li> <li>• fitting and adjusting computer hardware</li> <li>• installing, maintaining, repairing, and diagnosing malfunctions of microwave, telemetry, multiplexing, satellite and other radio and electromagnetic wave communications systems</li> <li>• providing technical advice and information, and monitoring the performance of complex telecommunications networks and equipment</li> <li>• installing and repairing cabling for computer, radio, telephone and television transmission</li> <li>• joining telecommunications and data cables and sealing sheathes</li> <li>• installing, maintaining and repairing antennae used in communications</li> </ul>

No.	Job role	Description
40.	Project Managers of Media IP (eg. Assistant Director, Production Manager, Line Producer, Post-Production Supervisor)	The Project Manager is responsible for all the operational aspects of production to make sure the project run smoothly, meet deadlines and stay within budgets. His/her reports to the Producer and Executive Producer with duties including estimating budgets during pre-production, assisting producers to recruit production team, engage suppliers, negotiate engagement agreements, rent and/or procure materials and resources, drawing up and keeping to the production schedule, supervise and report expenses, and enforce compliance to regulations and agreements.
41.	Production Crew	<p>The production crew carries out the technical aspects to providing the visual and audio elements of the TV and film content. They report to various heads of department in charge of camera, production, sound, art/set/production design etc.</p> <p>For instance, crew members in the camera department work closely with the Director of Photography and Director to prepare and maintain camera equipment as well as operating the equipment to achieve the desired shoots. Lastly, they are responsible in transferring the raw footages to the Editor without any data loss or corruption.</p>