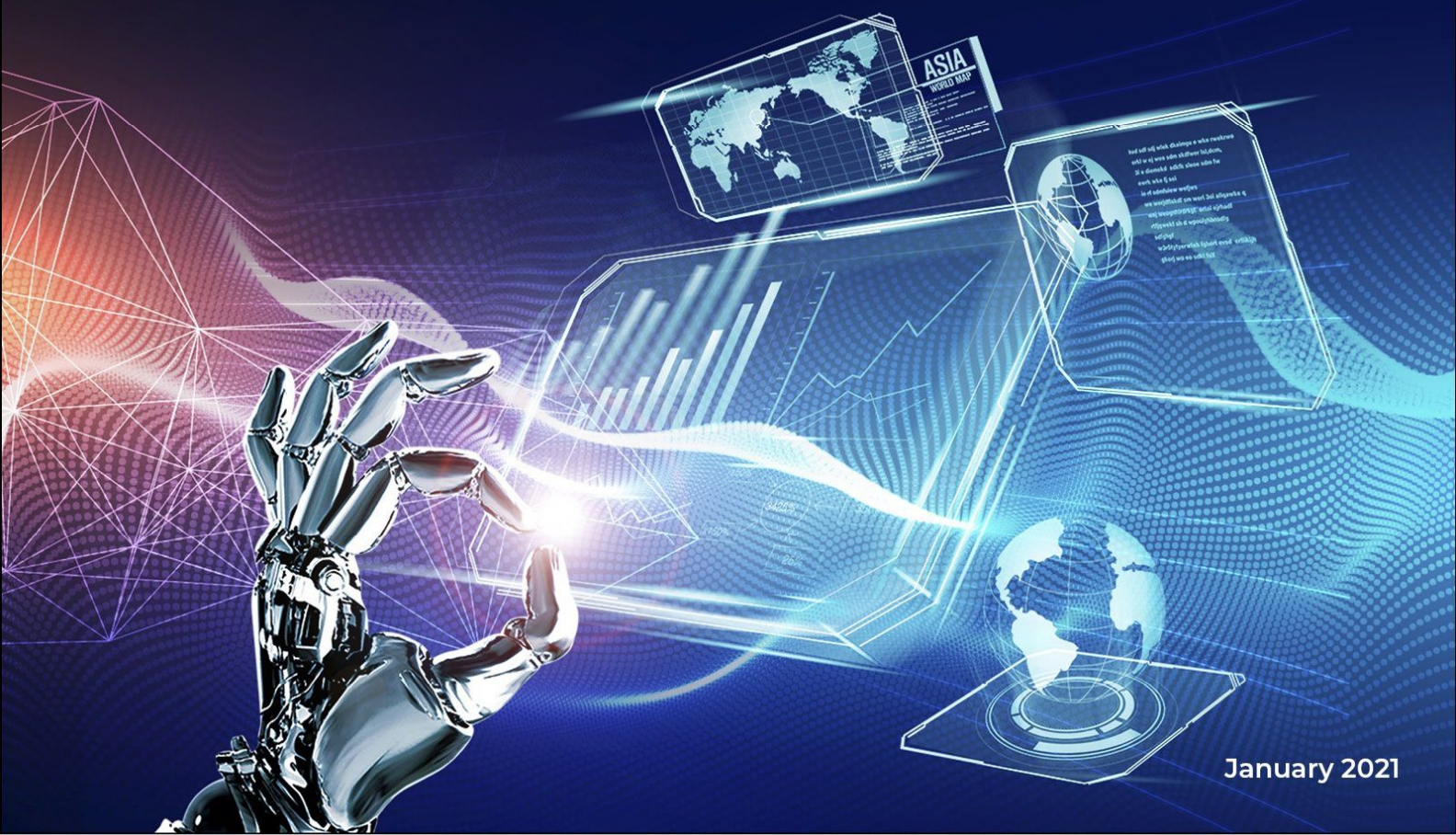
LEVERAGING ICT INNOVATION IN THE CENTRAL INFORMATION SYSTEMS DIVISION



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Editorial Team

Abstract

CISD has moved from a traditional ICT support division of the Ministry of Information Technology, Communication and Innovation, embracing emerging technologies to enhance its performance in the Civil Service. It has brought innovations into its day-to-day activities so as to better service its users with a limited number staff. CISD management has adopted a strategic approach in its service delivery. A range of initiatives and innovative solutions have been implemented, both for internal use as well as for other Ministries/Departments. These solutions are namely:

(i) The adoption of certifications like ISO 9001 for quality management and ISO 27001 for information security;

(ii) The implementation of an Open source VoIP system to reduce telecommunication charges;

(iii) The implementation of a Chatbot with live agent support on CISD's website to automate answering of queries pertaining to problems of IT equipment encountered by users;

(iv) Modernisation of websites of Ministries/Departments to leverage on emerging technologies;

(v) The use of Data Analytics for visualisation and prediction based on data available at the CISD;

(vi) Improvement in the payroll system, which is used to process data for around 55,000 employees of the Civil Service;

(vii) The adoption of a well recognised Project Management standard for efficient management of ICT projects initiated within CISD;

(viii) The use of Speech Technologies to assist in creation and collation of documents;

(ix) The elimination of repetitive tasks by using Robotic Process Automation (RPA);

(x) The monitoring of applications and servers in real time by the Command and Control Centre (CCC) to ensure proactive problem resolution.

All the above, which exclude the traditional ICT support activities (related to database administration, commissioning, network administration, onsite PC and printer troubleshooting and application development), are discussed in this e-book.

List of Abbreviations

AI	Artificial Intelligence
API	Application Programming Interface
ATA	Analogue Telephone Adapter
BI	Business Intelligence
CCC	Command Control Centre
CISD	Central Information Systems Division
COBOL	Common Business Oriented Language
CPU	Central Processing Unit
DBA	Database Administrators
DPD	Data Processing Division
EDA	Exploratory Data Analysis
FAQ	Frequently Asked Questions
FORTRAN	Formula Translation
FTP	File Transfer Protocol
GOC	Government Online Centre
GUI	Graphical User Interface
HD	High Definition
HPO	High Performance Organisation
HTTP	Hyper Text Transfer Protocol
ICT	Information and Communication Technology
IP	Internet Protocol
ISO	International Organization for Standardization
ISMS	Information Security Management System
MCSA	Microsoft Certified Solutions Associate
ML	Machine Learning
MPSAIR	Ministry of Public Service, Administrative and Institutional Reforms
OAC	Oracle Analytics Cloud
OCA	Oracle Certified Associate
OCP	Oracle Certified Professional

OTSU	Oracle Technical Support Unit
PC	Personal Computer
PLC	Project Life Cycle
PMBoK	Project Management Body of Knowledge
PMI	Project Management Institute
PMP	Project Management Professional
PSTN	Public Switch Telephone Network
RPA	Robotic Process Automation
SIP	Session Initiation Protocol
SQL	Structured Query Language
VoIP	Voice over Internet Protocol
WAN	Wide Area Network

Chapter 1

Introduction

1.0 Introduction

Globalisation of businesses, fierce competition and the need for higher productivity are factors that are compelling organisations to rethink their strategies for higher performance. High Performance Organisations (HPOs) are emerging to cater for higher efficiency and effectiveness. HPO is a concept attributed to any organisation that has focused on certain factors to yield higher performance. With higher performance, the organisation benefits from higher productivity, profit and reputation, among others. So far, there is no single set of standardised factors that has been put forward to help organisations achieve their goals.

However, Public Sector organisations do not aim for profit as they act as facilitators and offer services to the public and businesses. These organisations are required to provide citizen-centric services as well as facilitate growth of private organisations. There are also public sector organisations that support other public sector organisations in their activities. As ICT support is such a service that can contribute towards the provision of citizen and business centric services, this e-book will reveal the means by which Central Information Systems Division (CISD) has improved its ICT support services, while overcoming the challenges of constantly evolving technologies and the high expectations of their clients. This e-book also demonstrates the success of the division in boosting its performance by leveraging on ICT innovations. It is to be noted that a plethora of software tools and techniques has emerged over the past few years to help in delivering services efficiently.

1.1 Background

ICT Organisations, whether Public or Private, are compelled to increase productivity and meet the expectations of their clients. Stakeholders, like the client organisations (Ministries and Departments) and citizens are more and more demanding. In the case of

private ICT organisations, competition has evolved from a local to a global dimension as geographical barriers tend to shrink and disappear with the increasing use of the Internet. Global organisations are now adopting the "follow the sun" practice for round-the-clock services. Leaders and Managers are in constant search of means to effectively and efficiently transform their organisations to achieve superior performance.

The need for higher expectations puts extra pressure on ICT service organisations. The CISD, being aware of such expectations, has leveraged on ICT innovations to transform itself by boosting its performance.

1.1.1 Evolution of the CISD

The CISD, formerly known as Data Processing Division (DPD), was created in 1971. It started its operations with the use of punched card machines. Programs and data were represented by holes punched in paper-based cards called punched cards.

With evolution in technology, two ICL computers were acquired and these equipment made use of magnetic media (magnetic tape and disk packs to store the data). Programming tasks were raised to a higher level with languages like COBOL (COmmon Business Oriented Language) and FORTRAN (FORmula TRANslation). The DPD handled computerisation tasks centrally for the entire Civil Service as well as for Local Authorities and some parastatal organisations as personal computers were not yet available. The DPD adopted a batch processing mode, whereby data was received, hand-written on forms and subsequently entered by data entry staff. Processing was performed on specific dates and lists of resulting information were printed and sent back to Ministries and Departments. No internet connection or other communication lines were available for online systems.

Further evolution in technology, namely the arrival of personal computers and networks led to decentralisation of computerisation. Ministries and Departments started to procure their own computer equipment to handle their computerisation tasks, thereby relieving the DPD to some extent.

However, this relief was short lived. The newly set up division, CISD, soon got into new areas like networking and database management. As Ministries and Departments had their own IT sections, they required IT staff to man their computer equipment and software. Requests were obtained to post CISD staff in IT sections of various Ministries and Departments.

1.2 Current Status

With evolution in technology, significant transformation has occurred within the CISD to meet the challenges. In terms of structure, now, the division has 2 main sections namely the Technical section (Analyst cadre) and the Operations section (Technical Support and Data Entry cadre).

There are also the Registry, Human Resources, Procurement and the Finance sections providing administration support to the division.

CISD is currently providing services in web development, open source application development, remote monitoring of systems, wide area networking, email administration, in addition to PC and printer troubleshooting tasks.

However, it is to be noted that CISD continues to process data for all employees of the Civil Service (currently some 55,000 employees are concerned). This responsibility is considered as a priority task to allow employees to receive their salaries on time. Although this service is largely unknown among Government employees, it is to be noted that internally, it is a monthly challenge to mobilise staff for the payroll process. Often, CISD staff are not released from their sites to attend to payroll processing. It is important that responsible Officers from Ministries and Departments are aware of the importance of CISD calling back its Officers for payroll processing to serve all Government employees by ensuring that they obtain their salaries on time.

1.2.1 Mission of the CISD

Providing Reliable, Timely and Cost-Effective ICT Support Services to Government Institutions.

1.2.2 Vision of the CISD

To achieve excellence in the provision of State-of-the-Art ICT Support Services to the Civil Service.

1.2.3 Staffing of the CISD

The total number of staff as at November 2020 stands at 206. Around 75 of them are located in the Headquarters, while the rest are posted in various Ministries and Departments.

1.2.4 Organigram

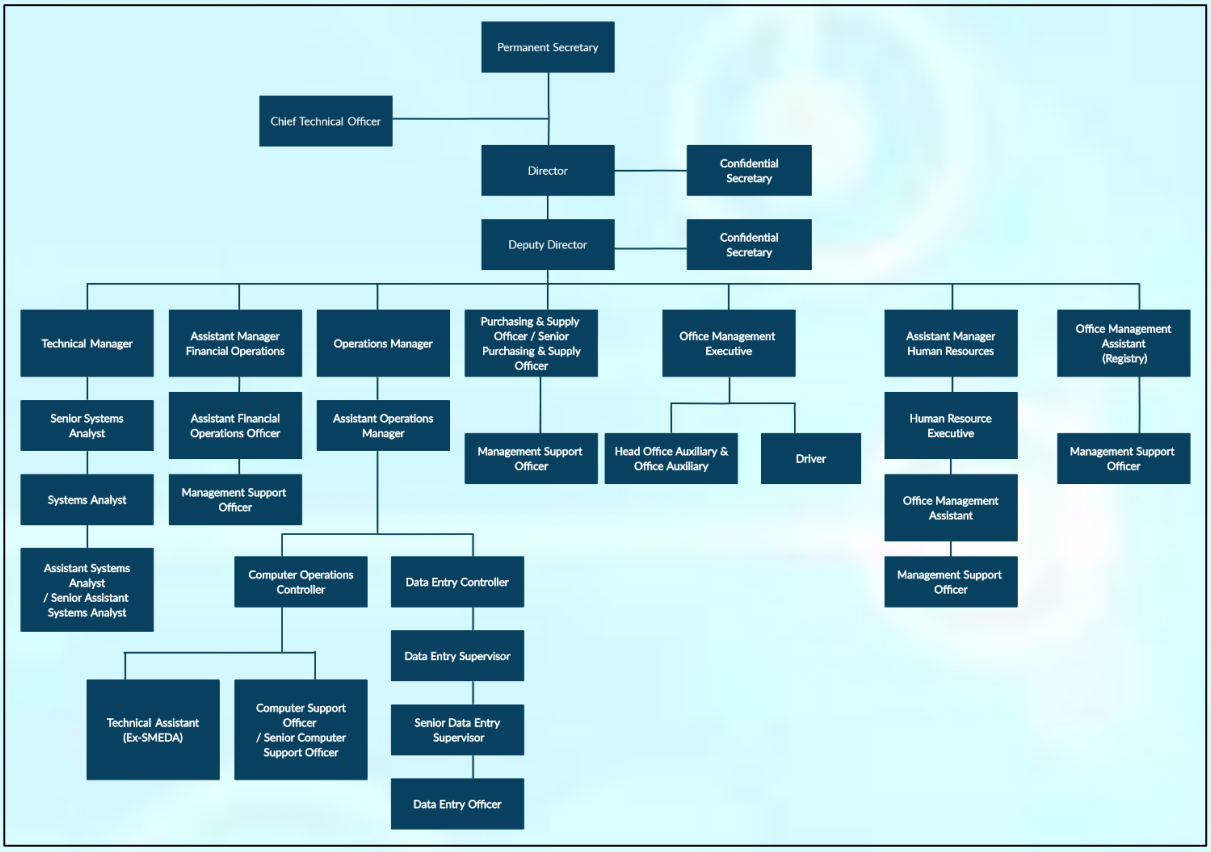


Figure 1: Organigram

1.2.5 Support Services

These constitute:

(i) Maintenance of the Payroll System for all the employees (around 55,000) of Ministries/Departments. The current Payroll System has been in operation for

several years and is expected to be replaced by a new system.

(ii) Development and maintenance of websites for client organisations. All Ministries/Departments have their websites, maintained by the staff of CISD. The websites are centrally hosted at the Government Online Centre. Staff involved in the maintenance activities work either at Headquarters or are posted in Ministries/Departments. They also provide other ICT services like database administration, network administration among others.

(iii) Administration of Email Services for Ministries/Departments, comprising the creation and maintenance of user accounts. Currently, there are around 7,000 email accounts and there is a plan to provide all employees of Government with an email account.

(iv) Administration and troubleshooting of a Wide Area Network (WAN) comprising all Ministries/Departments. The activities involved are:

a) Configuration, administration and commissioning of the networking equipment (currently around 250 switches and routers).
b) Remote monitoring of WAN
c) Troubleshooting of malfunctioning networking equipment and resolving the problems within a short timeframe.

(v) Technical assistance in the choice of computer hardware, software and related services.

a) Upon request, CISD provides assistance in the choice of hardware, software and related services.
b) Evaluation of proposals for computer equipment and Information Systems following call for tenders.

(vi) Application Development and implementation

a) Ministries/Departments request the services of CISD for the development of small and medium-sized software applications.

b) These software applications are maintained centrally by the Application Development Unit of CISD.

(vii) Database, System and Network Administration

a) Many Database systems are in use in various Ministries/Departments. These databases are maintained by CISD.

b) Upon request, installation and configuration of Windows Server and Linux is also performed by CISD.

c) Network administration, maintenance and troubleshooting of ICT equipment at various Ministries/Departments are carried out by CISD.

(viii) Commissioning of computer equipment

Commissioning of ICT equipment (e.g. PCs, printers, servers, routers, etc.) for Ministries/Departments is carried out by CISD. This exercise pertains to the verification of the computer equipment against the specifications requested.

(ix) First-Level technical support on ICT equipment and software

(i) Technical staff of CISD attend to first-level support on ICT equipment and software.

(ii) Recommendations for repairs by suppliers are provided to clients when required in case hardware/software supplier interventions are required.

(x) Provision of Central Backup Service for Ministries/Departments

CISD collects backup media from various Ministries/Departments, on which backup of data has been carried out by its IT staff, and keeps them in a safe offsite location. This procedure ensures business continuity in the event of a disaster.

(i) The technical staff operate from CISD or are posted in Ministries/Departments to troubleshoot Computer equipment problems. They are regularly trained on latest technologies/equipment being used.

(ii) There is a Help Desk facility, which operates within Office hours to assist Ministries/Departments, where there are no CISD staff posted.

(iii) Running of the payroll is one of the activities grouped under the mandate of the technical support staff.

(iv) Provision of experienced support staff to service ad-hoc events for Ministries/Departments. Such events include conferences, training sessions and presentations.

(xi) Data Capture

(i) Upon request, CISD provides dedicated Data Entry staff to populate databases of application systems in various Ministries/Departments.

(ii) Data Entry staff input data for the payroll at the beginning of each month.

1.3 Aim of this E-Book

The aim of this E-Book is to highlight the importance of CISD in the provision of ICT services to Government and also to show how its services have evolved to meet the expectations of its user community.

Moreover, this e-book will provide information on how CISD has leveraged on innovative technologies to enhance its services and at the same time give a boost to its performance. Such technologies can also help other Ministries/Departments in enhancing their services.

1.4 Structure of this E-Book

This E-Book is divided into 8 chapters as follows:

- In chapter 1, Introduction, the scene is set by providing a background information about CISD, its portfolio of activities and the structure of this e-book.

- In chapter 2, **Enhancing Support through Certifications**, the benefits of certifications are discussed. Both certifications of the organisation and the staff have been mentioned.

- In chapter 3, the implementation of an **open source VoIP** solution is explained. This has enabled communication among CISD staff (within the head office as well as with staff posted in Ministries and Departments) free of telecommunication charges.

- In chapter 4, the **Provision of ICT support services through Chatbot** is highlighted. The Chatbot is an automated system replying to queries of users with respect to problems encountered with the use of computer equipment. In addition, e-payslip queries are also included. A Chatbot relieves Computer Support Officers from replying repeatedly to common questions asked by users.

- In chapter 5, the work conducted in the **Modernisation of Government websites** is explained. The evolution in templates used is also discussed. The need to embrace new technologies is not an option, but a necessity given the new features available.

- In chapter 6, **Data analytics** is discussed as a means to process the large volume of data available. The importance of visualisation to summarise information is an advantage derived from this new area of data analytics.

- In chapter 7, improvement in CISD's **E-payroll** system is explained starting with e-payslip, through capture of data in a decentralised manner by finance sections, to a paperless environment. CISD has continued to maintain the payroll system by taking proactive measures to provide new facilities to its users.

- In chapter 8, the **Project Management** methodology, PMBoK that CISD has started to use to manage its projects is explained.

- In chapter 9, **Speech Technologies** used in CISD are explained.

- In chapter 10, **Robotics Process Automation** to automate repetitive tasks is exposed.

- In chapter 11, the role of the **Command and Control Centre** is discussed.

1.5 Conclusion

In this chapter, the aim of this e-book has been provided. Background information has been highlighted to enable the reader to understand the role of the CISD, which is not well known within the Civil Service. In addition, the main services of the division have been described. The organigram shows the different grades in the division. Again the roles of the different technical staff, namely analyst and support cadres, lead to confusion and are often a source of conflict and this has been cleared in this chapter.

Chapter 2

Enhancing support through Certifications

2.0 Introduction

Certification is a way to ensure that an organisation has achieved a certain standard in its services and continues to improve its processes. CISD has strived to achieve two certifications, namely ISO 27001 for Information Security in the entire division and ISO 9001 for Quality Management in its Operations section. In addition to these certifications, CISD has ensured that its staff also acquire certifications to pitch their knowledge and skills to global standards. As such, they have been encouraged and sponsored to acquire certifications like Oracle Certified Professionals, ISO Lead Auditors, Microsoft Certified Solutions Associate and Artificial Intelligence Analysts. More staff are following other training courses like Cyber Security and Linux courses with a view to get certified and eventually offer specialised support.

This chapter provides details on the certifications received by the division as well as the staff. These certifications are proof of the professional skills available within CISD. These skills are necessary given the evolution of the ICT sector and the complexity of technologies being deployed.

2.1 The Importance of Certifications

The International Organization for Standardization (ISO) is an independent, non-governmental, international organisation that develops standards to ensure the quality, safety, and efficiency of products, services and systems. Specifications for products, services, systems and procedures are used to measure the level of excellence. Ensuring a consistent approach is important for interoperation of systems and to minimise defects in products and to provide an acceptable level of service.

Furthermore, the purpose of standardisation is to streamline production in various organisations/industries to ensure the consistency and safety of products, and the promotion of global collaboration and compatibility.

Professional certifications for employees are also important to provide proof that they have acquired a level of knowledge and skill with a guarantee that their services have been assessed to have attained a high standard. Certifications ascertain that the employees have the necessary knowledge and experience by displaying practical skills. Certificate programmes set out a specific period of learning and training. After successful completion of the certificate programme validated by an examination, a certificate is awarded. Certificate programmes are suitable for training individuals in a specific and specialised task or to develop competences in a particular skill. According to Jain (2020), professional certifications are important for:

- Improved opportunities for employment. Many companies value professional certifications more than academic qualifications. The CISD lays a lot of emphasis on certifications to professionalise its services. Ministries and Departments have benefited from certified professionals of the Oracle Technical Support Unit of the CISD. Instead of paying huge amounts of money to private companies, the CISD has been providing Oracle support, which would have been costly if such services were requested from private companies.

- Accessing community involvement benefits. Certification allows professionals to share information in a community and hence form part of a network with a common aim to perform better in an area of expertise. Reliable guidance can be obtained from the community of experts, thus improving one's career and serving the users better. Certified professionals can also keep up to date on latest development. Certified professionals can also act as a peer support group in order to contribute to the subject knowledge and learn at the same time.

- Better opportunities for job retention. Employers benefit a lot from certified professionals, who justify their importance in the organisation. The importance of certification for professionals is in the form of job retention prospects. A

certification helps one to prove one's case for required skills and knowledge.

- Advancement in one's career. Certification can also justify the merit of employees for promotions. It also helps in proving knowledge, skills and abilities acquired in new technologies, skills, and abilities thus leading to advancement in one's career.

- Establishing professional credibility. Certification demonstrates professional credibility in applying knowledge in an area. This is the case with Oracle, Microsoft, and other products. Many companies recruit staff with specific certifications to perform specific tasks. Even Project Management certifications, like PMP (Project Management Professional from the well-known Project Management Institute), are requirements for certain projects.

- Productivity and competitive advantage for organisations. Certified professionals can, without doubt, help organisations to perform better. Professionals with certifications engage better in their organisations by improving their capabilities in addressing a particular job. Therefore, organisations achieve better productivity with certified professionals.

  Profit-making organisations also attract more projects with a highly skilled workforce backed by certifications. Organisations that encourage their employees to pursue professional certifications receive additional credibility in the market. The importance of certification is visible in the form of the reputation of an organisation as a supporter of employees' professional development. Therefore, such organisations can also attract more clients and remain competitive.

- Staying relevant to the existing professional landscape. A certification in a particular technology is not an end in itself. It may require recertification/renewal to ensure that professionals are up to date in a particular area given that development in ICT is dynamic.

- **Showcasing uniqueness.** Candidates are required to invest considerable effort and time to clear certification exams. The difficulty in getting through successfully makes certified professionals stand out from the crowd. At the end, these professionals are able to show uniqueness in their approach to solve ICT problems and at the same time give their organisations a competitive edge over others.
- **Driving personal development.** Certifications drive a feeling of self-motivation, discipline, commitment and give professionals the ability to solve problems in a structured manner. Although they are intangible rewards, they highlight personal development and satisfaction to be among an elite group.

2.2 Certifications possessed by CISD

2.2.1 ISO 9001

ISO 9001, an internationally recognised certification, ensures quality of products and services of a company. CISD obtained ISO 9001:2000 certification in 2005. This certification has allowed the division's operations section to document its processes in order to service Ministries/Departments by maintaining a quality management system. The division was re-certified as follows: ISO 9001:2008 in 2010 and ISO 9001:2015 in 2018.

Several benefits (as mentioned by Cubucku (2015)) are reaped with ISO 9001 certification as listed below:

- Increased Credibility and Recognition: ISO 9001 certification is issued by International Organisation for Standardisation and is accepted worldwide. ISO 9001 certification increases the value of an organisation and also increases the status among its clients. It also confirms that the quality system has been tested successfully.
- Improved Consistency: ISO 9001 helps to increase the control of the business processes. The more the processes are controlled, the more the consistency increases. Increased consistency leads to a uniform level of quality service towards customers.
- Increased Customer Satisfaction: Better service is offered and there are less complaints and more satisfied customers.

- Empowered Employees: ISO 9001 certification requires the ongoing training and development of staff. Employees will be more knowledgeable of what they are doing and since they will be regularly trained, their careers will improve.

2.2.2 ISO 27001

ISO 27001 is an internationally recognised certification awarded to organisations having set up an Information Security Management System (ISMS). Data is an important asset that organisations possess. Confidentiality, Integrity and Availability are important security considerations for organisations handling data.

Since 2019, CISD has been awarded ISO 27001:2012 certification, thus proving its commitment to ensure the highest level of protection to data being stored and processed as per the standard. This standard has the following benefits for the division:

- It demonstrates a clear commitment for information security management to Ministries/Departments by addressing risks that can potentially affect the business operations.
- It provides a framework in the fulfilment of contractual and legal responsibilities.
- Increased reliability and security of its systems, thus providing necessary trust.
- Increased resilience of its system to provide a better service to its customers.
- Alignment with customer requirements, giving them the trust that their data are treated in a manner complying with the international standard.
- Continuous improvement of its processes to cope with new threats.

2.3 Certifications possessed by staff of CISD

2.3.1 Oracle Certified Professionals (OCP)

The Oracle Technical Support Unit (OTSU) has been actively involved in installation and troubleshooting Oracle products. Many large application systems in Government have Oracle as Relational Database Management Systems that hold large volume of data in a secure and reliable manner and at the same time providing high performance in terms of response time.

Most of the staff of OTSU possess the OCP certification, which is a prestigious and highly sought certification worldwide. This certification is obtained after following a rigorous training and successfully passing an exam. The prerequisites for this certification is another certification called the Oracle Certified Associate (OCA). Benefits have been noted with the certification of the staff as follows:

- Advanced support for Oracle databases at Ministry of Social Security, Public Service Commission and Infohighway systems. Outsourcing such services would have been costly to the Ministries/Departments concerned. In addition, prompt intervention of the OTSU staff is an advantage given their commitment and ability to resolve issues in order to reduce downtime of systems.
- Higher confidence of the staff in addressing issues related to Oracle products.
- Professional approach in solving problems in the shortest time given the skills and experience acquired through the certification programmes.
- Provision of training in Oracle database administration to other staff. As the certified professionals are well experienced, they are appropriate resource persons to train other staff, thereby reducing the training cost of the CISD.

2.3.2 ISO 9001 Lead Auditor Certification and Implementer's Certification

In order to implement the ISO 9001 framework, several staff of CISD followed the training to implement it. Some staff also had to follow the Lead Auditor Certification as they have the responsibility to conduct internal audit prior to external audit by the Mauritius Standard Bureau. The ISO 9001 team has shown a lot of commitment since 2005 to enable CISD to be awarded the certification as well as to maintain it.

2.3.3 Microsoft Certified Solutions Associate (MCSA)

Recently, one of our employee obtained his MCSA certification. This course has enabled the employee to have hands-on practice on installation, configuration and administration of Windows server and also acquire in-depth knowledge about creating and managing users and groups, network access and data security in windows server.

2.3.4 Artificial Intelligence Analyst Certification

The Artificial Intelligence Analyst Mastery certification is provided by IBM following a training in Artificial Intelligence Systems and an exam. Machine learning, Natural

Language Processing, Chatbots, Speech Recognition and Image Recognition are among the topics covered. A few staff have received the certifications and this led to adoption and exploration of some AI tools to help the division in enhancing its services.

The benefits of AI certification has been:

- Adopting AI solutions in CISD to enhance support services and for internal use.
- Exploring AI solutions that offer potential for implementation.

So far, a Chatbot with live chat has been configured and integrated on the website of the CISD. Details of the system is explained in chapter 4.

2.4 Way Forward

Specialised units have been set up at the CISD to enable the staff to acquire special knowledge, experience and skills. These units cover activities like Networking, Database administration, Application development, Web development & maintenance, remote monitoring of systems and research and testing of new technologies. It is important for the staff in the specialised units to get certified in Networking, Microsoft products and IT Security. These certifications will help the staff to perform their duties with confidence. Ministries/Departments will benefit from their services in various areas of specialisation.

2.5 Conclusion

Investment in certification provides numerous benefits to organisations. Thus, CISD has benefited from documenting its processes, enhancing its performance, professionalising its services and adoption of a structured approach towards ICT problem solving, among others. The way forward is for more certification courses to be provided.

Chapter 3

Open Source VoIP

3.0 Introduction

Voice over IP (VoIP) is becoming a significant aspect and useful medium in the field of communication. The introduction of high speed internet connection together with the usage of mobile phones has enabled the utilisation of this highly innovative voice communication technology. Traditional telephony, known as the Public Switched Telephone Network (PSTN) works through physical phone lines, cable systems and networks and allows users to make landline and cellular telephone calls. IP telephony, however, is much more versatile and enables voice, data and video to be transmitted to a variety of devices including smartphones, laptops, tablets and IP phones at a much lower cost. Some of the famous applications of VoIP include Skype, WhatsApp and Facebook Messenger. These applications are extensively being used across the globe.

Taking into consideration factors such as security constraints, reduction in communication cost and mainly reduction in CISD budget, the division has explored means to operate within allocated budget. As such, CISD has implemented an open source system whereby users can communicate with each other without any cost and with no restriction in call duration.

Many Ministries/Departments have already implemented VoIP solutions but with associated maintenance cost. To call someone using VoIP, a SIP-compatible desk phone or a VoIP calling app is required, which means it is assigned an IP address so that calls can be made from the network. Unlike landline phones, they are capable of high-definition (HD) phone calls. A VoIP phone system digitises analogue voice signals, sending them between the sender and receiver. Both phone landlines and mobile phone, as well as computer-to-computer using microphones and speakers or headsets can be used to communicate. Analogue signals are converted into digital signals and sent to the receiver via the internet in a similar way to digital data such as emails or online content.

3.1 How are VoIP calls made?

Unlike traditional phone services, the three most common ways to connect using a VoIP service are:

i. An Analogue Telephone Adapter (ATA)

An ATA is an adapter that allows the use of an analogue telephone with a VoIP service. It connects between the phone and the internet service, and will encode the outgoing analogue data from the phone into digital data that can travel across the internet.

ii. IP Phones

IP (Internet Protocol) phones look just like normal phones, however, they are built especially for VoIP. Instead of connecting to the wall socket using an RJ-11 phone cable, IP Phones will connect to the router using an RJ-45 Ethernet connector.

iii. Softphones

A softphone is a software that loads a VoIP service onto the computer, often with an interface that looks just like a traditional phone.

3.2 How was the system implemented?

Asterisk server was used for setting up the core environment of the VoIP server. Being an open source platform, the server allows for all sorts of configurations in setting up the IP PBX in CISD. The front end, known as FreePBX, which comes as a module is required to manage the asterisk server. The combination of both asterisk and FreePBX allow the setup of FreePBX with zero cost implementation.

FreePBX provides a rich and user friendly GUI to asterisk, which makes it easy for the administrator to configure VoIP Server. Several soft phones such as Zoiper (windows and MAC), Mizu phone, Microsip were tested and used as the client. Extensions for all CISD officers were created accordingly in the server to test real time communication. Another

advantage of this system is that IP Phones can also be integrated in this Freepbx system, which has already been tested and works well.

Two different SIP phones have been bought and tested successfully by using the same extensions created for staff. As such, officers have two choices, IP phones or soft phones (Desktop based, Android, IOS), according to their convenience. A softphone is a client software that loads the VoIP service onto the desktop or laptop. A user can pick up calls and transfer calls accordingly. A directory, consisting of all staff names and extensions, has also been created to be uploaded directly into the system, thus avoiding the hassle of creating contacts for each new user.

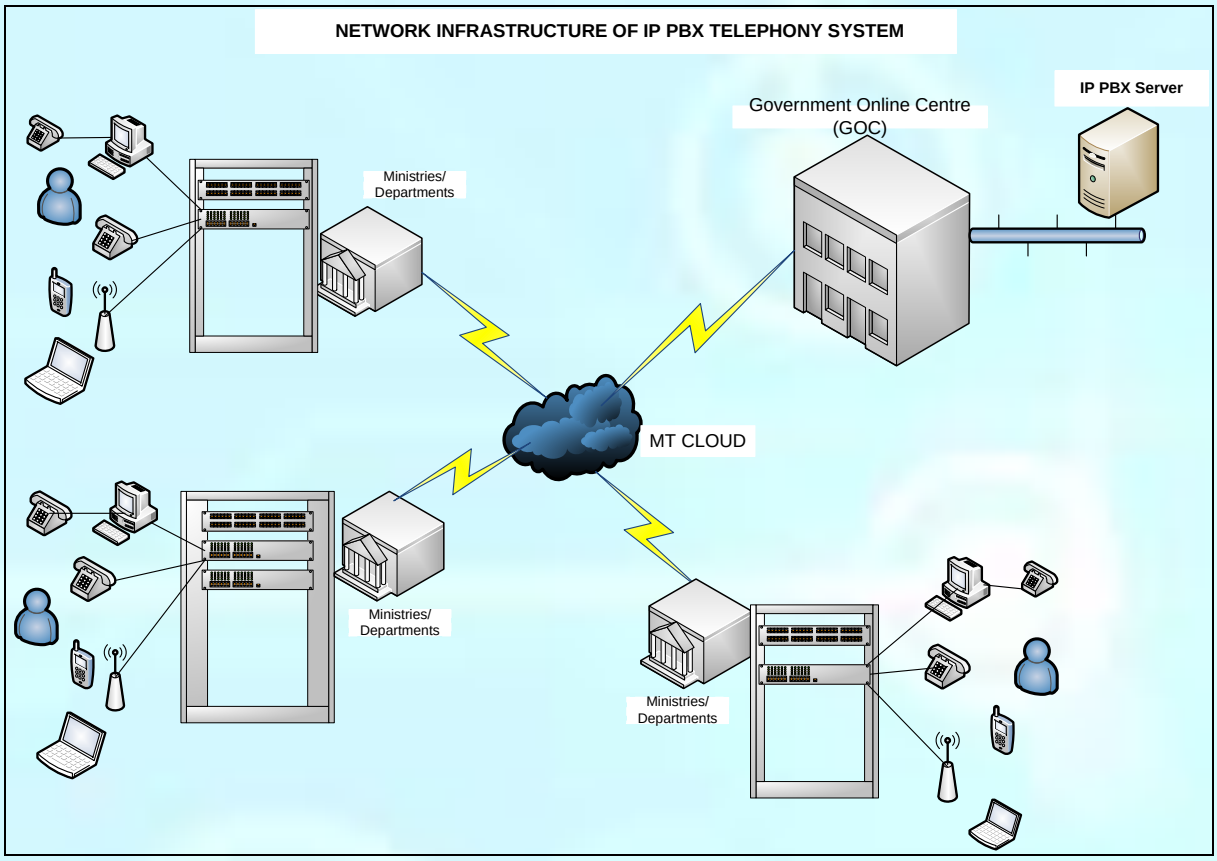


Figure 2: Network Infrastructure of IP PBX Telephone system

3.3 Conclusion

The successful implementation of free VoIP phone system in CISD has definitely avoided the exorbitant cost of traditional phone services by using packets and internet protocol. The point of considering VoIP phone service in the first place is the fact that it can result in a significant reduction in an organisation's communication costs. Furthermore, the CISD team is investigating further to improve the system and also expand this service to other Ministries/Departments so that they can benefit from it in the long term.

Chapter 4

Provision of ICT support services through Chatbot

4.0 Introduction

Chatbot can be defined as one of the most advanced and promising expressions of interaction taking place between humans and machines. Chatbots reduce the waiting time to be served from several minutes to immediate attention. The use of chatbot is everywhere and it is gaining popularity across the whole world, whether in university website (https://amityfutureacademy.com/Home/app/ or E-commerce sites (http://www.dragonelectronics.mu/) to respond to users' queries. Boston-based startup AdmitHub (https://www.admithub.com/) has designed Chatbot apps for Georgia State University, the University of Memphis, West Texas A&M and Arizona State University, EdSurge reports. While Chatbots can serve thousands of clients at a time, a human operator will be able to talk to at most two clients on phone by switching from one client to another from time to time.

4.1 CISD Chatbot

The main purpose of CISD Helpdesk is to answer queries of public officers pertaining to technical support. Users expect an instant resolution for the IT issues they run into on a frequent basis. To alleviate this issue, CISD has come up with a Chatbot available in its website to solve technical issues faced by users across all Ministries/Departments. The chatbot has the ability to connect to a live agent in case users' queries are not solved. An agent can solve multiple queries of users regarding different subjects simultaneously.

CISD's Chatbot has been developed using Dialogflow, an open source software, which is a natural language understanding platform that makes it easy to design and integrate a conversational user interface into an application. This Google-powered product enables developers to create text-based conversation interfaces for responding to users' concerns. Furthermore, the bot has been integrated with Tiledesk, another open source tool for connection with live agents. A live agent is the most important part of the bot as it brings in the skills and acts as the problem solver enabling users to interact with

support staff and offering much more flexibility, solving issues much faster and more efficiently than before.

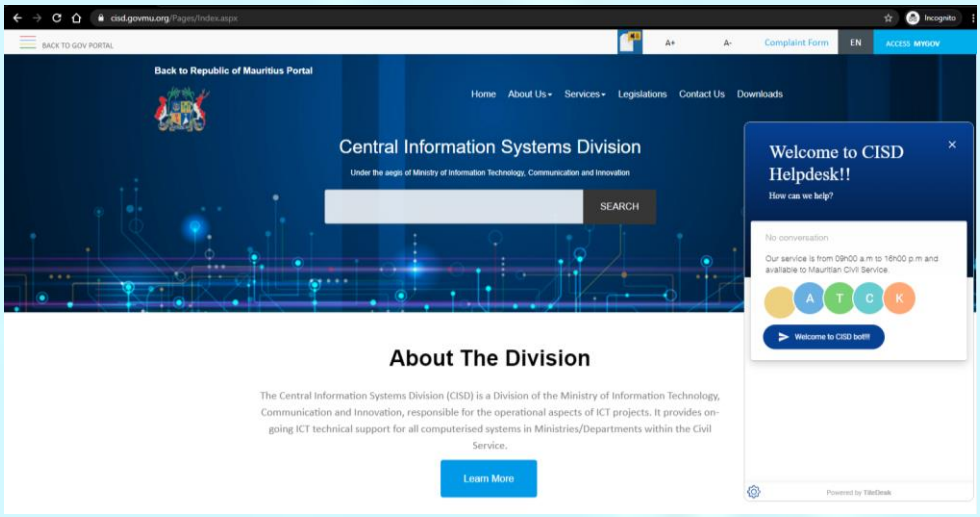


Figure 3: Chatbot in CISD Website

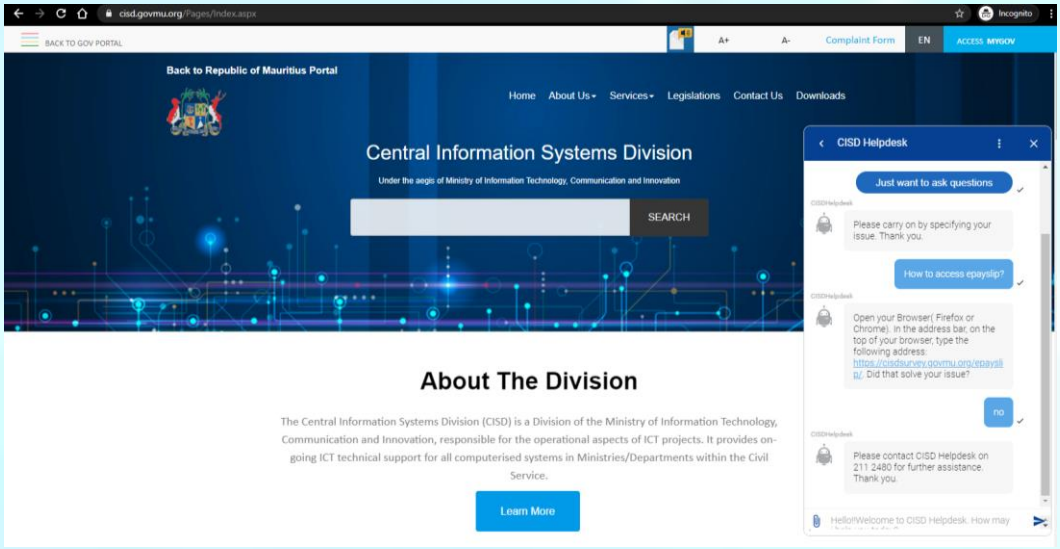


Figure 4: Conversation with chatbot

Admin Dashboard

i) Served (request already being attended to) and unserved requests (Pending request waiting in queue)

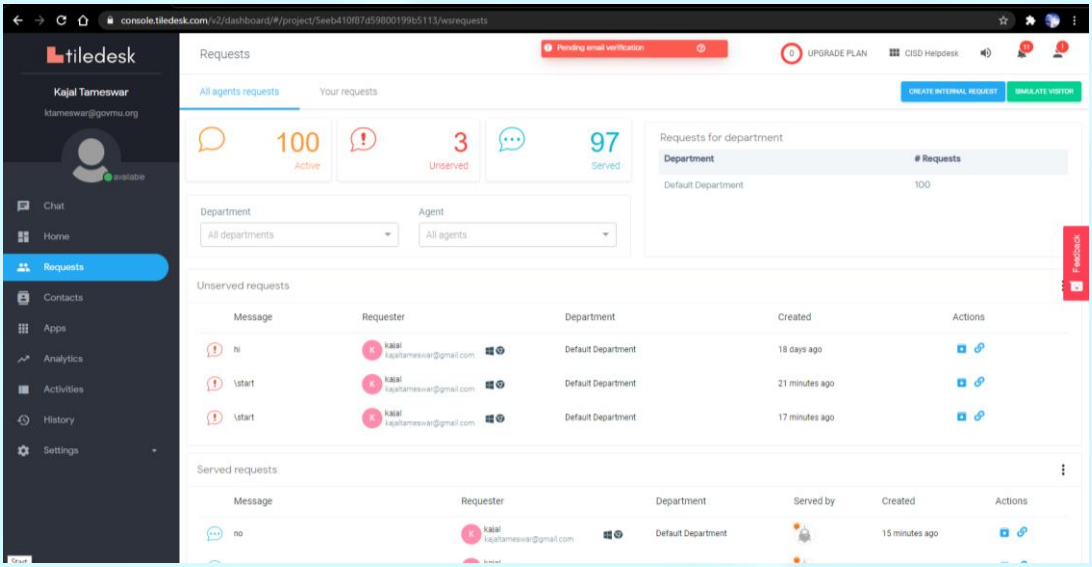


Figure 5: Admin Dashboard

4.2 How does the Chatbot work?

1. A user sends a text message to a device or an App.
2. The App/Device transfers the message to Dialogflow.
3. The message is categorised and matched to a corresponding intent (Intents are defined manually by developers in Dialogflow and is all about what the user wants to get out of the interaction).
4. Actions for each intent are defined in the fulfillment known as Webhook (Webhook is an HTTP request that is sent automatically whenever certain criteria are fulfilled).
5. When a certain intent is found by Dialogflow, the Webhook will use external Application Programming Interfaces (APIs) to find a response in external database.
6. The external database sends back required information to the Webhook.
7. The Webhook sends formatted response to the intent.
8. Intent generates actionable data according to different channels.
9. The actionable data goes to the output App/Device.
10. The user gets a text/image response.

4.3 Integration of Dialogflow Chatbot with Tiledesk

The Chatbot instantly responds to users with content from FAQs or built questions/answers, passing control to a human operator when needed. The Tiledesk

application takes control when a user requests for additional information that the Chatbot cannot provide a suitable answer. This service is activated when the user types "Agent".

The features of the Chatbot and Tiledesk include:

- Unlimited chat conversation
- Unlimited agents
- Widget customization tools
- Conversation labels
- Conversation notes
- Chat history

4.4 Conclusion

The Chatbot has been in use for nearly 2 months. It has been used in CISD to service requests from Public Service Officers pertaining to e-payslip, printers and email. There is a need to market the Chatbot properly in the Civil Service. A Chatbot can handle thousands of queries concurrently, while a human operator can handle at most two queries at the same time. With the connection to a live chat agent, users are transferred to a human operator for an in-depth and customised support.

Chapter 5

Modernisation of Government websites

5.0 Introduction

Government websites have been developed since the beginning of this century. Initially, very few Ministries/Departments had a website with little information. Over the years, since the number of citizens connected to the internet have been increasing, it became imperative for all Ministries/Departments to have a presence to provide useful and prime information to citizens. Presently, there are some 169 websites for Ministries, Departments, Embassies and Consulates. A website is now the showcase for the Ministry/Department it represents. Citizens normally visit Government websites for official information and expect all relevant information to be available.

In the early days, webmasters were using Microsoft FrontPage to design websites. Government websites were not standard but elements such as Mauritian Coats of Arms, and contact details were included in all websites. Webmasters had a copy of their websites on their pcs and after modifications/amendments, the webpages were transferred to the web server at National Computer Board via File Transfer Protocol (FTP).

5.1 Evolution in Website design

As from 2004, the first Content Management System to design all government websites was purchased and installed at the GOC by an Indian and Mauritian consortium. All websites used the same template and had the same background color.

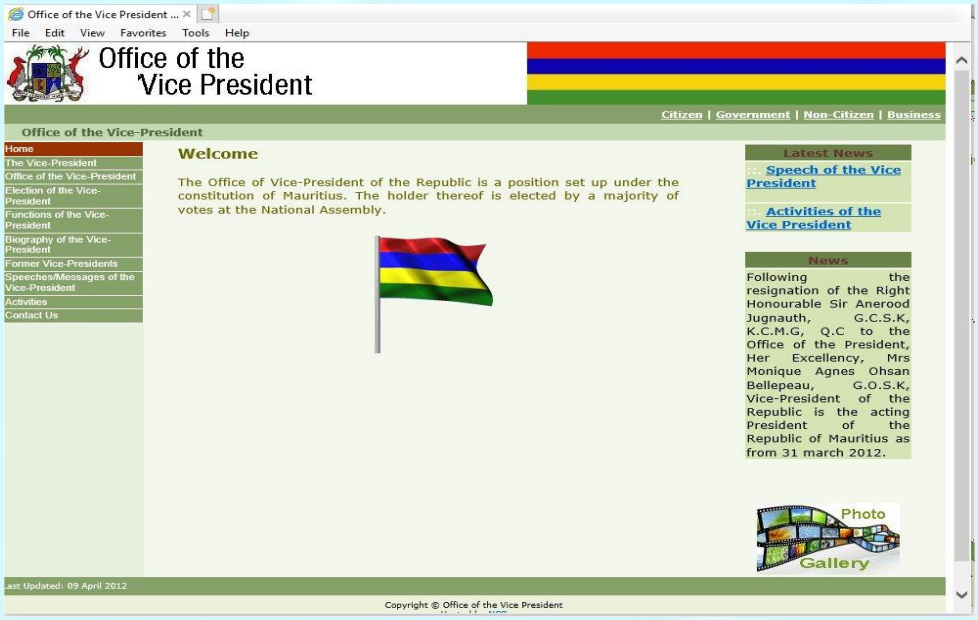


Figure 6: First website design in a CMS

This enabled all websites to have a standard design and webmasters no longer needed FTP connection. Since updated and timely information became crucial for many Ministries/Departments, it became easier for webmasters to update their websites.

Due to obsolete technology, a total revamping occurred 9 years later. An Egyptian company, in partnership with a local firm, was selected to redesign the website with a new look and feel.

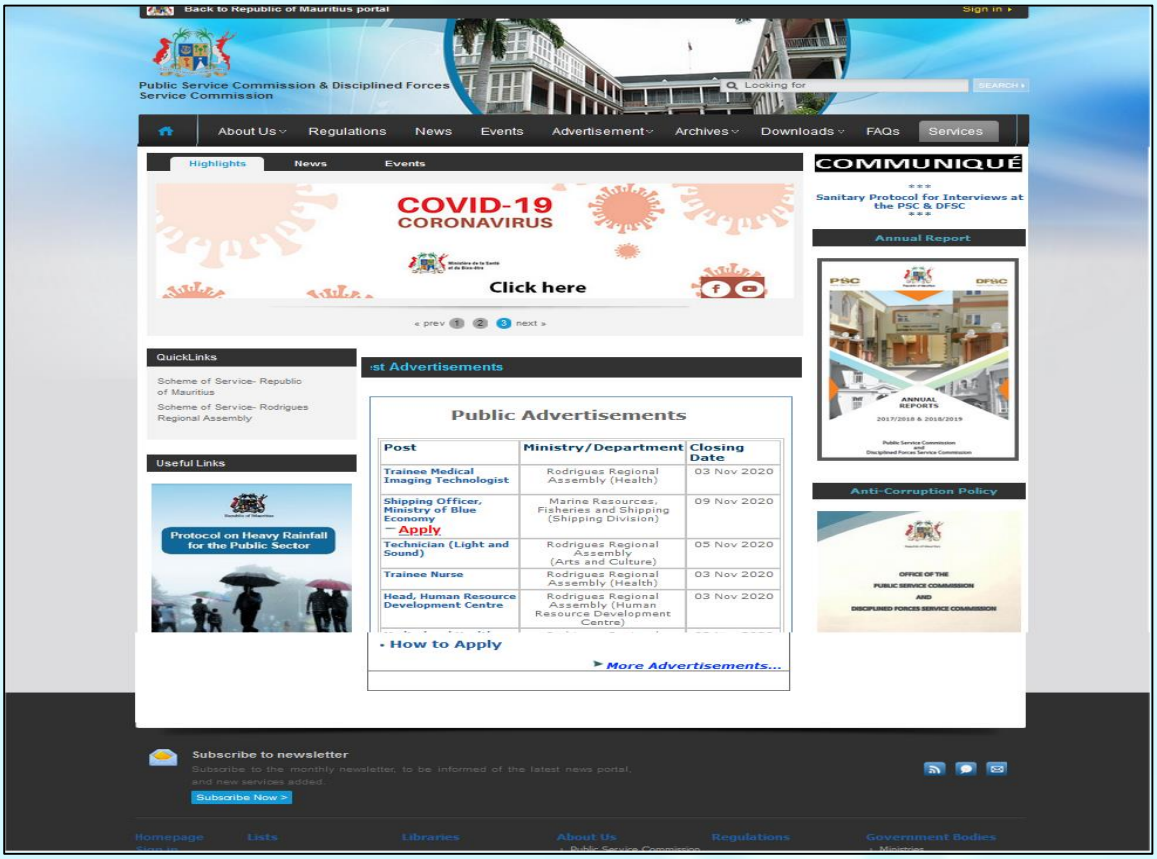


Figure 7: Second website design

The new content management system enabled the Government to introduce new types of services such as online forms and e-services. Websites were designed for desktop users with the most important information on top. The number of online facilities increased. Online payment for some services was also provided to allow citizens to avail of services at their own comfort. However, with the rapid adoption of new technologies by citizens, it became imperative that Government websites become mobile responsive.

According to ICT statistics 2019 obtained from Statistics Mauritius, there are some 1,866,600 mobile phones in Mauritius and some 1,189,100 mobile internet subscriptions. These figures show that the way Mauritians access information digitally has changed and they have switched from desktop devices to mobile phones and tablets. So, making government websites mobile responsive was no longer a nice-to-have feature but a necessity to service a larger section of the population both locally and abroad. In 2020, the Government decided to redesign and migrate all Ministries/Departments websites with the following features:

- Visually appealing

- Mobile responsive
- Better response times
- User friendliness and easy to navigate
- Meet basic web standard

5.2 Website migration process

In 2020, CISD was entrusted the responsibility of migrating all Ministries and Departments websites from one platform to another. The migration process was split into five main essential phases:

- Phase 1: Scope and planning
- Phase 2: Development
- Phase 3: Testing
- Phase 4: Launching of websites
- Phase 5: Post launching review

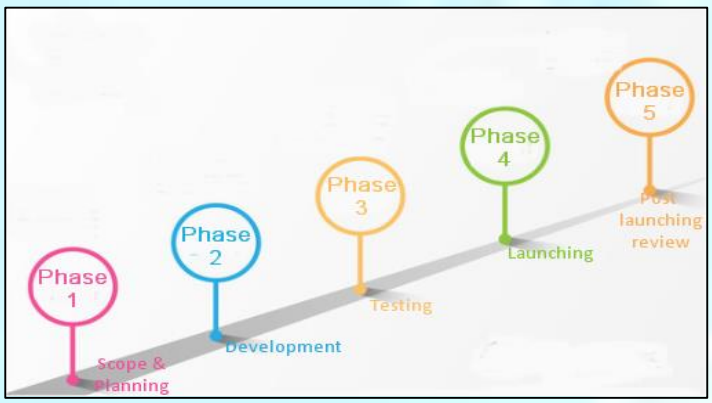


Figure 8: Migration phase

Phase 1: Scope and planning

The journey started in January 2020, when all Ministries/Departments were requested to select one template among four different templates provided. Since there were 169 websites to be migrated, these were divided as follows in order of priority:

- Migration of 39 Ministries' websites,
- Migration of 48 Departments' websites and,
- Migration of 20 missions' and 62 consulates' websites.

The migration started in February 2020. Webmasters worked on the site architecture, which included the sitemap and wireframes. This phase ensured that all key pages were considered to show their relationship to each other.

Phase 2: Development

This phase involved the creation of the website. It was a time consuming phase as the website had to be created again taking into consideration that information should be well organised, searchable and displayed properly. Webmasters started the migration of some 4,425 pages for Ministries websites after the site map was worked out. All pages, documents and images were downloaded from the existing websites. All required images and documents were moved manually into the new infrastructure, at the same time creating the navigation structure. The creation of the first page was critical to ensure a new look and feel by taking into consideration new positioning of information as well as mobile responsiveness. One of the four templates is displayed below:

Figure 9: CISD website on different devices

This phase was the most challenging given the COVID-19 sanitary curfew, which was imposed in March 2020. All webmasters were requested to continue the migration of their respective websites at home and there was an urgent need for secured access from home. To complete the project, webmasters and the webteam worked in close collaboration. In April 2020, during confinement, all 39 websites were successfully migrated.

As from June 2020, migration of 48 Departments' websites started. Some 10,689 pages were created and 20,027 documents were uploaded. In July 2020, 20 missions' and 62 consulates' websites were migrated to the new platform.

A close monitoring was performed during the whole exercise and daily progress was reported to management through reports.

Phase 3: Testing

Since a website is the windows to a Ministry/Department, any mistake/error, such as long loading times, broken links or grammar mistakes could give a bad image to the public and spoil user experience. A testing checklist was prepared and sent to all webmasters for a thorough test. Mobile responsiveness, functionality, usability and compatibility tests were performed on all websites on the development environment and after they were moved on the test environment. At the same time, a quality test on all 169 websites was performed at CISD using website testing tools.

Ministries/Departments are the custodian of the information appearing on websites and have to ensure that the most current and up to date information are displayed. Thus, representatives of Ministries/Departments were requested to go through their respective websites and to inform their webmasters and webteam about any issue before launching.

Phase 4: Launching of websites

Since the official launching date was set on the 08th September 2020, it was agreed between GOC and CISD that all websites should go live on the 5th of September 2020. Webmasters were requested to perform a thorough testing of their websites and to ensure that latest information were migrated to the new website in collaboration with user representatives. Simultaneously, a team was set up at CISD to perform a quality test.

Phase 5: Post launching review

A successful website migration does not end with the migration and launching. A close monitoring was performed at CISD level and issues were reported to GOC for corrective actions or to webmasters. A report was prepared and submitted to management in relation to issues raised after launching.

5.3 Further improvement

Webteam used a collaborative process during the whole migration process. Constant discussions were held with different stakeholders along with gathering of feedback and approval all the way from different entities. In the end, each website had special attributes/ features specific to its Ministry/Department while ensuring a professional and pleasant look and feel. However, the journey has just started and more need to follow such as:

- Provision of mobile responsive online forms
- Improving the mobile experience, mainly the navigation part.
- The need for a webmaster administration tool

5.4 Conclusion

The migration journey which started in 2019 with the design of the different templates was a challenge for CISD. Webteam and webmasters gained a lot from this experience, mainly working during the confinement period beyond normal Office hours and on weekends. Finally, Ministries/Departments have benefited from websites based on latest technologies and with new features.

Chapter 6

Data Analytics

6.0 Introduction

Data analytics is the process by which valuable insights are extracted from large amounts of data after the data has been cleaned, transformed, and modelled. Data analytics is becoming increasingly important in today's fast-paced world because huge amounts of data are being generated and these data are too complex and time-consuming for people to process.

Data analytics can be broken down into 4 components:

I. **Descriptive analytics**

Descriptive analytics comprises the statistical analysis of data to determine what happened over a specified time period. It helps organisations gauge performance in the form of data visualisation like dashboards, charts, reports, and others.

II. **Diagnostic analytics**

Diagnostic analytics or root cause analysis provides more in-depth investigation as compared to descriptive analytics, as it aims to determine why things happened the way they did. This involves techniques such as Exploratory Data Analysis (EDA), data mining, and drill down analysis.

III. **Predictive analytics**

Predictive analytics uses historical data and feeds it into a Machine Learning (ML) model that takes key trends and patterns into account. The model is then applied to the given data to predict what might happen next.

IV. **Prescriptive analytics**

Prescriptive analytics works together with predictive analytics to suggest possible courses of action and the likely implications for each scenario.

6.1 Why is Data Analytics required?

The implementation of analytics in business functions is important as it has several advantages. One of these advantages is that data analytics can identify efficient ways of conducting day-to-day processes and in doing so, it can help in cutting costs. Since CISD aims at making optimum use of its limited resources and skills to deliver prompt ICT support services in Government, it can benefit from data analytics as well by generating statistical data on its resources (assets, Human Resource, budget, etc.) to spot areas of strengths and weaknesses for future decision making.

Furthermore, the implementation of an interactive dashboard will provide management with timely information that is required for decision making.

6.2 Implementation of Data Analytics within CISD

The aim is to develop an Oracle Analytics Cloud application with an interactive dashboard that is connected to the multiple data sources available in CISD, including the payroll database, ICT asset management system, excel documents and other unstructured data from Finance and Human Resource sections, Technical Support Unit application system, training management system and commissioning database, among others. This is shown in the following figure.

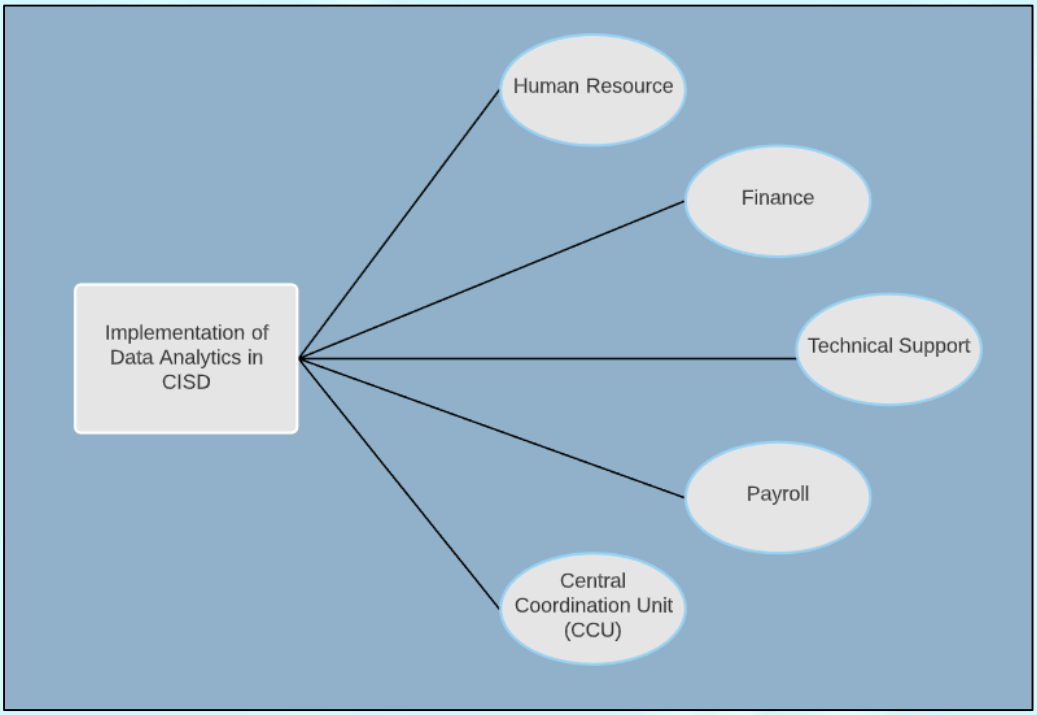


Figure 10: Sections providing data for the project

Once developed, the fully interactive dashboard will comprise data visualisations and will be accessible to Management. The visualisation segment of any decision support system is highly significant since it displays an overall picture of the critical issues that decision-makers need to explore during the decision-making process. Also, through the use of data mining models such as clustering analysis, regression and others, hidden patterns in the data may be unveiled.

6.3 Analytics tool used in the project

There exist several platforms that cater for data analytics and data visualisation in particular, such as Microsoft Power BI, Tableau, R, and Oracle Analytics Cloud (OAC) among others. The chosen platform for this project is Oracle Analytics Cloud since CISD has an Oracle Cloud subscription account since 2016 which is annually renewed. As part of this subscription, Oracle Analytics Cloud (OAC) was provisioned for a knowledge upgrade as CISD has a lot to gain from exploring potential business areas that would stem from this technology. Moreover, the Oracle Technical Support Unit (OTSU) has already developed some expertise in maintaining the OAC account and can provide support to the project developer, should the latter face any technical issues with the platform.

Besides, OAC is able to handle both structured and unstructured data within CISD and provides a platform for effective data mining and reporting in a timely manner. It also has

an in-built powerful predictive analytics capability with a sophisticated Machine Learning feature.

It should be noted that the Ministry of Public Service, Administrative and Institutional Reforms (MPSAIR) is also currently making use of the platform to develop an analytics application for Human Resource purposes.

6.4 Dashboard Screenshots

So far, dashboards have been created for the Payroll section and the Finance section. Some excerpts of both dashboards are as follows:

1. Basic Salary distribution (of CISD staff)

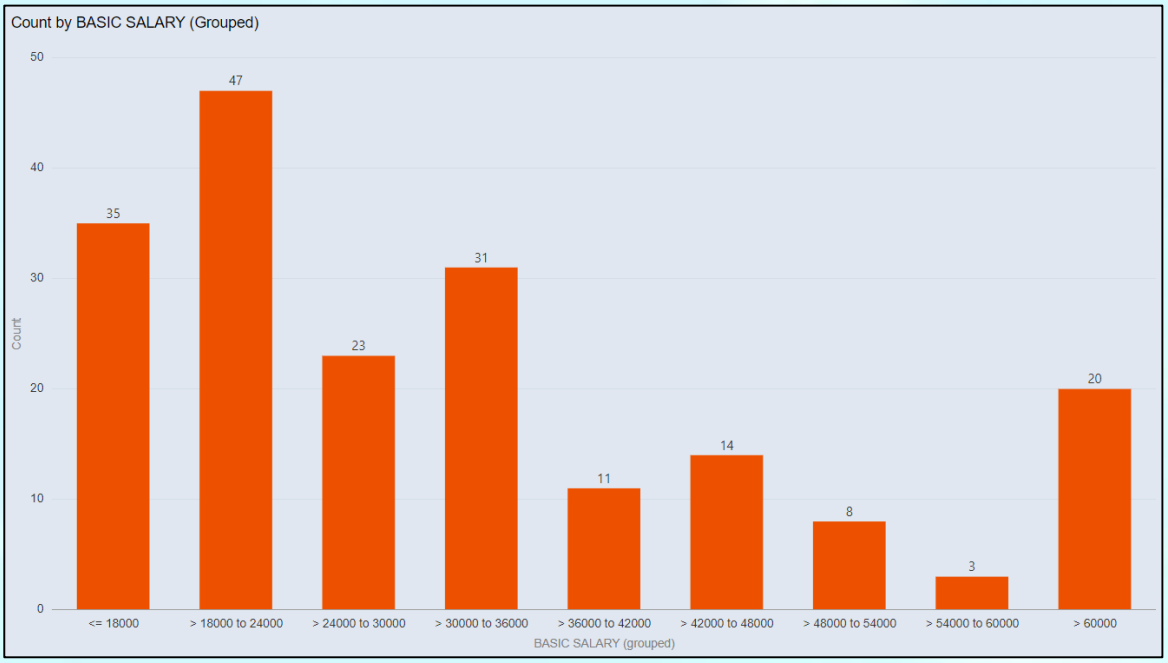


Figure 11: Basic Salary Distribution of CISD staff

From the above figure, it can be inferred that the basic salary does not follow a Gaussian (Normal) distribution. Most people have their basic salary ranging between Rs. 18,000 to Rs. 24,000 while very few people have their basic salary ranging from Rs. 54,000 to Rs. 60,000. From this distribution, cluster analysis was conducted as shown in the following figure.

2. Cluster Analysis of Basic Salary

Figure 12: Cluster Analysis of Basic Salary (Emp Code values have been blurred to preserve the privacy of officers)

3. Number of people retiring per year

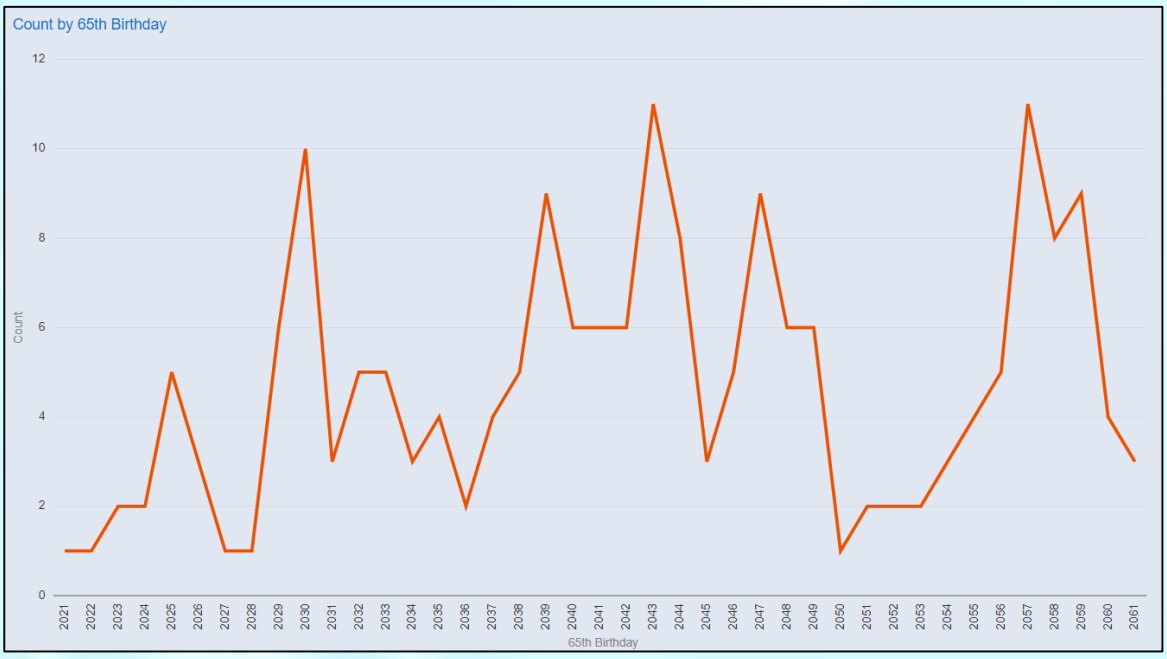


Figure 13: Number of people retiring per year

The above figure shows a line graph that indicates the number of CISD officers who will be retiring in the years to come. It can be seen that 11 officers will be retiring in 2043 as well as 2057 and thus, it can be deduced that most of the employees are aged 42 and 28 years.

4. Percentage of allocated funds per item

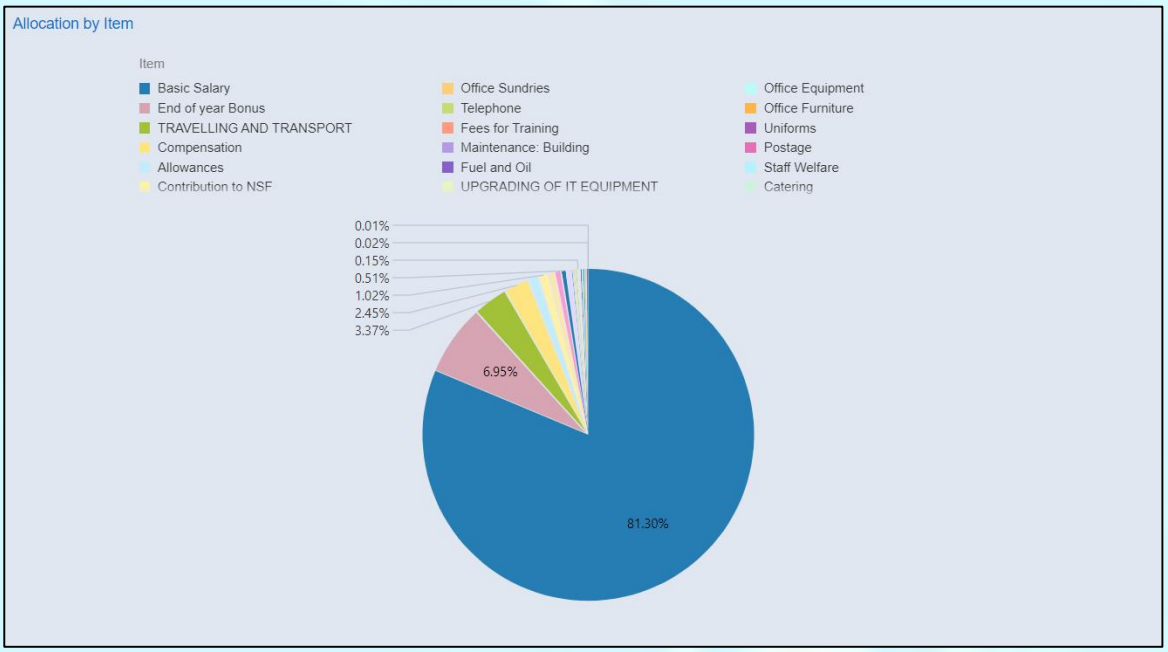


Figure 14: Percentage of allocated funds per item

The above pie-chart shows the different kinds of expenses to be incurred by CISD and the percentage of funds allocated to each of them for the financial year. It can be observed that most of the funds have been allocated for *Basic Salary* while the least amount of funds (0.01%) have been allocated for *Publications.*

5. Funds allocated and used per item

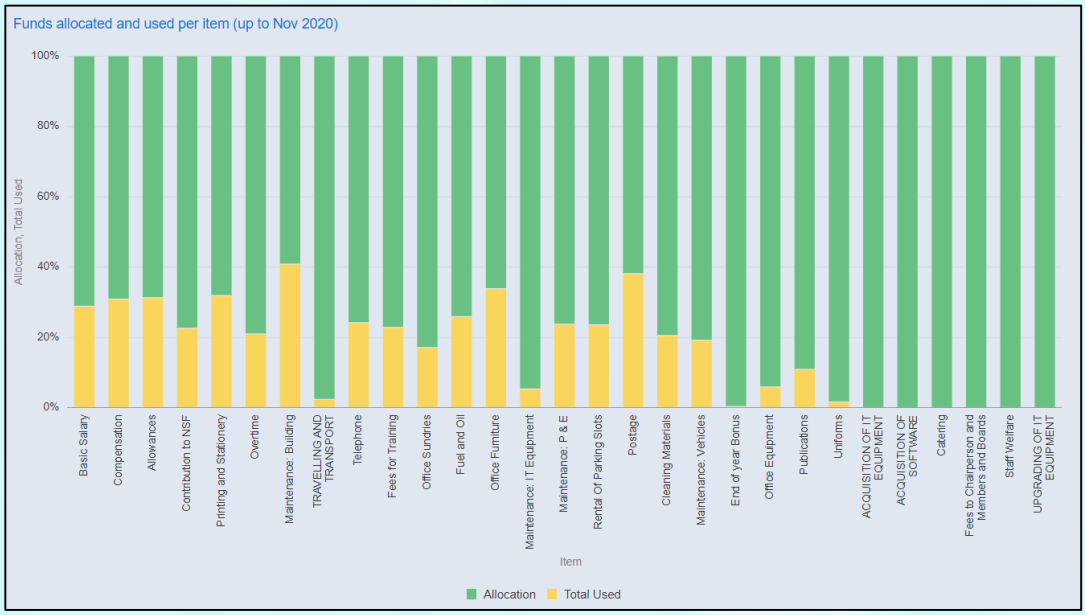


Figure 15: Funds allocated and used per item

The above figure shows the funds allocated and funds used per item and confirms that *Basic Salary* has used up around one third of its allocated funds while *Acquisition of IT equipment, Acquisition of Software, Catering, Fees to Chairperson and Members and Boards,* and *Upgrading of IT equipment* still have all of their allocated funds left.

6.5 Future Direction

Data analytics has several advantages and can help organisations unlock their full potential. It can also be implemented for the entire public service to enable informed decision-making and to make operations more efficient. Within the next decade, the importance of data analytics is expected to increase considerably. Proper data and better analytical skills will certainly reveal insights that have never been envisioned.

6.6 Conclusion

Data analytics is increasingly being used by organisations for visualisations and predictions given the large amount of data that they generate. Insights can be readily obtained by analysing patterns in data. The ability of mining text, videos and audios presents organisations with the opportunity to acquire a competitive edge in this globalised environment. CISD has embarked on the journey of applying analytics on its data for both visualisation and prediction for informed decision making.

Chapter 7

E-payroll

7.0 Introduction

Payroll is one of the flagship applications used at CISD for several decades. Currently, it concerns around 55,000 employees of the Civil Service. The application software was developed by State Informatics Ltd in 1995. Prior to this period, CISD had developed and maintained an application using the Common Business Oriented Language.

Given the batch processing nature of the payroll application, data was traditionally received on paper-based forms for input into a computer system. Processing was carried out during a certain period of the month and payslips as well as payroll reports were generated and forwarded to respective Ministries/Departments. Payslips were finally distributed to the employees prior to crediting their bank accounts.

7.1 Adapting to Emerging Technologies

Novel technologies bring new opportunities for improvement with better performing and more efficient systems. It is thus imperative to adapt to and adopt emerging technologies to better serve our customers.

7.2 Payroll processing with COBOL

Formerly, input of data was carried out centrally at CISD (previously known as the DPD). All the data were received through paper-based pre-defined forms including basic data and variations. The data were captured into the payroll system by Data Entry Officers. Validation of data was carried out and checklists of correct and incorrect data were

generated. Printed copies of these checklists were distributed to the Finance Officers of all Ministries/Departments. The Finance Officers verified the checklists against their variation books to ensure correctness of data. Following detection of discrepancies, amendments were sent again to CISD through variation forms for additional changes. The process of validation and generation of checklists was repeated three times after which payslips and payroll reports were printed.

CISD had a relatively small team of Systems Analysts and Programmers working on the design and development of computerised systems. All programs were developed and maintained in-house for the entire Civil Service as well as for Local Authorities. As far as payroll was concerned, all requirements in terms of new reports and amendments to cater for new features were dealt with by the Systems Analysts and Programmers. Data were stored on flat files (as compared to the modern database files). Most of the requirements of users were entertained by writing new programs in COBOL. The programming environment had a lot of disadvantages:

(i) Most of the new requirements demanded the development of new programs, which were time consuming.

(ii) Running computer tasks was time consuming due to the sequential nature of processing. Computing tasks were kept in a queue and programmers had to wait for their turn.

(iii) Data files, especially for payroll, were kept on magnetic tapes and these devices were slow to access. To search for data at the end of the tape, the latter had to be read from beginning till the end and this process was inefficient.

(iv) Queries and reports generation were lengthy processes as COBOL was a 3rd generation language, which was based on "how to do" principle, that is the programmer had to explain to the computer how to perform certain tasks. Modern 4th generation language is based on "what to do" principle, whereby in many cases, the programmer instructs the computer what has to be done and it is left to the computer to find a way to get the job done.

7.3 Payroll processing with ORACLE

As from 1995, a new payroll system based on ORACLE was developed by the State Informatics Ltd. ORACLE is a relational database system that eliminated many of the shortcomings inherent in COBOL. The system made use of tables (instead of files) that were connected to each other based on certain items of data (key fields). This system of tables provided a flexible way to join tables to extract data. ORACLE provides a number of tools that helped in development and maintenance of application software.

More important was the flexibility in querying and extracting data using a Structured Query Language (SQL). Within a short time period, a SQL statement can be written to extract large volume of data based on complex criteria. Previously, with COBOL, an entire program was required to be written and executed in a queue. With the availability of cheap and abundant processing power as well as large amount of computer memory, greater flexibility was attained in processing payroll.

In 2014, a new feature was added to allow Officers of the Civil Service to obtain their payslips online one week before the pay day. This feature has so far been well accepted and used by Civil Service Officers.

As from 1995 to mid-2020, one major task conducted at the CISD was the data capture of payroll variations. Paper-based forms containing hand-written or typed data were received and the data were captured by Data Entry Officers. This led to unnecessary efforts, namely writing or typing the data on paper-based forms and subsequently typing the data into a computer system.

7.4 Enhancement of payroll system

As from mid-2020, an amendment was brought to reduce the data entry tasks at CISD. An interface was designed, developed and provided to Finance Officers to enter the data directly into the payroll system, with all the validations carried out at source. The new enhancement was completed in September 2020. This reduced the time taken to capture payroll variations and at the same time led to a reduction in paper usage.

Figure 16:E-payroll System Interface

The interface and the intermediate database file used were built entirely on an open source technology, where no licences were required. This relieved the Data Entry Officers, who were only required to capture data for new recruits in the Civil Service. As the Data Entry grade has become evanescent, the number of Officers in the grade has kept on decreasing and there was much pressure on the remaining Officers to deal with data capture of payroll data.

This amendment led to a move towards an e-payroll system with an almost entirely paperless environment as well as a reduction in the operating cost of payroll.

7.5 Further enhancements to be carried out

The ORACLE-based payroll system has been operating since 1995 and from that time, there has been remarkable progress in technology. The version of ORACLE has changed giving way to more features and hardware and telecommunications have improved. It is time to take advantage of the new and emerging technologies.

As far as hardware is concerned, there is a need to replace the server for even higher performance. In addition, the version of the ORACLE database has to be upgraded to a new version. All these changes require the development of a modern application software with value-added features.

With several inbuilt features and with added controls in the current e-payroll system, CISD is ready to embark on a paperless environment as far as payroll is concerned.

The payroll process has been made less tedious, less error prone and faster. Finance Officers can, however, print individual payslips upon request from Officers as well as print batch payslips per paysite should the need arise.

7.6 Conclusion

The payroll system is a major system being run by CISD. The division has been embracing new technologies since the first system was set up. Proactive measures, with reduced cost, have been adopted at the level of CISD to ensure that the payroll system continues to meet the needs of Government. These measures did not occur without the effort of the staff involved in software development and payroll processing. The changes have been achieved through a systematic analysis of the system at different points in time and with the technology change that has occurred. Changes brought so far, has enabled the achievement of an almost entirely paperless environment with its associated reduction in cost of operation. However, to ensure preparedness at the level of our stakeholders, paper copies are still being continued at their request until further notice.

Chapter 8

Project Management

8.0 Introduction

Apart from the operations tasks handled by CISD staff, the division also receives requests from various Ministries/Departments for the development of small to medium-sized software. Some Officers of CISD have been trained on Project Management Body of Knowledge (PMBoK), a popular project management standard, developed by the Project Management Institute (PMI). CISD has started to use PMBoK to manage its projects. The project management approach covers the full project management cycle starting from Initiation, through Planning, Execution, Monitoring & Control to Closing phase. In addition, 10 knowledge areas are considered as per the PMBoK standard.

The use of a project management standard/methodology ensures a higher likelihood of success by managing resources effectively and efficiently. PMBoK is being used globally to manage all types of projects. PMP (Project Management Professional) Certifications are also provided by the Project Management Institute to professionalise the discipline.

In this chapter, the details of the Project Management standard are explained.

8.1 Project and Operation

A project is defined by the Project Management Institute as *a temporary endeavor undertaken to create a unique product, service, or result*. Projects can also be considered as an agent of change in an organisation, thus the need for change management. One undesirable characteristic of projects is the high level of inherent uncertainty. In addition, projects often bring fear of loss of authority and the need to move out of a comfort zone. In case people affected by a project are unprepared, they may oppose the implementation of the project, leading to failure. Software development is even more affected by uncertainties, given the lack of visibility in the development process until a piece of program code has been-implemented and tested by the users.

According to Stareva (2019), operations are the ongoing execution of activities and they follow organisational procedures to produce the same result or a repetitive service that will help sustain the business. Projects are different from operations in that they end when their objectives have been reached or the project has been terminated.

Information Technology operations are unique in the sense that technology constantly changes with a new one replacing the old one. Learning, unlearning and re-learning are to be adopted by an IT professional to be efficient. A large variety of software and hardware is constantly upgraded and replaced and they (both hardware and software) also get more sophisticated and complex. For example, learning the features and operations of a Disk Operating System several decades back is no longer the same as learning a Windows Server Operating System. Similarly, network systems have evolved drastically with the range of communication devices of different makes and models and this has introduced unprecedented complexities. In the same way, programming languages and database systems have evolved to provide more features, but at the same time introducing a higher learning curve for IT professionals.

The CISD provides training to its staff throughout the year. However, it takes time for someone to be conversant with a new technology as it requires experience in some cases. With reduction in the training budget, the division was compelled to look for free online courses. The lack of practical sessions in many cases and no face-to-face interactions with experienced tutors have been reported by the staff.

8.2 Project Management

The Project Management Institute in its PMBOK *Guide* defines project management as: "*the application of knowledge, skills, tools, and techniques to project activities to meet project requirements*."

The 10 knowledge areas are depicted below:

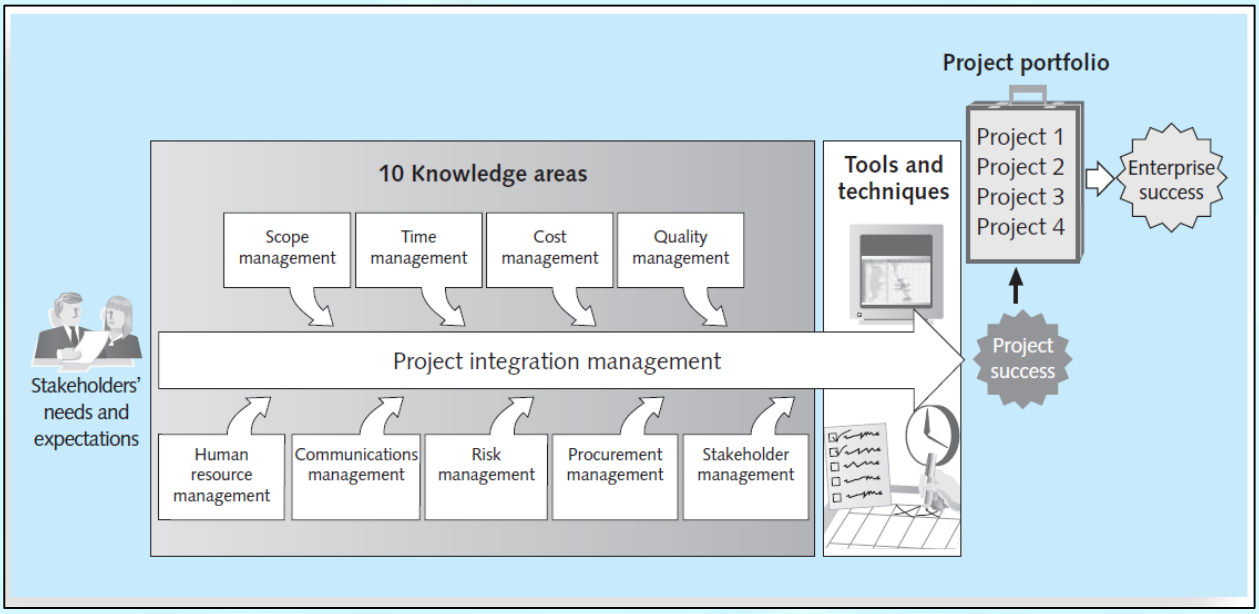


Figure 17: Knowledge Areas of Project Management

Scope, Time, Cost and Quality management are the core functions, while HR, Communications, Risk, Procurement and Stakeholder management are the facilitating functions of PMBoK. They are all considered in an integrated manner, thus the role of project integration management. The 10 knowledge areas are described by Marchewka (2012) and Schwalbe (2016) as follows:

- Project integration management - This knowledge area is the "hub" for all other knowledge areas. It focuses on coordinating the project plan's development, execution, and control of changes.
- Project scope management – The project's scope is the work to be completed by the project team. Scope management provides assurance that the project's work is defined accurately and completely and that it is completed as planned. In addition, scope management includes ways to ensure that proper scope change procedures are in place. The scope of a project driven by CISD is prepared by in-depth requirements gathering and regular meetings with the users.
- Project time management - Time management is important for developing, monitoring, and managing the project's schedule. It includes identifying the project's phases and activities and then estimating, sequencing, and assigning resources for each activity to ensure that the project's scope and objectives are met. CISD makes use of a Gantt chart to plan the project activities and track their progress.

- **Project cost management** - Cost management ensures that a project is developed and completed within approved budget. Software development projects handled by CISD has no monetary cost to the users and, therefore, the cost of development is ignored.
- **Project quality management** - Quality management focuses on planning, developing, and managing a quality environment that allows the project to meet or exceed stakeholder needs or expectations. Quality involves customer satisfaction, fitness to use the product and conformance to requirements, which in turn include performance and user friendly interfaces.
- **Project human resource management** - People are the most important resource in an IT project. Human resource management focuses on creating and developing the project team as well as understanding and responding appropriately to the behavioural side of project management.
- **Project communications management** - Communication management entails communicating timely and accurate information about the project to the project's stakeholders. CISD organises regular meetings to communicate progress and issues related to project execution. Email communications are encouraged to report issues that need timely action.
- **Project risk management** - All projects face a certain amount of risk. Project risk management is concerned with concerns identifying and responding appropriately to risks that can impact the project.
- **Project procurement management** - Projects often require resources (people, hardware, software, etc.) that are outside the organisation. Procurement management ensures that these resources are acquired properly. Procurement management is especially important for in-house projects to manage contracts.
- **Project stakeholder management** – Stakeholders are people who have a stake in the project. It includes identifying and analysing stakeholder needs while managing and controlling their engagement throughout the life of the project.

Project management is performed over the application and combination of a set of 49 logical processes. These processes are further grouped in 5 Process Groups called Initiating, Planning, Executing, Monitoring & Controlling, and Closing phases. The ten (10) knowledge areas are considered and they are managed through the 5 process groups.

8.3 Project Life Cycle (PLC)

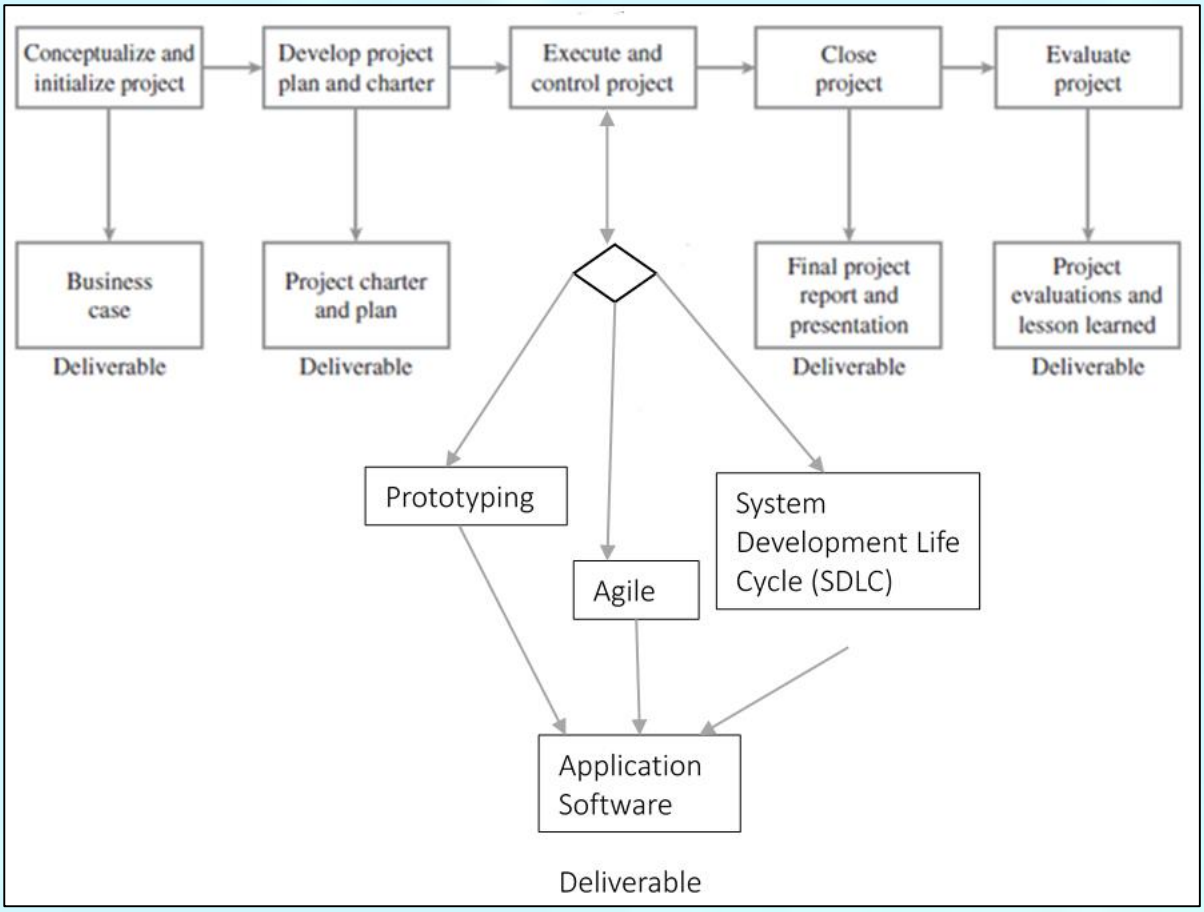


Figure 18: Project Life Cycle

The above are project phases of a project and they are not to be confused with process groups (as described by Marchewka (2016)) as follows:

- Initiating processes include defining and authorising a project or project phase. For example, in the close-out phase, "*initiating processes*" are used to ensure that the project team completes all the work, that someone documents lessons learned, and that the customer accepts the work.
- Planning processes include devising and maintaining a workable scheme to ensure that the project addresses the organisation's needs. Projects include several plans, such as the scope management plan, schedule management plan, cost management plan and procurement management plan. These plans define each knowledge area as it relates to the project at a particular point in time. For example, a project team must develop a plan to define the work needed for the project, to schedule activities related to that work, to estimate costs for performing the work, and to decide what resources to procure to accomplish the

work. To account for changing conditions on the project and in the organization, project teams often revise plans during each phase of the project life cycle. The project management plan coordinates and encompasses information from all other plans.

- Executing processes include coordinating people and other resources to carry out the various plans and create the products, services, or results of the project or phase. Examples of executing processes include acquiring and developing the project team, performing quality assurance, distributing information, managing stakeholder expectations, and conducting procurements.
- Monitoring and controlling processes include regularly measuring and monitoring progress to ensure that the project team meets the project objectives. The Project Manager and staff monitor and measure progress against the plans and take corrective actions when necessary. A common monitoring & controlling process reports on performance, where project stakeholders can identify any necessary changes that may be required to keep the project on track.
- Closing processes include formalising acceptance of the project or project phase and ending it efficiently. Administrative activities are often involved in this process group, such as archiving project files, closing out contracts, documenting lessons learned, and receiving formal acceptance of the delivered work as part of the phase or project.

All projects and all project phases need to include all five process groups. The mapping of the project management process groups to knowledge areas (as described by Marachewka (2016)) is shown in the following table:

Knowledge Area	Project Management Process Groups				
	Initiating	Planning	Executing	Monitoring and Controlling	Closing
Project Integration Management	Develop project charter	Develop project management plan	Direct and manage project work	Monitor and control project work, perform integrated change control	Close project or phase
Project Scope Management		Plan scope management, collect requirements, define scope, create WBS		Validate scope, control scope	
Project Time Management		Plan schedule management, define activities, sequence activities, estimate activities resources, estimate activity durations, develop schedule		Control schedule	
Project Cost Management		Plan cost management, estimate costs, determine budget		Control costs	
Project Quality Management		Plan quality management	Perform quality assurance	Control quality	
Project Human Resource Management		Plan human resource management	Acquire project team, develop project team, manage project team		
Project Communications Management		Plan communications management	Manage communications	Control communications	
Project Risk Management		Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk responses		Control risks	
Project Procurement Management		Plan procurement management	Conduct procurements	Control procurements	Close procurements
Project Stakeholder Management	Identify stake-holders	Plan stakeholder management	Manage stakeholder engagement	Control stakeholder engagement	

Figure 19: Project Management Process Groups

8.4 Conclusion

As CISD conceptualises and executes software development projects for other Ministries/Departments, a project management approach is necessary for managing the projects. The use of PMBoK is expected to help CISD in managing projects efficiently, while at the same time keeping adequate documentation on the processes.

Chapter 9

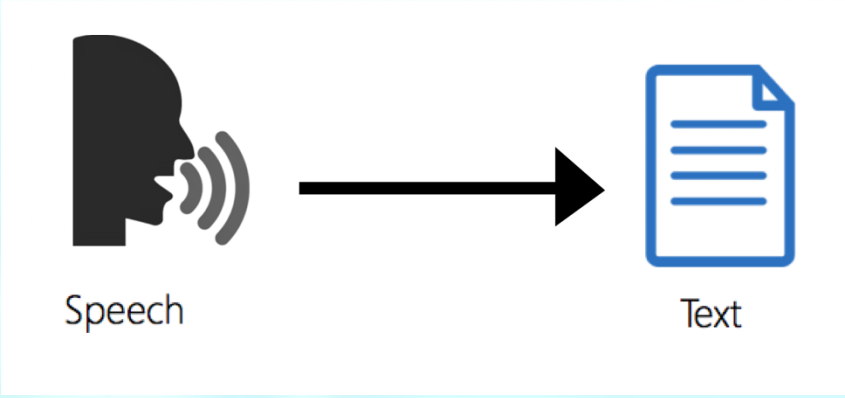
Adopting Speech Technologies

9.0 Introduction

Voice is one of the most valuable tools in the communication industry. It has always been a crucial part of the way that connects human to human. However, now voice is also becoming an element in how connection is made between human and machine. With the progression of artificial intelligence solutions for enterprises, speech technologies have many applications in all sectors, including law, healthcare, security, finance, enterprise and personal use. Some of the best Speech Recognition software include: Dragon Professional, Dragon Anywhere, Siri, Amazon Lex and Google Docs.

9.1 How Speech Technologies work?

Speech recognition technology allows computers to take spoken audio, interpret it and generate text from it by using the wonders of signal processing. Speech is simply a series of sound waves created by vocal chords, when they cause air to vibrate around them. These sound waves are recorded by a microphone, and then converted into an electrical signal. The signal is then processed using advanced signal processing technologies, isolating syllables and words.



One of the most notable advantages of speech recognition includes the dictation ability it provides. With the help of this technology, users can easily control devices and create documents by speech. Speech recognition allows documents to be created faster

because the software generally produces words as soon as they uttered, which is usually much faster than a person can type.

Speech technologies comprising Text-to-Speech and Speech-to-Text have found various applications in CISD. For instance, this e-book has also been partly prepared using Speech-to-Text using Google Docs, whereby the Officer reads through a microphone and the text is prepared from the digitised voice. An audio version of this e-book has also been prepared. In addition, the Text-to-Speech option in Microsoft Word is used by HR section for collation of documents.

9.2 Conclusion

In a world where people and digital components are becoming more intertwined, speech technologies could be the key to making the most of this intelligent technology on the market. Although Speech Recognition still has a long way to go to reach the human-level performance, it is already capable of delivering sufficiently robust and low-error performance for many practical applications. Hence, the way forward is to extend the adoption of this technology in CISD to facilitate other daily tasks.

Chapter 10

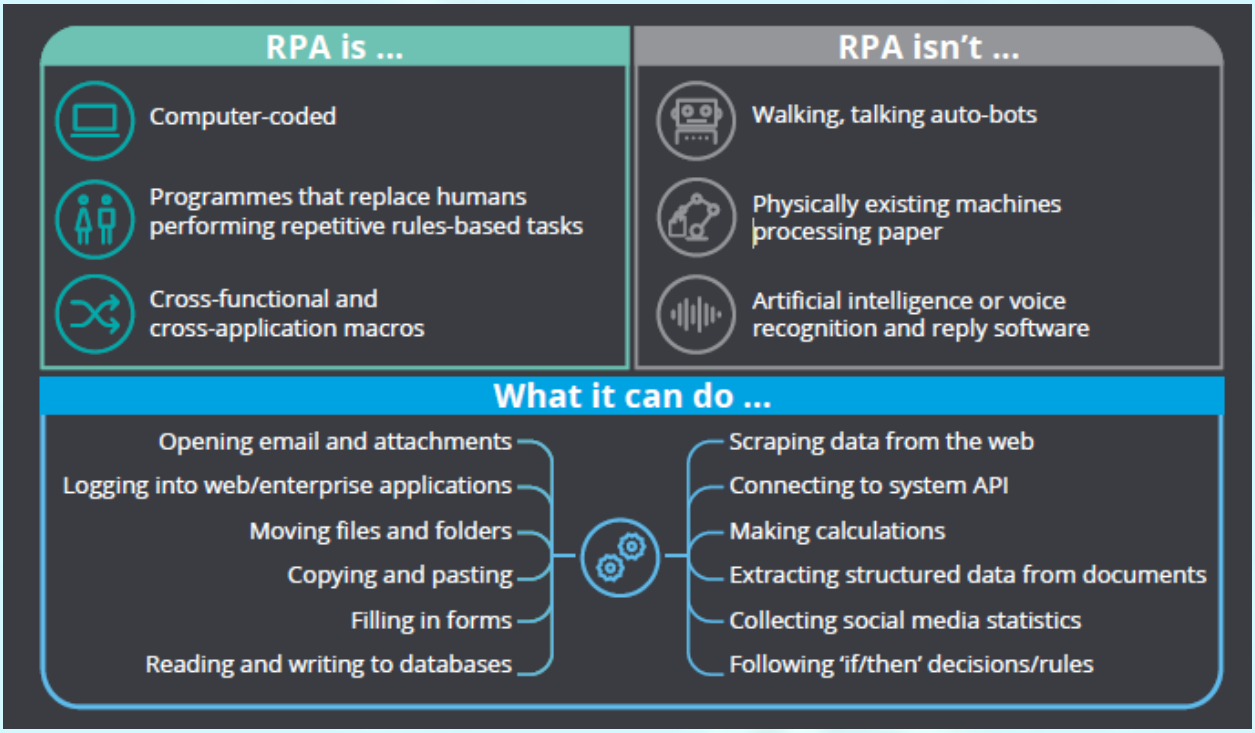
The future of operations with Robotics Process Automation

10.0 Introduction

"Robotic Process Automation is the next wave of innovation, which will change outsourcing. We are, already, seeing the beginnings of a race to become the top automation-enabled service provider in the industry. In time, we are likely to see an arms-race for innovation in automation tools leading to new offerings and delivery models."

Sarah Burnett, Vice President of Research at the Everest Group (2019)

The RPA wave has hit. Robotic Process Automation is one of the most advanced technologies in the area of Computer Science, Electronic and Communications, Mechanical Engineering, and Information Technology. It is a combination of both hardware and software, networking and automation for doing things in a very simple way. RPA is a software program that imitates human actions while interacting with a computer application and accomplishing automation of repetitive, rule-based processes. RPA has abundant applications including healthcare and pharmaceuticals, financial services, outsourcing, retail, telecom, energy and utilities, real estate and many more sectors.



10.1 Implementation of RPA

For implementing RPA, a software-based technique, software robots or virtual assistants or bots are created that can perform the processes like accounting, finance, management, data entry, etc.

The following methodology, should be followed for a successful RPA implementation:

- First, identify the automation opportunities.
- Optimise the identified processes.
- Build a business case for RPA journey.
- Start initial RPA robots' development.
- Lastly, expand RPA scope and continue building RPA robots.

10.2 Tool used to investigate RPA

In order to implement RPA in CISD, UIPath studio Community edition (which is open source) has been investigated. UIPath studio is a platform that allows development and execution of bots. It is based on VB .Net but with a GUI, which makes developing robots in UiPath much easier for people with very basic or no programming knowledge. The UiPath platform consists of three main products. Those are:

- UiPath Studio: It is a desktop application which enables development of automation projects and workflows in visual manner, using diagrams.
- UiPath Robots: The robot executes the process built using the UiPath studio. The robots can work unattended (run without human supervision in any environment, be it virtual or not) or as attended (a human triggers the process).
- UiPath Orchestrator: It is a web application that can be used to monitor and manage the robots, deploy and schedule the robots while business exception handling is available through centralised work queues.

10.3 Conclusion

Robotic Process Automation is a technological movement that can already be considered a phenomenon. It is part of the innovations that drive the so-called “digital transformation era” and will definitely offer countless benefits in CISD upon its application to eliminate repetitive tasks. Ultimately, there is no magic solution for implementing RPA, it requires an intelligent automation system that should be part of the long-term journey for adopting it in our daily routines.

Chapter 11

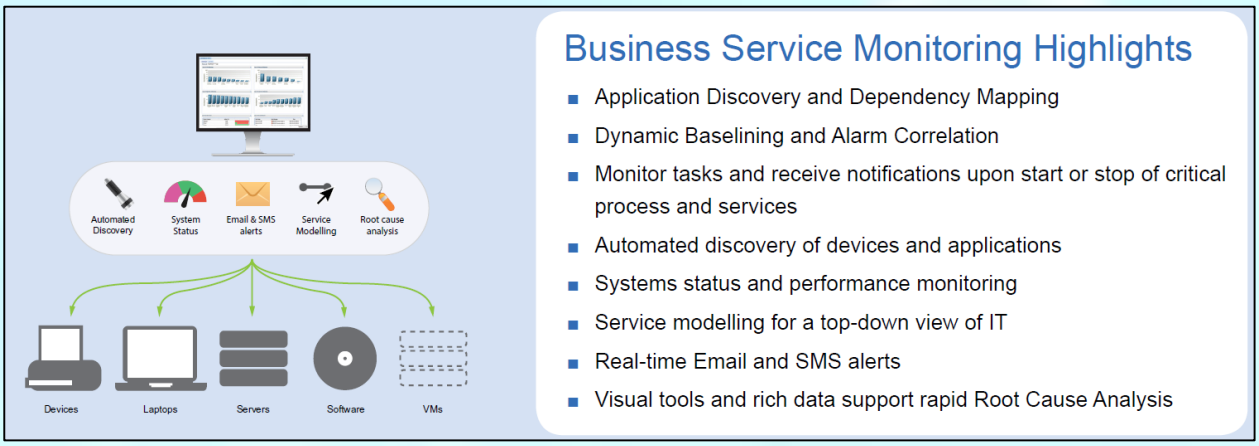
Command and Control Centre

11.0 Introduction

The IT personnel of every organisation has a very daunting task: to provide constant uptime for the mission-critical applications running in their ICT infrastructure. However, unplanned outages can happen and IT staff must be proactive in finding ways to prevent them. Our mandate is to provide State of the Art ICT support service within 48 hours. But what if we could have forecasted the upcoming problem?

11.1 Birth of the Command and Control Centre

CISD was in need of a business service monitoring solution for device/software-level monitoring and providing automated, priority-based notifications, ensuring CISD Staff could respond effectively to support the business. Hence, the Command and Control Centre (CCC) was established in January 2019. The CCC ultimately assists in finding the issues that are most important to the business more effectively and efficiently.



The CCC has been set up in CISD to monitor all the different servers, machines and networking equipment localised in the different Ministries/Departments of the Government of Mauritius which are interconnected via the Government IntraNet System (GINS). The monitoring solution is hosted in the GOC Cloud and CISD Officers operate it

via appropriate localised monitors and networking equipment at the CISD headquarters. ZABBIX, an open source enterprise-level monitoring tool, has been selected. The monitoring parameters (figures and status) received from the devices being monitored are interpreted through easy to use and understandable graphical user dashboards using GRAFANA, an open source software that acts as the front end.

11.2 Aims and Objectives

The aim of the CCC in CISD is to provide the tools and information that allow the System, Network and Database Administrators (CISD staff posted in the respective Ministries/Departments to administer user computer systems to assess the performance level and the load of each equipment that make up the system and network Infrastructure, and to be alerted through email, SMS and Slack upon tolerance thresholds being reached. Using this new system, Ministries/Departments moved from a reactive mode of operations of their computer systems to a proactive mode of operations as it empowers the DBAs in the Ministries/Departments to pre-emptively analyse, diagnose and resolve issues leading to degradation and failure of Government ICT systems.

The objectives are:

- To assess and improve the level of the service provided
- To alert the designated parties for timely and efficient remedial action
- To facilitate and assist the analysis and diagnosis of performance issues
- To maintain an acceptable level of performance in the GINS infrastructure
- To monitor CPU load on servers and take proactive measures against service degradation

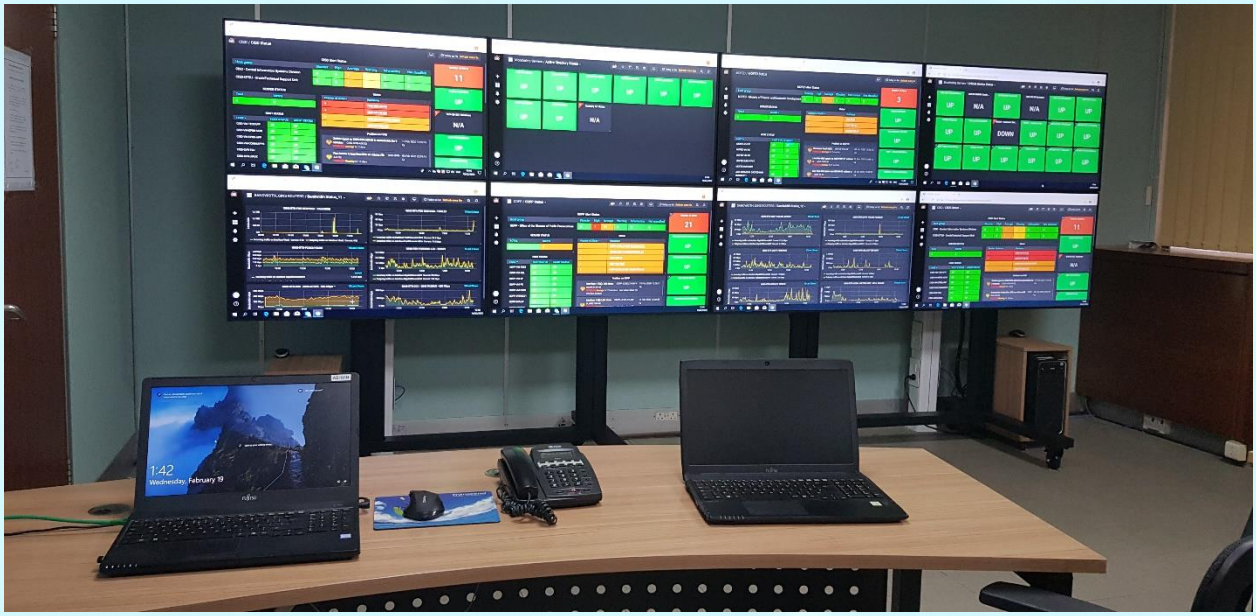


Figure 20: CCC section at CISD

11.3 Conclusion

Computer disaster is one of the major issue we come across in the Public Sector that makes the headlines frequently. By taking a proactive approach to problem resolution the CCC is of great assistance to critical Government systems, aiding in early detection and consequent resolution of issues thus minimizing disruptions.

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About this CISD E-Book

This E-Book has been prepared following five decades of operations of the CISD (formally known DPD). An audio version of this E-book is available on CISD e-library at http*://ebooks.govmu.org*. There has been a significant evolution in CISD's activities, moving from a centralised ICT support division to a decentralised one. From a purely programming aspect, this division has expanded its services to include networking, database administration, website development, pc troubleshooting and support, among others. Since 1971, CISD has continued to undertake the operations of the payroll system, which is one flagship application although there has been major and sustained innovation initiated by the division.

In 2020, CISD initiated a plethora of projects taking advantage of emerging technologies in order to enhance its services. These included open source VoIP, enhancement in payroll process, Chatbot with live agent, Data Analytics, Robotic Process Automation and Speech Technologies.

Discover more on our innovative projects inside this E-book.