

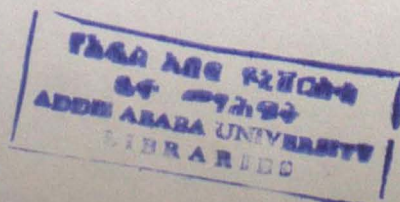
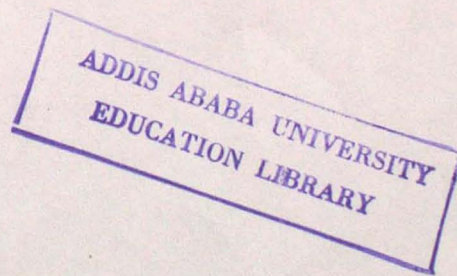
ADDIS ABABA UNIVERSITY
COLLEGE OF EDUCATION

DEPARTMENT OF CURRICULUM AND TEACHERS
PROFESSIONAL DEVELOPMENT STUDIES
(SCHOOL OF GRADUATE STUDIES)

OCCUPATIONAL STANDARD FOR ICT
TECHNICIANS VERSUS REQUIRMENT OF
THE LABOR MARKET IN SELECTED TEN
GOVERNMENT/PRIVATE ORGANIZATIONS

BY GENENE ABEBE

JULY 2007
ADDIS ABABA



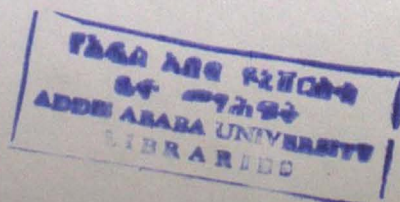
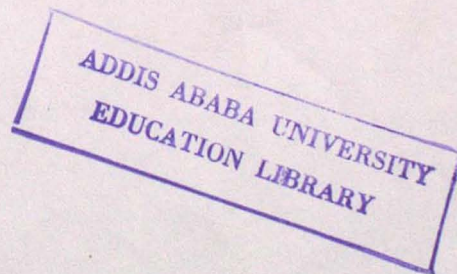
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BY GENENE ABEBE

**A thesis submitted to the Department of Curriculum and
Teachers Professional Development Studies**

College of Education

Addis Ababa University

(School of Graduate studies)

**In partial fulfillment of the requirements for the degree of
Master of Arts in Curriculum and Instruction**

JULY 2007

ADDIS ABABA

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COLLEGE OF EDUCATION

DEPARTMENT OF CURRICULUM AND TEACHERS
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BY GENENE ABEBE

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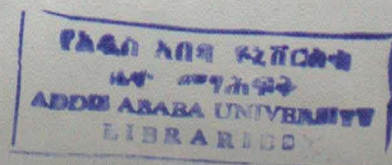
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Table of contents

Content	Page
Acknowledgement.....	i
Table of contents	ii
List of figures.....	v
List of tables	vi
List of acronyms	vii
Abstract.....	viii
Chapter One: Introduction	
1.1. Back ground of the study.....	1
1.2. Statement of the problem.....	2
1.3. Objectives of the study	3
1.4. Significance of the study	4
1.5. The scope of the study	5
1.6. Limitations of the study	5
1.7. Structure of the report.....	6
1.8. Operational definition of terms.....	6
Chapter Two: Review of Related Literature	
2.1. Overview of occupational standards.....	8
2.2. Technical and vocational education as compared to general education.....	8
2.3. Review of occupational standard in Ethiopian Education and Training System.....	9
2.3.1. Introduction	9
2.3.2. Objective of the national occupational standard.....	18
2.4. International experience in developing occupational standards	18
2.4.1. Different countries' perception of the need for occupational standards.....	18
2.4.2. Approaches to occupational standards development process.....	19
2.5. Occupational/Job analysis methods in developing occupational standards ...	24

Content	Page
2.5.1. Introduction	24
2.5.2. Components of the occupational/job analysis process	24
2.5.3. Major methods of occupational/Job analysis	24
2.6. Stakeholder involvement	25
Chapter Three: Research design and Methodology	
3.1. Introduction	28
3.2. Research approach	28
3.3. Research design	29
3.4. Methodology	31
3.4.1. Sources of data	31
3.4.2. Population and sampling	31
a. Selection of research settings	31
b. Selection of research participants	33
3.4.3. Tools for data collection	34
3.4.4. Data collection procedures	36
3.4.5. Methods of data analysis and organization	39
3.4.6. Ensuring good quality of data	42
3.4.7. The Researcher's role	43
3.4.8. Ethical issues	44
Chapter Four: Data analysis and Interpretation	
4.1. Within-case analysis	46
4.2. Cross-case analysis	72
4.2.1. Cross-case analysis of the occupational titles	72
4.2.2. Cross-case analysis of skills required from ICT technicians	73
4.3. OS gap analysis	80
4.4. What might have caused the gap?	83
4.4.1. Only one method used in the OS development process	84
4.4.2. No involvement of ICT technicians in the OS development process	85
4.4.3. Insufficient labor market information	86



Content

Page

Chapter Five: Summary, Conclusions and Recommendations

5.1. Summary	89
5.2. Conclusion.....	91
5.3. Recommendation.....	93

References

Appendix I: Open-ended questionnaires

Appendix II: Interview questions for representatives from industries, from MOE, and from GTZ

Appendix III: Interview questions (Expert interview protocols) for ICT Technicians

Appendix IV: Participating organizations by number of participants

List of figures

Figure	Page
Figure1. Flowchart showing the occupational standards development process and its application by (HRDC)	20
Figure3. Standard's development process by CANTA	22
Figure4. Model of certification by CANTA	23

List of tables

Table	Page
Table 1. Skills in terms of duties for Assistant soft ware Technician (Level I)	10
Table 2. Skills in terms of duties for ICT Application Developer (Level III).....	11
Table 3. Skills in terms of duties for ICT Technician	12
Table 4. Skills in terms of duties for Assistant ICT system Technician	14
Table 5. Skills in terms of duties for ICT system Technician	16
Table6. Documents and type of data they contain.....	36
Table7. Skills required of office machine maintenance technicians: The case of ROME computers.....	60
Table8. List of organizations and types of occupations they have for ICT technicians.....	71
Table9. Themes/skills for computer operators	76
Table10. Themes/skills for computer technicians	77
Table11. Themes/skills for network technicians	78
Table12. Themes/skills for communications technicians.....	79

List of Acronyms

- BIBB (A German acronym) - Federal Institute for Vocational Education and Training of Germany
International Advisory Services
- CANTA-Caribbean Association of National Training Agencies
- DACUM-Developing A Curriculum
- DDN-Digital Data Network
- EICTDA-Ethiopian Information and Communication Technology Development Agency
- ETC-Ethiopian Telecommunication Corporation
- ET-Ethiopian Airlines
- FJA-Functional Job Analysis
- GTZ (A German acronym)-German Technical Cooperation Agency
- HRDC- Human Resource Development Canada
- ICT-Information Communication Technology
- IFIP- International Federation for Information Processing
- ITOs- Industry Training Organizations
- LMI-Labor Market Information
- MOE- Ministry of Education
- MOLSA-Ministry of Labor and Social Affairs
- NBE-National bank of Ethiopia
- NOS-National Occupational Standard
- NTA-National Training Agency
- NVQ-National Vocational Qualifications
- OS- Occupational Standard
- PC-Personal Computer
- SPI- Sectoral Partnerships Initiatives
- TTNVQs-Trinidad and Tobago National Vocational Qualifications
- TVET-Technical and Vocational Education & Training

Abstract

The labor market requirement versus Occupational Standard for ICT Technicians

This thesis addresses what skills and knowledge the labor market requires from ICT technicians who graduate from Technical and vocational education & training institutes and colleges. It also analyses the occupational standard for ICT technicians and finds out the gap between the labor market demand and the OS for ICT technicians.

The major objective of this study is to investigate the degree of responsiveness of the OS for ICT technicians to needs of employers.

The research approach employed in this study is the qualitative research approach. The research design employed in this research is multiple-case studies. Selection of research settings and sources of data was mainly based on purposive sampling technique. 10 organizations were chosen by purposive sampling. 17 ICT technicians were involved in this study from the selected 10 organizations.

The data collection methods included open-ended questionnaires, interview and document analysis. Sources of data were human resource officers of 10 organizations, ICT technicians in the organizations, industry representatives who involved in the development of the OS for ICT technicians, representative from MOE and representative from GTZ. Representative from MOE and representative from GTZ were chosen based on their availability. Two industry representatives, who participated in the development of the OS, were selected purposively for the interview.

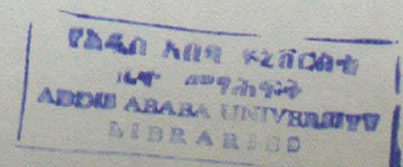
The data obtained were qualitatively analyzed. The analysis methods used in this research were within-case analysis, cross-case analysis and OS gap analysis.

The major findings of the study were the following:

- No adequate market information was gathered before developing the occupational standard for ICT technicians.*
- Almost all the industry representatives who involved in the development of the occupational standard were not ICT technicians.*
- There is mismatch between the skills and knowledge that are listed in the occupational standard and the skills and knowledge that the labor market seeks from ICT technicians.*
- The occupational standard for ICT technicians was found to be insufficiently responsive to changing employers' needs as well as the existing employers' need.*

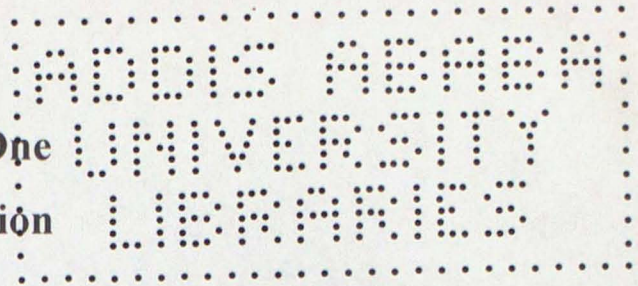
It is very important to gather sufficient market information to develop OS that is sufficiently responsive to current and future skills needs of employers. Using only one method to gather labor market information is not sufficient. As the OS was found to respond to the labor market demand insufficiently, the researcher recommends that the OS should be revised before it is implemented at national level.

Finally, it is recommended that further needs analysis is needed to develop OS that fully responds to the present and future demands of employers.



Chapter One

Introduction



1.1. Background of the study

High unemployment rates among educated young people and their low skill levels are issues of critical policy concern for many countries. According to the National Technical and Vocational Education & Training (TVET) Strategy (August 2006) of Ethiopia, the official unemployment rate is about 26% in urban areas. The figure obviously exceeds this in rural areas. This is combined with another policy concern that school-leavers from different institutions are entering the labor market ill-prepared for the world of work. This could be attributed partly to absence of link between training providers and the labor market. The following was taken from Strategy to Revitalize Technical and Vocational Education and Training (TVET) in Africa (January 2007):

In almost all countries in Africa, large numbers of graduates coming out of the formal school system are unemployed, although opportunities for skilled workers do exist in the economy. This situation has brought into sharp focus the mismatch between training and labor market skill demands. Critics argue that the lack of inputs from prospective employers into curriculum design and training delivery are partly responsible for the mismatch. (p.17)

In fact many were left unemployed after graduating from the technical schools. According to Education Sector Development Programme III (ESDP III) 2005/2006-2010/2011 (April 2005), the problem of unemployment still exists even though the new education and training policy that the country by now follows gives better attention to Technical and Vocational Education and Training program. There are indications that TVET still lacks effectiveness and efficiency. Studies have shown that many TVET graduates remain unemployed even in those occupational fields that show a high demand for skilled manpower.

According to Desalegn Mulaw and Julia Schmidt (September 2006), Findings from the World Bank study of TVET in Ethiopia show the following:

- Low productivity and low average wages
- Many youths enter the labor market
 - through low-quality jobs in the informal sector

- or into unemployment
- Labor supply is growing fast (2.6% population growth since 1990)
 - 1.5 million Youth annually enter the labor market

According to the National Technical and Vocational Education & Training (TVET) Strategy (August 2006), an important response from Ministry of Education is to undergo outcome-based TVET reform, which includes the development of occupational standard to facilitate the school to work transition and reduce skills gaps and skills mismatches in the labor market.

To reach this goal, several activities have been introduced. The following activities were launched to respond to the labor market demand for skilled labor force: Revising curriculum, skill upgrading for TVET teachers, employing expatriate teachers to ease teacher shortage, drafting legal framework for the TVET management and operations, developing directives and guides on accreditation, apprenticeship, trade testing, certification, and developing occupational standards. It was believed that occupational standards which are developed and accepted by the world of work bear utmost importance for defining the qualifications of labor force demanded by employers.

To this end, the Ministry of Education in collaboration with German Technical Cooperation Agency (GTZ) and other stakeholders prepared a written document of occupational standard for ICT technicians in April 2006 in order to bridge the employment and training systems with the intention to serve the needs of the labor market. The purpose of this study was to examine whether the developed occupational standard responds to the skills and knowledge requirements of the labor market.

1.2. Statement of the problem

Studies showed that large numbers of graduates coming out of the formal school system are unemployed, although opportunities for skilled workers do exist in the economy and this was found to be the result of the mismatch between training and labor market skill demands (Strategy to Revitalize Technical and Vocational Education and Training in Africa, January 2007). The major problem that initiated me to study this area is the unemployment rate of graduates from TVET, which is partly associated with low skill of the graduates. (Education Sector Development Programme III (ESDP III) 2005/2006-

2010/2011, April 2005). If the OS is not prepared in a way that it responds to the labor market requirement, the ICT curriculum which will be designed based on the OS will not be able to equip trainees with sufficient skills and knowledge that makes them fit to the world of work. It is therefore important to explore whether or not the OS responds to the labor market requirement to find out the root cause of the problem and to give recommendations for solving the problems. The research set out to answer the following question:

- Does the OS for ICT technicians respond to the needs of the labor market?

In order to answer the main question, the following subsidiary questions were also developed:

- What are the major occupations for ICT technicians in the world of work?
- What skills does the labor market require from ICT technicians?
- Does the OS for ICT technicians include the major occupations that the labor market requires?
- Do the skills included in the OS for ICT technicians align with the skills that the labor market expects from ICT technicians?
- How was the OS for ICT technicians prepared?
- Who participated in the development of the OS for ICT technicians?
- Did those people who developed the OS for ICT technicians gather sufficient labor market information before developing the OS?

1.3. Objectives of the study

The research objectives were

- to identify occupations for ICT technicians in the world of work
- to assess the skills and knowledge that employers require from ICT technicians
- to find out whether there is a gap between the OS and the labor market requirement
- to identify possible causes for the mismatch between the occupations and skills included in the OS and the occupations and skills required by the labor market.

-to forward recommendations on how to reduce the gap between the OS and the labor market requirements.

1.4. Significance of the study

In both industrialized and developing countries, a complaint is heard that training providers like TVET do not deliver the skills required by business and industry. Many developing countries like Ethiopia are relying on supply dominated approach to the preparation of graduates entering the labor market. It is therefore vital to equip TVET graduates with skills and knowledge that industries require, and this will be possible if occupational standard, which determines the curriculum to be developed, is prepared with thorough understanding of the labor market needs.

In the absence of reliable information relating to employment needs, the OS is at best guided by assumptions rather than hard facts. It is therefore very important to make sufficient study of skills and knowledge requirements of the labor market before preparing occupational standard.

- ❖ This study will enable those who develop occupational standards to see whether the OS that they prepared responds to the labor market needs. It will also pinpoint skills and knowledge that are not addressed by the occupational standard. It is believed that this study will initiate those who are involved in the development of the occupational standard to revise the existing occupational standard so that it would be responsive to the current and future skill needs of the labor market.
- ❖ This study will also add to the pool of research knowledge available on developing occupational standards. It tries to show important issues to be considered in developing occupational standards. It addresses an issue that needs further study before developing occupational standards and also before implementing them.
- ❖ This study tries to address a big issue that will have implication at national level as it focuses on occupational standard that is expected to be used by all ICT education and training providers throughout the country.

1.5. The scope of the study

The research focused on what skills and knowledge the ICT technicians should have to be competent in the world of work. It tries to find out the gap between the skills included in the OS for ICT technicians and the skills that the labor market requires from the technicians. This research doesn't include the expectations of training providers, professional associations and other stakeholders who might have interest in the OS that is developed. It is beyond the scope of this research to deal with the skills that the labor market expects from ICT professionals, those who have first degree and above in computer science or other related fields.

1.6. Limitations of the study

One of the limitations of this research is that it was difficult to get similar researches in this area locally and at international level. The concept of occupational standard came with the reform of TVET, which by itself is a relatively new concept in the education and training systems. Though many countries are advocating the importance of having national occupational standards to bridge between the labor market & training providers, and though there are literatures about how OS is prepared, it was difficult to find a research that has been carried out to check whether the occupational standards that are prepared respond to the labor market requirement. In fact this was one reason for the fact that I employed qualitative approach in this research (Creswell, 2003).

The other limitation of this research is that observation could not be used as a method though it was believed that this kind of research requires the inclusion of observation as one method for data collection. When using observation as a method, the job analyst (researcher) watches the employees perform the work and simultaneously interviews them. It is believed that, with observation, the job analysis gains acceptance and credibility among job incumbents and supervisors. However, this method requires a significant period of time. Therefore, this method was not used due to time constraint. In fact I had a chance to observe some of the activities that the technicians do and some tools and machines they used, though I didn't formally included it as a data collection method.

The other constraint in this research was that in some of the organizations it was not possible to interview the technicians for more than 20 or 30 minutes as their supervisors were urging us to finish our discussion as they wanted them to get back to their jobs. As a result, there were cases that I couldn't get full information from the ICT technicians.

1.7. Structure of the report

Chapter one contains the following:

- ❖ Back ground to the study
- ❖ Statement of the problem
- ❖ Objectives of the study
- ❖ Significance of the study
- ❖ Limitations and delimitations of the study

Chapter two contains

- ❖ Description of occupational standard
- ❖ International perspective of occupational standard
- ❖ How occupational standard is developed
- ❖ Methods used in developing occupational standard

Chapter three contains

- ❖ Research design
- ❖ Methodology
- ❖ Methods of data analysis
- ❖ Ethical issues considered in the study

Chapter four contains the analysis and interpretation of data

Chapter five focuses on major findings of the study and recommendations based on the findings.

1.8. Operational definition of terms

To help readers understand this thesis more easily, this section provides the definitions of nine related terms used in the thesis.

Clustering-Merging occupations or job families using a criterion of commonality of worker skills required to perform each occupation.

ICT technician-a person who has certificate or diploma in computer science, Information Technology or related fields and works in processing data and developing information, or works on technologies designed for processing data or developing information.

Occupation-the activity (job) that a person is engaged in to earn money.

Occupational standard- Industry accepted descriptions of what ICT technicians have to be able to do and have to know in order to perform specific jobs or tasks in the work place.

Occupational title- The title given to ICT Technicians in the place where they work. E.g.:-Network technician.

Organization- in this paper refers to any entity that comprises two or more individuals working for the same goal. It includes government organizations, private companies and enterprises.

OS gap analysis- a process to determine if an OS currently covers all the occupations & skills that the labor market needs.

OS gap-an occupation or skill that is found to be required by the labor market but does not exist in the OS

Skill- Capacity of a worker to perform individual job tasks; detailed description of a job position in terms of duties

Chapter Two

Review of Related Literature

2.1. Overview of occupational standards

Occupational Standard (OS) describes what an individual needs to do, know and understand in order to carry out a particular job role or function. It is a benchmark of performance. It provides the means for assessing performance in a job: It is work-related statements of the ability, knowledge, understanding and experience that an individual should have to carry out key tasks effectively (IFIP, 1998).

Standards function as a quality-warranty, a goal-indicator, and a change-promoter (Silvan, 1993). In the context of education, standards clarify expectations of student performance (Rahn, O'Driscoll, & Hudecki, 1999). According to Silvan (1993), the greatest implication of occupational standards has been the evaluation of student performance. Advocates believe that occupational standards have the potential to

- (1) improve the workforce;
- (2) provide uniform measures for the international marketplace;
- (3) provide portability of employment for workers.
- (4) increase accountability, and
- (5) meet the needs of business and industry (Bunn & Stewart, 1998).

2.2. Technical and vocational education as compared to general education

The term technical and vocational education encompasses programs that provide participants with skills, knowledge, and aptitudes that enable them to engage in productive work, adapt to rapidly changing labor markets and economies, and participate as responsible citizens in their societies.

In 1999, at the Second International Congress on Technical and Vocational Education in Seoul and at the 30th session of the General Conference of UNESCO in Paris, it was

agreed to adopt the phrase “Technical and Vocational Education and Training” (TVET) to describe the combined process of education and training and recognize the common objective of employment as their immediate goal. The congress emphasized that TVET should be a multi-domain concern, requiring collaborative and integrated approaches.

Technical vocational education differs from general education in that general education creates ‘general human capital’ and vocational and technical education ‘specific human capital’ (Becker, 1964).

2.3. Review of occupational standard in Ethiopian education and training system

2.3.1. Introduction

According to the National Technical and Vocational Education and Training (TVET) strategy (August 2006), traditionally Technical and Vocational Education and Training (TVET) in Ethiopia has been fragmented and delivered by different providers at various qualification levels. According to the strategic document of 2006, the National TVET strategy replaced an older version adopted in 2002. As indicated in the strategy, it was decided to move towards an occupational standard-based TVET system to replace the current curriculum-centered approach. It declares that with the introduction of National Occupational Standards, the existing TVET curricula will be gradually phased out and new curricula will accordingly be developed based on the new occupational standards. Curriculum-based approach is more centralized approach than the occupational standard-based approach. IN OS-based approach, each TVET institution will be free to develop its own curriculum based on the OS. According to this strategic document, the new curricula will no longer be federally binding curricula. TVET providers have to develop their own curricula that are based on the national occupational standards and substantial support will be provided to the TVET providers to enable them to translate the occupational standards in to appropriate curricula.

To this end, the Ethiopian Technical and Vocational Education and Training (TVET) Qualification Authority has developed Occupational Standards (OS) in 2006. The occupational standard for ICT technicians (which was Facilitated, prepared and compiled by Ministry of Education /MoE, May 2006) contains the following occupational titles and corresponding skills described in terms of duties.

Table 1. Skills in terms of duties for Assistant soft ware Technician (Level I)

Assistant Soft ware Technician is a person who performs fixing minor software problems, gather system requirement, and secure a system by establishing backups.

Duty	Tasks				
1. Gather System Requirement	1.1 Assess users requirement	1.2 Assess existing system	1.3 Identify system requirement		
2. Install Software	2.1 Identify users need	2.2 Select software	2.3 Identify type of Installation /New Installation or upgrading/		
3. Establish Backup System	3.1 Identify data for backup	3.2 Schedule backup	3.3 Select media to take backup	3.4 Take backup	3.5 Handle backup
4. Secure Software	4.1 Identify software security levels	4.2 Label software	4.3 Handle software	4.4 Set password & user name for clients PC's	4.5 Keep backups
5. Trouble Shoot Software	5.1 Identify problem	5.2 Identify possible solutions	5.3 Make backups	5.4 Fix the problem	5.5 Restore backup
	5.6 Format storage media				
6. Managing Data	6.1 Select key word for search	6.2 Use internet connection	6.3 Search data	6.4 Organize collected data	6.5 Prepare documentation
	6.6 Encode data				

Table 2. Skills in terms of duties for ICT Application Developer (Level III)

ICT Application Developer is a person who performs assistance in software development activities by designing simple data base, web page, training and consultation of users and system administration.

Duty	Tasks				
1. Perform Documentation (Level II)	1.1 Collect data/ Information	1.2 Classify files	1.3 Organize data	1.4 Prepare index	
2. Design web page (Level III)	2.1 Collect required information	2.2 Select technology/ software	2.3 Design interface	2.4 Manage web page	2.5 Manage web site
3. Gather system requirement (Level II)	3.1 Prepare proposal	3.2 Prepare data gathering instruments	3.3 Analyze user requirement	3.4 Interpret collected data	3.5 Generate reports
4. Support customer (Level II)	4.1 Consult customers	4.2 Upgrade software	4.3 Update software	4.4 Secure customer PC	4.5 Assist customer on application software
	4.6 Schedule customer support				
5. Design data bases (Level II)	5.1 Collect data	5.2 Analyze user requirement	5.3 Identify entity	5.4 Analyze relation	5.5 Select data base management
	5.6 Create data base application	5.7 Manage data base			
6. Design multi media system (Level II)	6.1 Select media	6.2 Prepare multi media tools	6.3 Collect data	6.4 Select Application	6.5 Prepare storage
	6.6 Edit data	6.7 Prepare animation			
7. Train users (Level III)	7.1 Assess Training needs	7.2 Prepare training guideline	7.3 Prepare user manual	7.4 Conduct training	7.5 Evaluate trainee
8. Maintain software (Level III)	8.1 Consult customers	8.2 Identify system problem	8.3 Search new system	8.4 Schedule maintenance	8.5 Modify software
	8.6 Debug software	8.7 Test software			
9. Administer system (Level II)	9.1 Prepare privilege policy	9.2 Access Authorization	9.3 Check system status	9.4 Administer web site	9.5 Administer data base
	9.6 Administer software				

Table 3. Skills in terms of duties for ICT Technician

ICT Technician is a person who can install hard ware component and soft ware, Identify and repair simple problems in computer system and net works

Duty	Tasks				
1. Install hard ware components	1.1. Prepare tools and materials for installation work	1.2. Install mouse	1.3. Install key board	1.4. Install power unit supply unit	1.5. Install monitor
	1.6. Install printer	1.7. Install scanner	1.8. Install projector (LCD)	1.9. Install floppy disk drive	1.10. Install DVD/CD drive
	1.11. Install clock battery	1.12. Install hard disk drive	1.13. Install modem card	1.14. Install network cards	1.15. Install random access memory (RAM)
	1.16. Install power cables	1.17. Install sound card			
2. Install system application software	2.1. Install operating system (OS)	2.2. Install anti virus software	2.3. Install printer driver	2.4. Install graphics adapter (VGA) driver	2.5. Install network interface card (NIC) driver
	2.6. Install modem driver	2.7. Install sound card driver	2.8. Install scanner driver	2.9. Install application software	
3. Identify simple problems in a computer system	3.1. Identify loosely connected mouse	3.2. Identify corrupted operating system	3.3. Identify power supply init failure	3.4. Identify hard disk failure	3.5. Identify simes battery failure

Duty	Tasks				
	3.6. Identify monitor problems	3.7. Identify floppy disk failure	3.8. Identify memory problem	3.9. Identify CD/DVD Drive failure	3.10. Identify power cored failure
	3.11. Identify processor fan failure	3.12. Identify data cables failure			
4. Repair simple problems created in a computer system	4.1. Fix loosen cables	4.2. Fix mouse problems	4.3. Fix key board problems	4.4. Give solution for power cored problem	4.5. Correct mal functioning processor fan
	4.6. Repair hard disk problem	4.7. Repair failed floppy disk drive	4.8. Repair CD/DVD drive	4.9. Fix simple monitor	3.10. Repair corrupted operating systems
5. Identify simple net work problems	5.1. Identify loose connections at work stations and hubs	5.2. Identify damaged network cables	5.3. Identify IP Address conflict	5.4. Identify absence of input power in the network devices	5.5. find problems on both end RJ – 45 connecter
	5.6. Identify problem on network card	5.7. Identify proper arrangement of network cable wires			

Table 4. Skills in terms of duties for Assistant ICT system Technician

Assistant ICT system Technician is a person who can perform can perform upgrading of hard ware components and soft ware, conduct structural cabling, make simple network configuration maintain medium faults and provide training.

Duty	Tasks				
1. Upgrade hard ware components	1.1. Upgrade hard disk	1.2. Upgrade CD Rom	1.3. Upgrade RAM	1.4. Upgrade printer	1.5. Upgrade network interface card
	1.6. Upgrade processor				
2. Upgrade soft ware	2.1. Upgrade operating system	2.2. Upgrade application software	2.3. Install service packs	2.4. Upgrade Anti-virus	2.5.
3. Conduct structural cabling	3.1. Read instruction document	3.2. Prepare working tools	3.3. Prepare working materials	3.4. Install PVC trunking	3.5. Run cables along the PVC trunks
	3.6. Grimp cable ends	3.7. Test crimped cable ends	3.8. Label cables		
4. Conduct simple network configuration	4.1. Assign work group name for hosts	4.2. Assign host name to each network host	4.3. Assign IP address to network hosts	4.4. Test network configuration	4.5. Configure hosts for internet connection

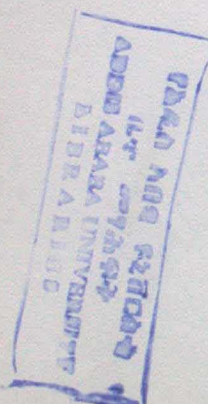
Duty	Tasks				
	4.6. Test the internet connection for each host				
5. Identify and maintain medium faults in computer systems and networks	5.1. Identify BIOS settings	5.2. Arrange BIOS settings	5.3. Identify upgradeable hard disk	5.4. Identify upgradeable RAM	5.5. Identify upgradeable CD drive
	5.6. Identify network configuration problems	5.7. Maintain network configuration problems	5.8. Identify internet connection problems	5.9. Maintain internet connection problems	5.10. Provide support for users

Table 5. Skills in terms of duties for ICT system Technician

ICT system Technician is a person who can install, configure, test, maintain, administrator hard ware and soft ware devices and provide consultancy service and technical supports in ICT system and networks

Duty	Tasks				
1. Install hard ware and soft ware in ICT system and net works	1.1. Install rack for network devices	1.2. Mount network devices on rack	1.3. Fix cable ends on to patch panel	1.4. Label cable ends	1.5. Install UPS
	1.6. Install network printer	1.7. Install server operating system (OS)	1.8. Install corporate anti-virus	1.9. Install security software	1.10. Install back up devices
2. Configure hard ware and soft ware and soft ware in ICT systems and networks	2.1. Configure UPS	2.2. Configure serve operating system	2.3. Configure switch	2.4. Configure corporate anti-virus	2.5. Configure network printer
	2.6. Configure security software on server and clients	2.7. Configure backup devices			
3. Test hard ware and software ICT systems and networks	3.1. Test server	3.2. Test UPS	3.3. Test switch	3.4. Test network printer	3.5. Test corporate anti- virus
	3.6. Test back up devices				

Duty	Tasks				
4. Maintain ICT systems and networks	4.1. Maintain UPS	4.2. Maintain server operating system	4.3. Identify switch failure	4.4. Maintain switch	4.5. Maintain corporate anti- virus
	4.6. Maintain network printer	4.7. maintain back up devices	4.8. Maintain security soft ware	4.9. Maintain ends on patch panel	4.10. Identify hub failure
	4.11. Maintain hub failure				
5. Administer ICT systems and network	5.1. Administer server operating system	5.2. Administer switch	5.3. Administer network printer	5.4. Administer corporate anti-virus	5.5. Administer security software
	5.6. Administer back up devices				
6. Deliver consultancy service and technical support	6.1. Analyze maintenance requirements	6.2. Analyze service requirements	6.3. Develop guide lines for maintenance	6.4. Develop guide lines for service	6.5. Plan service usage policy
	6.6. Implement service usage policy	6.7. Monitor the implementation of service usage policy	6.8. Develop training manuals	6.9. Deliver training	6.10. Provide technical support



2.3.2. Objective of the national occupational standard

According to the strategic document, the occupational standard serves as a benchmark for TVET.

The objectives of the OS, as pointed out in the written OS document (2006), is to inform all stakeholders including g the trainees and job seekers about the general occupational requirements a candidate has to fulfil during examination in order to obtain Nationally accredited Certificate' and in order to bridge the employment and training systems to better serve the needs of the employment life.

2.4. International experience in developing occupational standards

2.4.1. Different countries' perspective on occupational standards

Driven by growing concerns about educational quality and perceptions that a more competitive international economy demands a higher skilled workforce, industry-based occupational standards have moved to the center of mainstream education and training reform. It is widely believed that an improved system of occupational standards is essential for improving the fit between what is learned in educational institutions and what is needed on-the-job, facilitating the movement from the institutions to work, and ultimately strengthening the country's economic position (Commission on the Skills of the American Workforce, 1990).

According to the Federal Institute for Vocational Education and Training of Germany International Advisory Services (BIBB, 2004), assessments have shown that employers are often not satisfied with the quality of vocational education and training. In particular, they complain the low quality of training schemes, lack of practical skills of trainees as well as inappropriate training contents.

Another report from BIBB by Dybowski (2005) shows that more and more countries are seeking the development of uniform VET (Vocational Education and Training) standards. It is increasingly being recognized that occupational standards are important benchmarks for the quality of vocational education and training and its international compatibility. Furthermore, such standards constitute a necessary reference framework in order to link

the demand for occupational competences on the labor market more closely with the training offered by the vocational education and training system.

According to BIBB (2004), many countries still don't have a uniform system of occupational standards that could serve as an orientation for training programmes and as a basis for the examination and certification of the competences acquired. The development of a national standardization, examination and certification system in cooperation with all the relevant stakeholders, particularly in the economic sector, is another key component in the reform process of the VET systems that has been launched in several countries where BIBB's consulting services are very much in demand.

BIBB (2004) also indicated that in many countries a growing need is emerging for greater orientation of the TVET profile towards the requirements of the labor market. One ongoing major problem is that the opportunities for companies to assess needs when it comes to developing human resources are limited. Furthermore, many companies are not sufficiently aware of the role which training can play in promoting economic growth and competitiveness. Consequently, it is still difficult to identify the demand for specific skills on the labor market. Hence, the TVET system is only capable to a limited degree of equipping people with the right knowledge and skills.

Journal of Industrial Teacher Education (2003) indicates that current directions and strategies for developing career and technical education in different countries are similar in that occupational standards for designing curriculum contents and teaching methods are developed to meet the needs of enterprises and lifelong learning.

According to Fretwell and his colleagues (2001), many but not all developed countries have occupational standards, and middle-income countries are increasingly developing standards.

2.4.2. Approaches to Occupational Standards Development Process

A. Human Resource Development Canada (HRDC, 2000) developed Occupational Standards Development Process "to support the Sectoral Partnerships Initiatives (SPI) and to provide industry, sector councils, associations, and national occupational groups with a simple, general and proven approach to help clarify the steps involved in the development of occupational standards and related training and certification programs."

The report outlines a flowchart of the process and briefly describes each of the critical steps.

Fig1. Flowchart showing the occupational standards development process and its application (By HRDC)

(Source from <http://www.hrdc-drhc.gc.ca/fas-sfa/rpp0203.shtm>)

Phase I: Planning the Process

Planning for Standards Development	Selecting an Occupational Analysis Facilitator	Selecting Industry Participants for the Occupational Analysis Workshop
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Phase II: Producing the Standards

Preparing for the Occupational Analysis Workshop	Conducting the Occupational Analysis Workshop	Drafting and Translating the Analysis
Validating the Occupational Analysis	Finalization and Acceptance of the Standard	Printing and Distribution of the Standard

Phase III: Establishing Approved Training Program

Developing a Curriculum and Training Program	Delivering the Training Program
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Phase IV: Certifying and Accrediting

Assessment and Certification of Individuals	Accrediting the Training Program
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Phase V: Continuous Improvement Loop

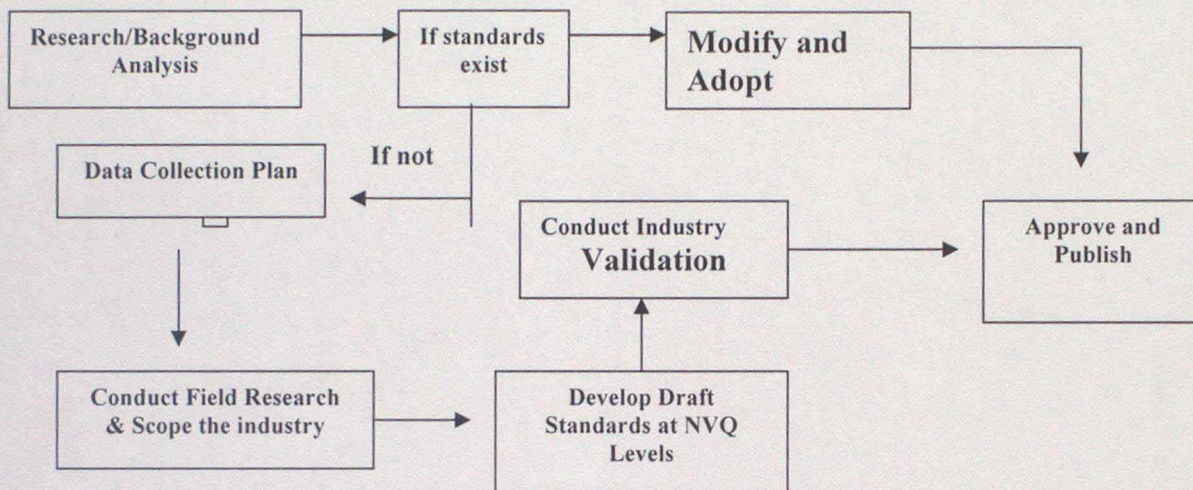
Monitoring and Measuring Effectiveness	Improving Processes
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B. The other approach in developing occupational standard is the one given by Caribbean Association of National Training Agencies (CANTA, October 2005). According to CANTA, standards development process involves the steps indicated in the chart below:

Fig2. STANDARDS DEVELOPMENT PROCESS (By CANTA)

(Source from

http://www.ilo.org/public/english/region/ampro/cinterfor/news/biblio/car_wtac.doc)

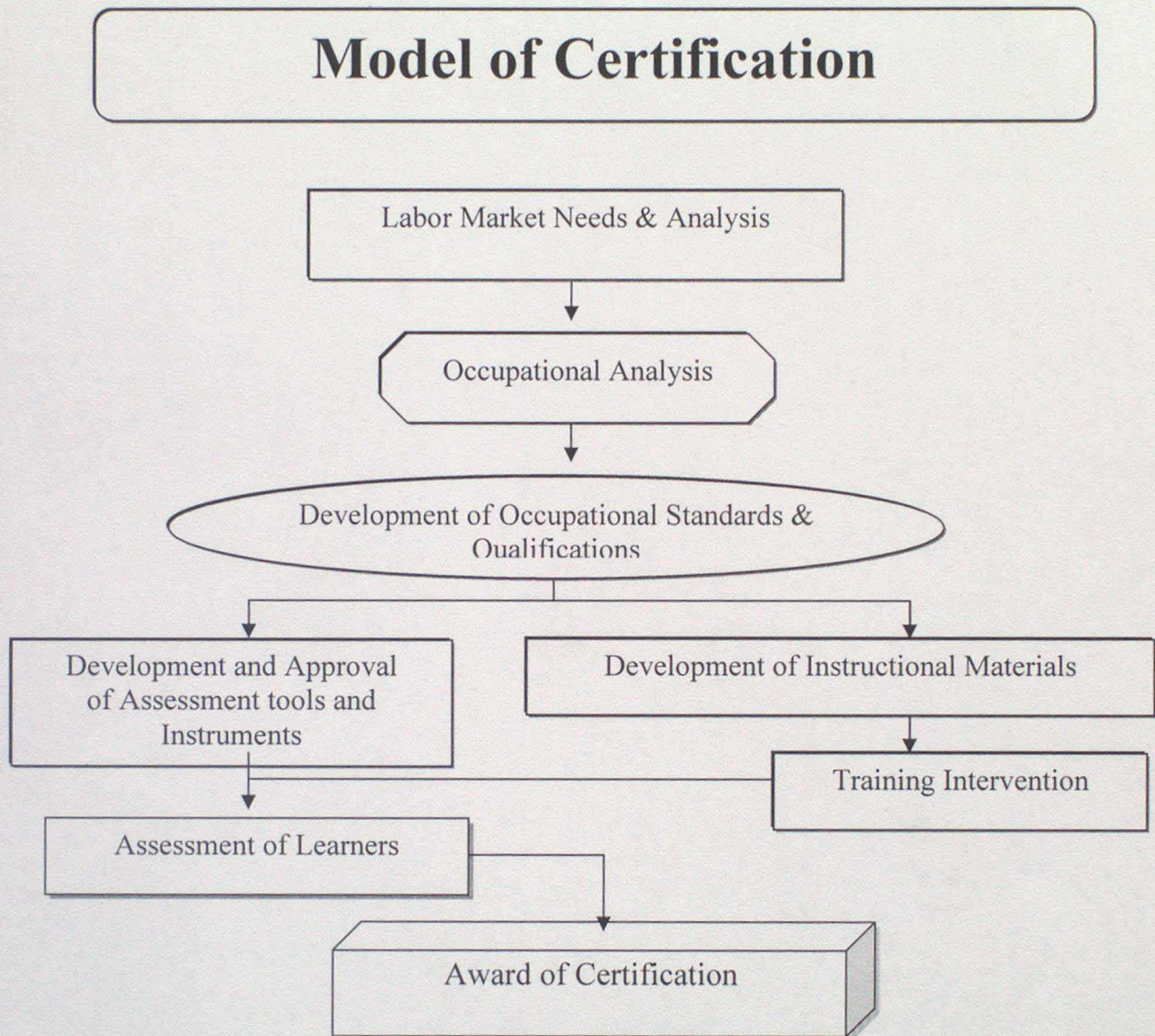


The whole process of the CANTA model is shown graphically as follows:

Fig3. Model of Certification by CANTA

(Source from

http://www.ilo.org/public/english/region/ampro/cinterfor/news/biblio/car_wtac.doc)



In all the approaches, it can be seen that labor market analysis (employers' needs analysis) is a prerequisite for developing occupational standards. Labor market information serves as an input for developing occupational standards. In other words, it is after collecting and analyzing labor market needs that occupational standards are developed.

2.5. Occupational/Job analysis methods in developing occupational standards

2.5.1. Introduction

Occupational or job analysis is a systematic effort to collect information about the work requirements associated with particular jobs. According to Capelli (1992) cited by Bailey & Merritt (December 1995), the analysis forms detailed frameworks for describing jobs. Most job analysis techniques have been in existence for at least thirty years. Throughout these years, they have been used as a crucial element in job design, the basis for establishing wage and salary structures, and as criteria for establishing the validity and legality of organizational decisions such as hiring, promoting, and training selection. More recently, job analysis has gained recognition as the foundation for industry-based skill standards. Indeed, Wills (1993) as cited by Bailey & Merritt (December 1995) contends that job analysis is fundamental to an investigation of industry standards because it provides a good basis on what workers do as work and also on the quality of their work performance.

Occupational standards must reflect ongoing economic and technical changes in the economy that result in changing skill demands in the labor force. Before embarking on development of OS, stakeholders need labor market information (LMI) to provide "early warning" and identify priorities for standards development in occupations. Analysis of LMI provides the starting point for in-depth occupational analysis and standards development.

There are several major methodologies for developing occupational standards, all of which start with analyzing what people in a certain occupation are doing. In spite of this common basis, occupational analysis methods differ considerably and so do the occupational standards that are the result of the analysis.

2.5.2. Components of the occupational/job analysis process

Wills (May 2, 2005) identified four components of the job analysis process. These are: Sources of Job Data, methods for obtaining Job data, Type of job descriptor and purpose of analysis.

2.5.3. Major methods of occupational/Job analysis

Fretwell & his colleagues (2001) identified three methods for occupational analysis. These are job/task analysis, DACUM, and Functional Analysis.

The most effective approaches

The question then becomes, "Which of the variety of job analysis techniques is most effective?" According to Wills (May 2, 2005), in spite of the fact that a number of studies have been performed around that question, no clear conclusions can be drawn. Several studies suggest that both simple and complicated analysis methods frequently produce adequate data. Hermann, Willett and Rayner (1988, 1989), as cited by Wills (May 2, 2005), have investigated the types of analysis strategies that work best for producing particular types of job analysis data. Hermann and his colleagues argue that several types of job analysis data are produced during the studies. Not only are task descriptions produced, but the studies generate suggestions of skills and knowledge competency as well as information about the importance and extent of performance for any given task or competency. When these researchers investigated the Critical Incident Technique, DACUM, the Extended Search of Information (the library search of all published data on the job) and Observation techniques for providing each of these three types of data, they determined that while each technique produced useful task descriptions, DACUM and the Extended Search/Job Task Inventory were considerably more effective and efficient than were Observation and the Critical Incident Method. More specifically, DACUM and the Extended Search independently generated about 73% of the competencies on a master list of competencies provided through compiling results of all of these techniques. However, when DACUM and the Extended Search were combined, they produced 94% of the total competencies that were identified. Therefore, Hermann and his associates recommend the only truly effective way to conduct job analysis is through using multiple methods to deal with the entire range of tasks and competencies that might be produced in a job analysis.

2.6. Stakeholder involvement

Fretwell & his colleagues (2001) contend that the involvement of a broad range of stakeholders, with leadership from employers, is critical to the success of the development of standards. The very nature and content of OS dictates that the primary input must come from employers.

According to Badawi (August 2005), Employers, represented by economic sectors' committees/chambers, will be responsible for developing occupational standards, which will guide training institutions in developing performance specifications and training standards. These standards will serve as the criteria for developing objective testing with full participation of both employers and training institutions.

According to the National Training Agency (NTA, 2006) of Trinidad and Tobago, there are a number of standard-setting bodies called Industry Training Organizations (ITOs) which work in partnership with the National Training Agency (NTA) in the development, validation and publication of national occupational standards. The process is industry-led and relies on the active involvement of employers, employees, training providers, workers' unions and other people with expertise in the particular occupational area.

The National Training Agency has identified the following functions of ITOs:

- *Develop, review and implement national occupational standards for the sector, industry or occupational group.
- * Identify the current and future skills needed to ensure that the provision of training meets the industry's requirements.
- *Promote employers' investment in people as pivotal to improved business performance and increased competitiveness at home and abroad.
- * Improve linkages between vocational qualifications and progression routes from training programmes into employment.
- * Provide a forum for exchange between the industry representatives and government; to respond to national initiatives and to inform and influence the strategic development of the industry.

The agency further dictates that to be recognized as an ITO, existing associations which represent sectors or occupational groups must meet specific criteria. They must, for example, include representatives of:

- a wide cross-section of firms of varying sizes within the sector;
- the trade union/workers' association for the sector;
- the professional body which represents the sector;

- any research and development organisations in the sector.

In general we can see from literature that the key stakeholders who should actively participate in the development of occupational standards are government representatives, training providers, employers, employees/job incumbents and professional associations. It is indicated in many literatures that the involvement of employers in developing occupational standards is mandatory. In light of this, key stakeholders should be involved in the identification of occupational standards to ensure that TVET qualifications are employment-driven.

Chapter Three

Research design and Methodology

3.1. Introduction

This chapter discusses the research approach, research design and research methodology including sources of data, sampling technique, data collection instruments, data collection procedures, methods of data analysis, how good quality of data is maintained, and finally how ethical issues were handled.

3.2. Research approach

There are two research paradigms which shape the entire research process and provide valuable directions and principles concerning the approaches, methods and techniques for conducting a research (Guba, 1990; Ticehurst & Veal, 2000). These two research paradigms are the positivist and the interpretive paradigms. Positivist approach relies on statistical data where as the interpretive approach relies on meanings of particular situations. According to Ticehurst & Veal (2000), with respect to the paradigm decision, the researchers can freely select the best approach and employ it in their research.

According to Creswell (2003), there are three factors that affect the choice of an approach: the research problem, personal experience of the researcher and the audience(s) for whom the report will be written, and that there has been little or no previous research on the topic.

The research questions written for this research require qualitative approach. The main research question is whether the OS for ICT technicians responds to the skill demands of the labor market. It is very important to make thorough investigation and in-depth study of the labor market to determine whether there is alignment between what is included in the OS and what the labor market needs. This will be possible if qualitative approach is employed for this research. Therefore, this study has been undertaken using qualitative research approach. The other research questions such as What skills..., How was..., What are..., etc. are qualitative by nature as they are exploratory and, hence, necessitate in-depth understanding of the phenomena. The chosen qualitative approach matches these requirements.

The other reason to use qualitative approach for this research is that no previous research was conducted on this topic locally.

3.3. Research design

A research design is a plan or blue print of the activities planned for the research and it is selected in accordance with the type of research questions asked (Mouton, 2001). It is the logic that links the data to be collected and the conclusions to be drawn to the initial questions of the study (Rowley, 2002).

In order to explore the alignment between the OS for ICT technicians and the labor market demand, this study utilizes a qualitative case study design. Case studies can be particularly useful for studying a process, program or individual in an in-depth, holistic way that allows for deep understanding (Merriam, 1998).

Stake (2000) identified three types of case studies: intrinsic, instrumental, and collective. According to Stake, intrinsic case studies focus on a case that is unusual and is of particular interest to the researcher. The intent of intrinsic case studies is not to build theory (Stake, 2000). Creswell (2002) states that an instrumental case study is pursued in order to provide insight about a particular issue that may be generalizable. According to Stake (2000), the primary purpose of an instrumental case study is to help advance understanding. The collective case study encompasses more than one case so as to investigate different phenomena (Stake, 2000). Since the purpose is to help advance understanding, a collective case study is a grouping of instrumental case studies (Stake, 2000). Using a collective case study approach can allow for the possibility of stronger interpretation (Stake, 2000).

Though Stake (2000) uses the terminology "collective case study," this approach is known by other names such as, multiple case studies, cross-case studies, comparative case studies, and contrasting cases (Merriam, 1998; Yin, 2003). With multiple case studies, data are analyzed for insights both within each case and across cases (Merriam, 1998). Yin (2003) points out that multiple cases may be chosen to try to replicate insights that you find within individuals cases or to represent contrasting situations. Regardless of

whether the purpose is replication or contrast, multiple case studies are considered more compelling, and the overall study is therefore regarded as more robust (Yin, 2003).

Four types of case study designs were proposed by Yin (2003):

- ❖ Single case(holistic)
- ❖ Single case (embedded)
- ❖ Multiple case (Holistic)
- ❖ Multiple case (embedded)

According to Yin (2003), a single case design implies the deployment of one case study; and it is holistic when it involves simply one unit of analysis or the case itself. It is embedded when it integrates more complex sub units of analysis. Multiple case study refers to conducting several case studies, and it can be holistic if it entails several holistic cases in which each holistic case consists of only one unit of analysis. However, the embedded multiple case design consists of a number of embedded cases wherein each embedded case includes multiple units of analysis. (Yin, 1994; 2003).

According to Yin (1994; 2003), a single case study is suitable when:

- a) the case provides a vital test for established theory
- b) embeds an exceptional or unique event
- c) is a distinguishing or typical case

On the other hand, the grounds for using multiple case studies are mainly derived from replication logic where each case study is regarded as single experiment and investigation and the more cases that prove or disprove the existing theory, the more vigorous are the research outcomes (Yin, 1994; 2003). According to L. Miller and D. Brewer (2003), a case in a multiple-case study refers to several individuals, events or entities.

The research questions in this research require the study of different cases to address the questions. Skills that ICT technicians with different occupational titles (jobs) require to perform their jobs should be studied. Representatives from all stake holders who involved in the development process of the OS should be consulted. Documents should be revised to get insight of how the OS was prepared. All these require deeper and richer understanding of the events and entities. To deal with all these problems I found multiple case design the most appropriate for this research.

Moreover, Yin (2003) explains that using multiple case studies strengthens immensely the generalizability of research findings.

3.4. Methodology

Research methodology pinpoints the research process and the kind of tools and procedures to be used. Interview, open-ended questionnaires, and document analysis were used as data collection methods.

3.4.1. Sources of data

The research questions for this research demand to have data from different sources. Sources of data in this research include: Representative from MOE, representative from GTZ, industry representatives, ICT technicians who are currently working in 10 organizations, human resource officers of 10 organizations, documents such as the written OS, and the final report for clustering & classification of occupations in information and communication technology (ICT) in Ethiopia.

3.4.2. Population and sampling

a. Selection of research settings

Patton (1990) introduced the purpose of purposive sampling in multiple case studies by stating that case studies should be selected from among potential cases which are information-rich and provide the researcher with deep knowledge and understanding about the research issue. He identified sixteen different strategies of purposeful sampling for case selection of which one is maximum variation sampling. Maximum variation sampling implies selecting a wide range of variation on dimensions of research interests such as selecting different organizations from different sizes or industries. The other purposeful sampling strategy identified by Patton (1990) is criterion sampling wherein you use different criteria to select information-rich cases. The third purposeful sampling strategy identified by Patton (1990) is mixed purposeful sampling which implies mixing various strategies from the proposed sixteen strategies. I employed mixed purposeful

sampling strategy which is a combination of maximum variation sampling and criterion sampling techniques for selecting the research settings.

The research settings for this study were selected after making preliminary study of organizations (both private and governmental) to get list of some organizations that have ICT technicians in their staff. I selected some of the organizations based on my previous knowledge of the organizations that they have ICT technicians in their staff. I visited some of the organizations to ask whether they have ICT technicians in their staff or not. I got list of some ICT companies from a Proposal for the establishment of Center of Excellence in Information and Communication Technology, which was prepared by Addis Ababa University on September 2004.

As to the number of cases, there is no clear agreement among case study methodologists about how many cases a doctoral research or postgraduate research should contain. Eisenhardt (1989) suggested that a researcher should discontinue conducting additional cases and interviewing additional respondents when he/she reaches 'theoretical saturation'; that is collecting repetitive data and hearing the same stories repeated again and again. Patton (1990) stressed that in qualitative research there are no general rules for the sample size. Eisenhardt (1989) suggested that between 4 and 10 cases are relatively sufficient for multiple case studies.

Initially I had list of 20 potential organizations that I thought would have ICT technicians. I excluded some of the organizations like Ethiopian radio and television from the list after I visited the organizations and knew that they don't have ICT technicians in their staff. Finally I decided to select only ten organizations as I found that data gathered from these 10 organizations would suffice for the research purpose. These 10 organizations, five from government and five from private, were selected purposively as they are "closely connected to the research questions in that they provide an environment in which the questions can be addressed" (Holliday, 2002).

Criteria that I used for the selection were:

- Number of ICT technicians they have
- Services they provide. (A good example for this is SNAP Trading and Industry PLC which was selected based on the service it provides-Assembling computers).

-Variety of job positions for ICT technicians in the organization, which would help to identify different skills that are required for these varieties of job positions.

-Type of the organization (private, governmental, small enterprise, medium or large organization) which, I thought, would help to identify skills required from ICT technicians by different types of organizations.

b. Selection of research participants

The research questions demand to have four different groups of participants to be included in the study: ICT technicians, Human resource officers of the selected 10 organizations, representatives from MOE >Z, and industry representatives who participated in the development of the OS.

i) ICT technicians

According to E. Stake (1995), for collective case studies (multiple-case studies), selection by sampling of attributes should not be the highest priority. Balance and variety are important. I tried to follow the same principle in selecting ICT technicians as sources of data. Seventeen (17) ICT technicians, who are currently working in the selected 10 organizations, were interviewed. Some of the organizations have more than four ICT technicians, some of them are working in the same division (division here refers to network division, maintenance division, communications division, data center, etc) and the others are working in different divisions. From among ICT technicians who are working in the same division, only one of them was selected for the interview purposively as the technicians in the same division are doing the same jobs. From among ICT technicians who are working in different divisions of the organization, one technician from each division was purposively selected to get varieties of skills required from the technicians, as technicians working in different divisions require different skills.

ii) Human resource officers (their representatives)

There is obviously one human resource officer in every organization. One human resource officer from each selected organization, which makes a total of 10 human resource officers (or their representatives in some organizations) were involved in this study. From ten of them, only two of them did not provide the required information.

iii) Representatives from MOE and from GTZ

There was one representative from MOE to coordinate the development of OS for ICT technicians. He was selected for the interview. There was also one representative from GTZ to coordinate the development of the OS together with the representative from MOE. He was also selected for the interview.

iv) Industry representatives

There were industry representatives, some of them involved in the development of OS for hardware technicians and some were involved in the development of OS for software technicians. One industry representative was selected for the interview from each group, which makes a total of two industry representatives selected for the interview. This selection was done purposefully to have one representative from each group.

3.4.3. Tools for data collection

Research methodologists have identified several techniques of data collection of case study (Yin, 1994; 2003). These techniques encompass interview, open-ended questionnaire, observation and document analysis. I used three data collection methods: open-ended questionnaires, interview and document analysis. The concept of using different data collection methods was used in this research to add comprehensiveness to the data collection and to ensure quality of data.

Open-ended questionnaire

There are three basic types of questionnaire – closed-ended, open-ended or a combination of both. Open-ended questionnaires are used in qualitative research, although some researchers will quantify the answers during the analysis stage. Open-ended questions are very useful to elicit free flowing responses from the respondents. It is the best way of getting the respondent to answer free of any restrictions.

One disadvantage of open-ended questionnaires that is frequently heard is that open-ended questions can generate large amounts of data that can take a long time to process and analyze. As there are no standard answers to these questions, data analysis is more complex.

-Open-ended questionnaire as a method was chosen to get relevant information from human resource officers of each company under study.

Interview

Interview can be conducted face-to-face in person, over a telephone, or via e-mail.

There are many types of interview. The most common of these are unstructured, semi-structured and structured interviews.

In semi-structured interview, interviewees “are allowed sufficient freedom to respond to the interview questions “ at their own length and depth (Miller and Brewer, 2003). According to Uwe Flick (2002), the expert interview is one type of semi-structured interview such that the interviewee is less interest as a person than in his or her capacity of being an expert for a certain field of activity. According to him, the interviewee is integrated in to the study not as a single case but as representing a group of specific experts.

Semi-structured interview was used as a method to get in-depth information from representatives of industries, MOE and GTZ who involved in the preparation of the occupational standard for ICT technicians.

The ICT technicians of the selected 10 organizations were also interviewed about what they are really doing in their jobs every day and about the skills and knowledge they need to do their jobs using expert interview method as explained before.

Documents

Document analysis was chosen as a data collection method because of the value of this method in providing relevant information about the occupational standard that was prepared for ICT technicians. It served in providing information about job description of ICT technicians. The documents used were the written occupational standard for ICT technicians, the final report for clustering and classification of occupations in information and communication technology (ICT) in Ethiopia, and job descriptions for ICT technicians which were obtained from the responses to the open-ended questions.

The written OS was analyzed (examined) to see whether it covers all the necessary skills and knowledge that ICT technicians should have.

The report for clustering and classification of occupations in ICT was analyzed to identify the procedures that were followed in the development of the occupational

standard and to identify background of industry representatives who involved in the development of the occupational standard.

Job descriptions are written narratives of major duties and responsibilities of a job position. In principle, the first step in writing job descriptions is job analysis. It was mentioned in the review of related literature that job analysis is one of the steps in preparing occupational standard. Therefore, job description is another source of data to identify what employees in general and ICT technicians in particular do in the world of work. It helps to identify skills and knowledge that the labor market needs.

The following table summarizes the documents analyzed and the type of data obtained from the documents:

Table6. Documents and type of data they contain

Document	Type of data
1. Written occupational standard for ICT technicians	Description of the occupational standard
2. The final report for clustering and classification of occupations in information and communication technology (ICT) in Ethiopia	Description of ICT occupations in Ethiopia, List of participants in the development process of the OS
3. Job descriptions of ICT technicians who are currently working	Job descriptions and occupations of ICT technicians who are currently working

3.4.4. Data collection procedures

Data collection procedures for the multiple case studies involved three main stages: Designing and preparing the case study protocols, conducting a pilot study to refine the pre-planned case study protocols, and collection of data from different sources.

A. Designing and preparing the case study protocols

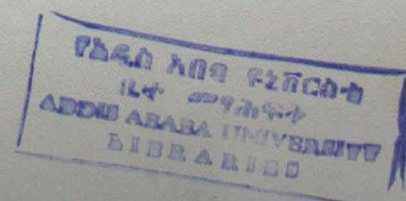
Case study protocols were designed and prepared prior to the data collection process. Here open-ended questions were prepared for questionnaires. Initially I prepared questionnaires for Human resource department of each organization and to the managers also. There were 20 questions set for each group. Some of the questions were concentrating on the overall structure of the organizations, the number of ICT staffs of the organizations, and job positions for ICT technicians in the organizations, job descriptions of the ICT technicians who are working in the organizations and future skill needs of the organizations in terms of ICT technicians. All the questions were written in English.

Semi-structured interview questions were also set to elicit data from ICT technicians, and from representatives of MOE and GTZ. The questions for ICT technicians were all about what major tasks the ICT technicians do in their organizations, what skills and knowledge they require to do these jobs, and what tools and equipments they need to perform their jobs. The questions for representatives of industries, MOE and GTZ were more about how the OS for ICT technicians were prepared, what procedures they followed in developing the OS.

B. Pilot study

The pilot study was the final stage prior to commencing gathering the actual data. As indicated by Yin (2003), the pilot case study mainly assists the investigator to refine the interview instrument and to improve the data collection procedures.

According to Yin (2003), the selection of the pilot study is determined by three main criteria: convenience, access and geographic proximity. I chose 2 pilot sites depending on their proximity, access and convenience. I conducted a pilot test using each data gathering method so that problematic areas can be uncovered and corrected. From these pilot sites, I identified key persons that could provide relevant data for the intended purpose. I distributed the open-ended questionnaires to these key persons in these two pilot sites and I learned that the questions were a lot and they need revision. I also learned from the pilot study that some human resource officers may not be good enough to understand questions written in English and to give response accordingly. The other thing that I learned from my pilot study was that managers and human resource personnel



officers may give similar data about their employees and their organization, and asking human resource officer is sufficient for the intended purpose. I also learned that respondents do not like to give response to lots of questions, particularly if the questions are open-ended.

In conclusion, the pilot study was fruitful, and modifications were made to the data collection instruments, particularly to the open-ended questions. The open-ended questions were reduced to 4 basic questions; they were re-written in Amharic.

C. Collection of data from different sources

Prior to the collection of field data, I received official letter from the department of curriculum and teachers professional development studies. Copies of the letter were submitted to the organizations which were visited. Before collecting data, I prepared appropriate formats that would help me to systematically write responses of the interviewees.

All the questionnaires were distributed to the concerned human resource officer in each organization.

Each interview was conducted at the convenience of the respondents. But prior contact was held with the respondents to arrange meeting times and the respondents were reminded for the interview one day before the scheduled time.

I went to the Ministry of Education (MOE) to ask the representative who supervised and facilitated the development of the OS for ICT technicians. I found him and asked him to give me the written OS. This person gave me the written OS and told me that there are additional documents with one of the experts of GTZ. I met that person from GTZ and asked him to give me any relevant document related to the OS for ICT technicians. The person gave me the final report for clustering and classification of occupations in information and communication technology (ICT) in Ethiopia. It was at this time that I arranged appointment with the representatives from MOE and GTZ for interview. I went to all the interviewees according to schedule we agreed up on and I interviewed them. I interviewed all the 17 ICT technicians in their own working areas. I interviewed some of them while they were doing their jobs. This gave me a chance to observe some of the activities they were doing. Going to their working environment had one advantage: While they were explaining to me what task they perform and how they perform it, they were

trying to demonstrate the task to me and they were also showing me the tools they use in performing the tasks. This made it easy for us to understand each other. Documents about job descriptions of the ICT technicians were obtained from the selected organizations.

3.4. 5. Methods of data analysis and organization

a) Methods of data analysis

Analysis of qualitative data requires describing, summarizing and looking for the relationships between various themes that have been emerged through the analysis process. Qualitative data analysis also refers to theoretical interpretation of the textual data (Thorne, 2000). Creswell (1994) also describes qualitative data analysis as a process of organizing, categorizing and meaningfully interpreting the data. According to Yin (2003), case study data analysis consists of examining, categorizing, tabulating, and recombining the data.

Yin (1994) and Creswell (1998) recommended two main stages of analysis for multiple case studies: within-case analysis and cross-case analysis. Within-case analysis entails analyzing the collected data of each case study independently after which the researcher concludes the findings about the research issues for each individual case. Cross-case analysis implies searching for cross-case patterns. Eisenhardt (1989) suggested three major cross-case analytic strategies. The first is to categorize cases based on certain dimensions and then search for similarities and differences among the group of cases. The second is to choose two cases and list similarities and differences between them. The final stage is to breakup the data by data source such as one researcher works on interview data, while another reviews questionnaire data.

Langley (1999) also identified different strategies for analyzing data for multiple case studies. Two strategies that he proposed are narrative and within-case analysis strategies. Different strategies were employed to analyze the data collected in this research process. The principal strategies that I used in this research were within-case analysis, cross-case analysis, and OS gap analysis strategies.

Within-case analysis

Two types of data were collected from each organization: one from ICT technicians and the other from the human resource officers. ICT technicians were asked to explain their occupational title, the duties they perform in the organizations and the skills and

knowledge they require to perform their duties. The human resource officers were asked to mention occupational titles of ICT technicians in their organization, to briefly explain job descriptions of the ICT technicians, and to explain future skill needs of their organization in terms of ICT technicians.

Most of the human resource officers, instead of writing job descriptions for ICT technicians in the questionnaire, attached copies of the job description of each ICT technician in their organization with the questionnaire and gave it to me. First I read answers to the open-ended questionnaires thoroughly. Then I categorized the answers depending on the research questions addressed. Next, I read the short note that I took during the interview and I categorized the answers depending on the type of the research question addressed. Finally I compared the answers from both types of respondents that address the same research question. I compiled the answers from both groups (ICT technicians and human resource officer from the same organization) and I wrote the answers in a way that they give sense. After I manually made the final list of the answers from both groups, I entered the final list in to a computer. A final list from each organization was kept in a different file. Occupational titles for ICT technicians were identified from the interview and the questionnaire results and they were kept in one file.

Cross-case analysis

After entering all the final lists in to a computer, a comparison was made among the lists from different organizations to identify common themes from all the lists. Before commencing coding of the data, I tried to search for information about software that may help in qualitative analysis. I reviewed different sources including internet. Finally, I found one qualitative data analysis software and I downloaded it in to my computer. The software is allowed only for 30 days trial period unless the full version is purchased. This software is named NVivo 7. I read the manual about how this software can be used and its unique features.

Creswell (2003) explains the use of qualitative data analysis software particularly when the qualitative data is large. Kelle (2000) as cited by O'Flaherty & Whalley (2004) lists a series of data management techniques supported by qualitative data analysis software. To

mention one, construction of electronic cross reference with the help of hyperlinks which used to jump between text passages.

I found NVivo software very useful because of its speed in handling, managing and displaying data and related items like codes. Data management became easier as the software allowed me to have some research documents (interview notes and job descriptions for ICT technicians) in one place and to jump from one document to the other easily. The only drawback that I noticed in using the software is the time it took to install the software (as I downloaded it from the internet to use it for 30 days) and the time I invested to understand & use it properly.

I kept together data about similar entities from different cases in one category. For example, I found data about network technicians from different sites. I kept this data in one category. I saved each category with a different file name for the sake of simplicity of data management.

The data for ICT technicians from all the 10 organizations were first imported in to the software. Common themes were identified from all the 10 organizations about a particular ICT technician (it could be a network technician). The common themes were organized and edited. Identification of common themes, organization and edition were all performed using NVivo 7. Finally, the output of the coding process (list of common themes) was exported to Excel for printing.

OS gap analysis

The third analysis strategy that was employed in this research was OS gap analysis. Here the skills identified by the analysis of data from different sources were compared with the skills included in the written OS. A technique similar to this called curriculum gap analysis is used by National Workforce Center for Emerging Technologies (2003) to identify the gaps between the skills and contents included in the curriculum and the skills and contents required by the labor market. I used the same technique to identify the gap between the OS and the labor market requirement. Results of the comparison were presented in descriptive form. Interview data obtained from representatives of different stakeholders were also analyzed and presented descriptively.

b) Methods of data organization

Holliday (2002) identified three ways of organizing and presenting qualitative data. These are :

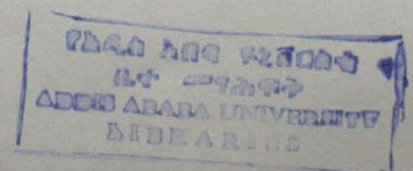
1. The thematic approach in which all the data is taken holistically and rearranged under themes which emerge as “running its totality”.
2. Organizing data simply according to how it was collected- what was found from the interview, what was found from the questionnaires, and what was found from documents.
3. A middle line between the two, what he called it “the mixed approach of data analysis”. Here the data is taken as a whole, and then organized according to themes, but the themes themselves are partly emergent and partly influenced by the research questions.

In this study, the mixed approach of data analysis was employed for organizing and presenting the data. Some of the emerged themes in the analysis were used as sub-topics “to provide a structure for writing” (Holliday, 2002). Some of the data were organized in topics according to the research questions.

3.4. 6. Ensuring good quality of data

In working with qualitative data, there is a risk of getting biased while collecting data. Researchers may tend to see what they want to see, or they may tend to ask questions that they are interested in and may miss that are relevant to their study. Yin (1994) lists six attributes that an investigator must possess to minimize problems with validity and reliability associated with the use of the human research instrument.

- A person should be able to ask good questions -- and to interpret the answers.
- A person should be a good “listener” and not be trapped by his or her own ideologies or preconceptions.
- A person should be adaptive and flexible, so that newly encountered situations can be seen as opportunities, not threats.
- A person must have a firm grasp of the issues being studied, whether this is a theoretical or policy orientation, even if in an exploratory mode. Such a grasp focuses the relevant events and information to be sought to manageable proportions.



• A person should be unbiased by preconceived notions, including those derived from theory. Thus a person should be sensitive and responsive to contradictory evidence.

Mehra (2002) also lists down some attributes that help researchers ensure the quality of their research papers. One of these attributes is the use of triangulation technique (utilizing multiple data sources).

I believe that I exhibited these personal characteristics. To minimize the risk of getting biased and missing relevant information, and to keep data reliable and valid, I used triangulation. Triangulation is defined as the comparison of results obtained from different data sources (i.e., interview, observation, and document analyses all lead to a similar conclusion). With regard to triangulation, Patton (1987) discusses four types of triangulation in doing evaluations, that is, the triangulation:

- Of data sources (data triangulation),
- Among different evaluators (investigator triangulation),
- Of perspectives on the same data set (theory triangulation) and
- Of methods (methodological triangulation).

Yin (1994) provides a list of data sources that can be used during data source triangulation such as interviews, analysis of documents and direct observation. I used three sources of data for data source triangulation: interview, open-ended questionnaires and document analysis to ensure good quality of data.

3.4.7. The researcher's role

Creswell (2003) contends that in qualitative research the researcher's role in the study should be made explicit. According to him, statement about the researcher's past experience, the way in which the researcher's presence in the research settings was managed, comment on connection between the researcher and the participants, steps taken to obtain permission to the research settings, and steps taken to gain entry should be explained.

I am working as a human resource expert in the areas of ICT. I coordinated trainings that were delivered to the ICT technicians (WoredaNet operators) and I also delivered the training for some days. As a result, I had close contact with the trainees & others. I am

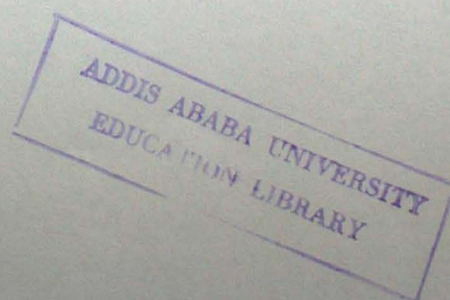
also member of a taskforce that was established to design a framework for ICT curriculum for schools and higher educational institutions including TVET. I was engaged in revising the already prepared OS for the ICT technicians so that it matches with the Competency Certification that was prepared for ICT technicians. All these previous experiences might have brought certain biases to this study. One subjectivity that I brought to this research was I already had an initial perception of what an ICT technician needs to know. I had my own expectation of occupational titles for ICT technicians. Though I had these expectations, I made an effort to ensure objectivity and to minimize my personal bias by refraining from asking leading questions that may bring the interviewee's attention to my own expectation. I tried to avoid leading, over-empathetic and manipulative questions that tend to divert the respondents' response towards my expectation.

My personal connection with the participants varies from organization to organization. In some organizations I found ICT technicians whom I personally know. Some were involved in the WeredaNet training that I coordinated. I also know some of the officials/administrators in the organizations I visited. I also personally know the industry representatives and the representative from MOE. My prior acquaintance with these persons helped me a lot in getting access to the organizations and to get relevant data easily.

The step that I took to obtain permission from the research sites to collect data was that I took official letter from my department and I gave copies of the letter to the concerned persons in the research sites. I also explained the objective of my study to these persons so that they would allow me to contact persons who could provide me appropriate data for the research.

3.4.8. Ethical issues

We were given a copy of ethical issues for researchers, that was prepared by the department of Curriculum and Teachers Professional Development Studies. As it is indicated in this copy, unethical research conducts lessen the quality of research activities that the department is determined to maintain. More over, Miles and Huberman (1994) list several issues that researchers should consider when analyzing data. They caution



researchers to be aware of these and other issues before, during, and after the research had been conducted. Some of the issues involve the following:

- Informed consent (Do participants have full knowledge of what is involved?)
- Harm and risk (Can the study hurt participants?)
- Honesty and trust (Is the researcher being truthful in presenting data?)
- Privacy, confidentiality, and anonymity (Will the study intrude too much into group behaviors?)
- Intervention and advocacy (What should researchers do if participants display harmful or illegal behavior?)

In order to abide by the ethical principles set by the department and also to comply with ethical principles that every researcher has to follow, I did the following:

- I tried to convey the purpose of the study to the participants of this research. In addition, I told the research participants (respondents)
 - Their right to participate voluntarily and the right to withdraw at any time
 - The procedures of the study
 - Their rights to ask questions
 - The protection of their privacy

To maintain the confidentiality of research participants, names of the respondents were deliberately excluded from this report, and the ICT technicians were given code names that were attached to their responses. Below are the representations of code names:

- ❖ HWT-Hardware technician
- ❖ NWT-Network technician
- ❖ PCT-PC technician
- ❖ PCA-PC assembler

In addition to all these, I showed the official letter that I received from the department to all the concerned persons in the visited organizations.

Chapter Four

Data analysis and interpretation

Analysis of data is organized under four major topics: Within-case analysis, cross-case analysis, OS gap analysis, and analysis of possible causes for the gap.

4.1. Within-case analysis

The within case analysis begins with a brief profile of each single case study comprising description of business area of the organizations. The description of each organization is based on the responses to the open-ended questionnaires by the human resource officers of the organizations. With in one organization, data from the interview and data from the open-ended questionnaires about any of the occupations were compared. Some of the skills and knowledge for a particular occupation were included in the job description for that particular occupation but they were not mentioned by the technicians. There were also cases whereby skills and knowledge required for one occupation were mentioned by the technicians during the interview but they were not included in the job descriptions. The gaps between the two sources of data were bridged by integrating the data from both sources so as to get a relatively complete list of skills and knowledge required by each occupation for ICT technicians. This was done for all organizations.

A. Case 1. Ethiopian Airlines (ET)

i) General description of the organization

ET is one of the well known government organizations. It provides air transportation locally and at international level.

In ET there are network and communication technicians, computer technicians and computer operators at different levels (junior, senior, lead)

ii) The findings of case 1

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there are four occupation in this organization related to ICT: Computer technician, computer (data center) operator, communications technician, and communications operator.

The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

a) Skill required of computer technicians

As there are many computer technicians there, I decided to talk to one of the senior computer technicians, who is referred to as PCT1 in this research. He told me that their major duty is to provide support to users in the ET compound and to users outside the compound such as travel agencies.

PCT1 said that the computer technicians play different roles at different times:

- ❖ Helpdesk technician- fix problems by remotely accessing user's PC
- ❖ Tour (site) technician- move from site to site and fix problems
- ❖ Workshop technician- fix problems of machines that are brought to the workshop.

Based on the data obtained from the computer technician and from the response to the open-ended questions, computer technicians in ET are expected to have the following skills:

- ❖ Diagnosis of PC problems
- ❖ Installing operating system
- ❖ Installing application software
- ❖ Installing hard disk, network card and power supply
- ❖ Replacing capacitors of a power supply
- ❖ Repairing corrupted system files using recovery tools
- ❖ Repairing printers

- ❖ Scanning computer and other devices with antivirus
- ❖ Fixing PC problems using remote access
- ❖ Scanning hard disk by making it slave in a normal computer
- ❖ Taking backup from a hard disk
- ❖ Formatting hard disk
- ❖ Identifying signs which indicate that a computer is infected by a computer virus
- ❖ Fixing problems of hard disk

b) Skills required of communications technicians

Communication technicians are required to have the following skills:

- ❖ Install and maintain communication facilities such as telephone, fax, telex, satellite TV
- ❖ Manage files
- ❖ Maintain installed network and communications equipment and cables
- ❖ Install equipments such as network interface card, computer hardware, and computer software.
- ❖ Operate communication equipments such as telephone switch board, fax machines, telex, and computerized communications equipments

c) Skills required of communications operator

According to the response to the open-ended questions, communication operators in ET are expected to have the following skills:

- ❖ Operate telephone switchboard, fax machines, commercial telex, and computerized communications equipments and provide centralized messaging and communication services
- ❖ Execute fallback procedures incase of communications system failure
- ❖ Keeps records of all reported problems and follows up on their compliance
- ❖ Captures fax, telex, internet and telephone charges by cost center into excel worksheet

d) Skills required of computer (data center) operators

According to the data gathered from responses to the interview and the open-ended questions, data center operators in ET are expected to have the following skills:

- ❖ Take backup(daily, weekly, monthly, 6 months, yearly) using DPS tapes following instructions
- ❖ Process payroll and generate & dispatch reports following instructions
- ❖ Trace systems- follow instructions to send data to the printer
- ❖ Refresh the system by setting the servers up and down the servers to make it available to users
- ❖ Download other airline tickets from the internet
- ❖ Ability to read, understand and follow instructions, identifying different servers, identifying types of backup tools, ability to set servers up and down, ability to use internet

B. Case 2. Snap trading and industry PLC

i) Description of the organization

Snap trading and industry PLC is a privately owned large-scale company. It has technicians and professionals in the ICT area. The business areas of the company are:

- Importing and distributing office machines like computers, printers and computer accessories.
- Assembling computers
- Providing maintenance services, repairing and upgrading services to computers, computer parts, and printers.

ii) The findings of case 2

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there are three occupations in this organization related to ICT: Network technician, PC technician and PC assembler.

The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

a) Skills required of network technicians

According to the response from NWT1, they install network for different organizations when a request comes from customers. He said that he goes to the place where he installs the network. According to him, the first thing he does is that he asks the customer how many computers he/she needs to connect right now, and also how many computers he/she wants to have in future expansion. Based on the information, he measures the floor and draws the plan using Visio, software to draw charts or diagrams. Then he identifies positions of the PCs and the outlets, identifies position of the switch or hub, estimates the length of cable and trunks (cable tray) it requires, determines the total cost for the machines and the cables, and informs the total cost to the customer. If the customer agrees, the installation starts.

The following is summary of responses of NWT1 and responses to the open-ended questions about the skills that network technicians in Snap trading and industry PLC are expected to have:

❖ **Install network**

- Measure cable and floor for network installation
- Map the measurement using flow charting and diagramming tools like Visio
- Fix patch panel, switch and router to the rack
- Punch the RJ-45 connectors to the wall outlet
- Stretch cable from the switch to the wall outlet
- Give number for tracing

- Test for good reading or bad reading using tester
- Test the cable whether it works or not after crimping
- Test the network installation either by viewing the Network group or by pinging, by checking the light emitting diodes in the hub or the network interface card
- Connect each workstation and the wall outlet with the network cable.
- Knowledge of cabling and crimping
- Knowledge of network topology, knowledge of cabling and crimping, Knowledge of pinging

❖ **Configure network**

- Configure server
- Configure workstation
- Load software
- Knowledge of system configuration procedures
- Knowledge of network operating systems

❖ **Perform security administration**

- Provide account for users
- Balance user privileges with security requirements of the organization
- Knowledge of network security systems and best practices such as encryption and biometrics.

b) Skill required of PC technician

According to PCT2, the major duty of a PC technician is to maintain PCs and the peripherals, and to troubleshoot hardware and software problems of PCs and the peripherals. He said that the major problems that he comes across as to the hardware parts are problem due to power. He said that the problem that usually occurs is problem of power supply. PCT2 said that the capacitors in the power supply usually burst and you can fix the problem by replacing the capacitors, or you may replace the power supply itself if the problem is severe.

The other common problem, according to PCT2, is software problem. The operating system may fail to work or application software may not work properly. According to PCT2, the major causes for these problems are computer viruses. He said that the viruses

usually affect the operating system. It can be fixed, according to PCT2, by the following methods:

- ❖ Scan the computer using updated antivirus
- ❖ remove the hard disk and install it in a normal computer as a slave and scan it with antivirus in the normal computer
- ❖ overwrite the operating system(use another operating system to repair the affected parts in the corrupted operating system)
- ❖ Format the hard disk (install a new operating system).

According to PCT2, the last option is not recommended unless all the other options are exhaustively tried and do not work. This is because, he said, when you format the hard disk you may lose important data, and also formatting reduces the efficiency of your computer.

Summary of skills required from PC technicians in Snap trading and industry PLC is presented as follows:

- ❖ Diagnose problems on power supply, power cable, monitor, motherboard, memory, processor, and hard disk; diagnosis of problems caused by computer viruses.
- ❖ Fix power supply problem by replacing the capacitors, motherboard problem by replacing the external sound card, memory problem by replacing chipsets, problem on processor, hard disk problem due to bad sectors by formatting the hard disk or using check disk software, motherboard problem (due to external sound card) by replacing the damaged part.
- ❖ Fix problems on the operating system by using operating systems with repair options to repair the corrupted OS, using check disk , replacing corrupted or deleted system file from another PC(depending on the file type), overwriting with operating system, or performing clear installation.
- ❖ Fix problems due to viruses by scanning with latest antivirus, by making the hard disk slave and scanning it with antivirus from the normal (Master) hard disk, or overwriting with another operating system.
- ❖ Fix problems due to antivirus conflict by removing the old antivirus by safe mode, from program files, or using add/remove program button or using Uninstall option

C) Skills required of PC Assemblers

PCA1 said that one of the major things that a PC assembler should know is to identify the packed PC components. He said that if you know the component parts of a PC, it is very simple to assemble them. The processes involved in PC assembly, according to PCA1, are presented as follows:

- ❖ Identify the packed PC components
- ❖ Install the motherboard on the case and insert CPU, CPU fan, and RAM
- ❖ Connect cables from the power supply to the motherboard
- ❖ Install CD-ROM, Floppy drive and Hard disk drive
- ❖ Connect the cables from the power supply to the drives
- ❖ Connect data cables (ID cables) to the motherboard, hard disk drive, floppy drive and the CD-ROM
- ❖ Connect the power switches, USB ports and audio (Microphone and speakers) to the mother board
- ❖ Install the Operating system and other software to the hard disk

C. Case 3. Alta Computec PLC

i) Description of the organization

Alta Computec PLC is also a large-scale private company. It has technicians and professionals in the area of ICT. Business areas of the company are:

- Import and distribute hardware elements like computers, printers, computer accessories, photocopy machine, and other office machines.
- Maintain, repair and give services to computer parts, printers and other office machines

ii) The findings of case 3

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there are three occupations in this organization related to ICT: Hardware technician, Network technician and presales technician.

The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

a) Skills required of network technicians

According to the response given by NWT2, one of the major duties of a network technician is to identify the tools that are used for network connection. According to him, the network tools include the server software including the network operating systems, the network card, the network cable types, the network connectors like the RJ-45 connector, the switches and the hubs.

NWT2 also added that a network technician should be able to install network which includes network design, specification, configuration of the work stations and the server. He also added that a network technician should have practical knowledge of cabling.

b) Skills required of hardware technicians

According to HWT1, a hardware technician should be able to do many things. He should be able to fix problems of printers, he should fix problems of monitor, power supply, system unit, and other components of a computer system.

c) Skills required of presales technician

According to the response to the open-ended questions, Alta computec believes in the importance of this position. If you hire a sales person who doesn't have idea about

computer and its parts, he/she may sale the computer or printer or other machines, but he/she can not tell customers the type of each machine, what it lacks and what advantages it has. According to the response given, the sales person can not prepare technical specifications of each machine as it requires knowledge of internal parts of the machine and efficiency or capacity of each component.

According to the data obtained from the interview with one of the ICT technicians in Alta computec, a presales technician should be able to explain to the customers the advantages and limitations of each type of machine, he/she should have communication skill, he/she should advice and help customers in selecting products, and he/she should be able to prepare technical specifications for machines like computers and printers. During the interview, it was indicated that though the position is important for that company, it doesn't require formal training at certificate or diploma level as the skill can be acquired on the job as far as you have knowledge of computers and their peripherals.

D. Case4. HARON COMPUTER PLC.

i) General description of the organization

HARON COMPUTER PLC is a large scale private company. Its major business areas are:

- Importing and distributing hardware elements like computers, printers and computer accessories.
- Maintain, repair and give services to computer parts and printers

ii) The findings of case 4

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research

question revealed that there are two occupations in this organization related to ICT: Office machine maintenance technician and hardware technician.

The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

a) Skills required of hardware technicians

According to HWT2, a hardware technician should be able to diagnose hardware problems. He said that there are ways to identify which part of the computer has failed. According to him, the following signs help to know which part of a PC has failed:

Motherboard failure-Observe the swollen capacitors of the board

Power supply problem-The power button on the system unit gives orange color

RAM failure-RAM that has failed has testing sound and you will see no display on the screen

Problem with the VGA card-Bip sound

HWT3 also indicated ways of detecting whether the problem on a PC is due to virus or not. According to him, you can predict that the problem is due to virus if you see the following:

- Some programs fail to work
- Pop up message
- Files are corrupted
- Shutting down of the OS
- The hard disk is filled with junk files, repetition of saved files
- Renaming of folder names
- Deletion of files, missing some OS files
- Difficulty during installing antivirus, log off virus
- DOS pop up, error log

The following is summary of the responses given by HWT2 and the responses to the open-ended questions regarding skills required of hard ware technicians:

- ❖ Diagnose Power supply problem, memory (RAM) problem, motherboard problem, and VGA card problem.
- ❖ Replace capacitors on power supply; replace power supply; replace mother board; replace VGA card,
- ❖ Recover deleted documents using utility or recovery CDs.
- ❖ Fix problems due to deletion of program files, operating system files and application software files by repairing using operating system CD or application software (such as office) CD.
- ❖ Diagnose problems due to viruses and fix the problems caused by viruses.
- ❖ Upgrade the windows security using operating systems like service pack 1 and service pack 2.

E. Case 5. Ministry of Works and Urban Development

i) General description of the organization

This, as the name itself implies, is ministry whose major activities are related to urban planning. There are different offices in the ministry. One is the urban planning institute and the other is the information unit (መረጃ ክፍል).

ii) The findings of case 5

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there is occupation in this organization related to ICT: data encoder

The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

During the interview with the ICT technicians it was learnt that there is only one occupation for the ICT technicians, data encoders. There are four data encoders who have come from different backgrounds: one of them has diploma in accounting, the other has diploma in secretarial science, and the third has diploma in computer science. The fourth one said that she is learning and she doesn't have diploma so far. The response to the interview questions revealed that data encoders require the following skills.

Skills required of data encoders

- ❖ Categorizing data
- ❖ Entering data in to a computer
- ❖ Generating report whenever required with appropriate format
- ❖ Knowledge of all the office application softwares

F. Case6. ROM computers

i) Description of the organization

ROM computers is a small-scaled privately-owned enterprise that imports and sales office machines like printers, computers, computer accessories and photocopy machines. One of the business areas of the enterprise is, maintenance, repair and services to computers, printers and photocopy machines.

ii) The findings of case 6

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there is one occupation in this organization related to ICT: Office machine maintenance technician. During the interview, the technician said that he graduated from electronics department as office machine maintenance technician though he maintains and repairs computers like any other office machines.

The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

Skills required of office machine maintenance technicians

According to the technician that I met in ROME computers, one skill required of office machine maintenance technicians is trouble shooting printer problems. His response to the interview questions revealed that the office machine maintenance technicians should know causes for malfunctioning of printers, effects of each cause and the steps taken to tackle the problems, which is presented in tabular form as example in the table below:

**Table7-Skills required of office machine maintenance technicians: The case of
ROME computers**

Job	Cause	Effect	First step	Second step
Printer repair and maintenance	-Dust	Interrupting proper functioning of the printer	Open the printer and clean the dust	
	Problem with the charger or ink	Blurred output	Clean the charger	-Replace the charger -Change ink
	Problem with the power supply or board	Power dead	Change capacitor, transistor or diode	
	Problem with printer cable, problem of the port on the PC or printer, problem in installation of software	The PC will not identify the printer	-Properly plug the printer cable -maintain or repair the port -Reinstall the software	-Replace the printer cable
	Dust on the lens or item on the cartridge	Dark output	Clean the dust Remove the item	

G. Case7. Ethiopian Information and Communication Technology Agency

(EICTDA)

i) General description of the organization

EICTDA is a young government organization under the Ministry of capacity building. Its major objective is the expansion of ICT in the country. There are 6 projects that implement the objective of the agency. These are:

1. E-Government

The basic objective of the project is to build up the capacity of ICT human resources in the appropriate mix, quality and quantity and promote ICT research and development initiatives.

3. ICT for Community Development

The objective of this project is to provide communities with information, which is readily accessible, inter-active, and is tailored to their particular needs.

4. ICT for Private Sector Development

The objective of this project is, to provide support and stimulus to private ICT sector development and to facilitate business sector activities with ICTs. In addition, the project promotes private ICT sector investment and direct foreign investment to have technology transfer and contribute to the country's overall economic development.

5. Information Systems Security and Management

The objective of this project is to put in place security measures that are necessary to protect the nation's information system resources (hardware, software, firmware, information/data, and telecommunications) from unauthorized access, use, disclosure, disruption, modification, or destruction. In other words preserve the integrity, confidentiality and availability of information systems resources of the country.

6. Standardization and Regulatory

The aim of this project is to put in place the legal and regulatory framework, to facilitate the utilization of ICT products and services, and to guide the deployment, exploitation and development of ICT; setting ICT standards are integral components of this project.

There are many ICT experts and technicians working in EICTDA. Almost all the ICT technicians in EICTDA are network technicians.

ii) **The findings of case 7**

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there is occupation in this organization related to ICT, Network operation technician with different grade levels: Network operation technician Grade I, Network operation technician Grade II, and Network operation technician Grade III. Response to the open-ended questionnaires revealed that there is additional demand for network operation technicians within the coming 6 months.

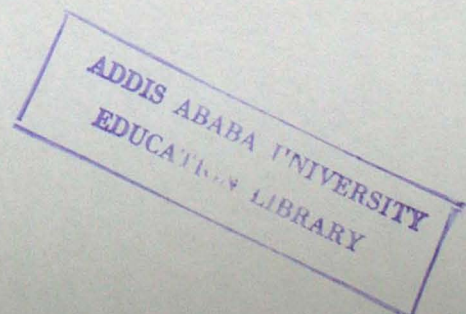
The second research sub-question is:

- What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows.

Skills required of network operation technicians

The first question that I asked the network technician in the National Data Center, NWT3, was to tell me his job title. He told me that he is a network technician. NWT3 continued,



Though my occupational title is network technician, I do many things like repairing computers when they fail, I give trainings, and I sometimes check the operations of the videoconference tools.

I asked him to tell me whether he had prior knowledge of the videoconference tools or not. NWT3 said that the servers that manage videoconferences at national, regional and wereda level are found in the national data center and he had the exposure to know the videoconference tools. I continued my interview and I asked him to tell me his opinion concerning whether network technicians should have skill to operate videoconference tools. He said that those technicians who are working at wereda level as weredaNet operators should know these things as they are the ones who should operate the tools whenever there is a videoconference at wereda level.

I asked NWT3 to tell me his duties as a network technician. The response from NWT3 and response to the open-ended questions regarding the skills that EICTDA requires from network operation technicians are summarized as follows:

❖ **Network installation**

- Check whether the PCs have the required hardware components such as Network card or not
- Crimp the network cable according to the network standard (Cross over or straight through)
- Test the cable whether it works or not after crimping
- Connect the PCs with the connectivity devices (Hub or Switch)
- Configure IP address, subnet mask and other services of each PC according to the network type or number of PCs to be connected
- Test the network installation either by viewing the Network group or by pinging, by checking the light emitting diodes in the hub or the network interface card
- Limit the client's access right on the network

❖ **PC trouble shooting and maintenance**

- Diagnose whether the problem is hardware problem or software problem
- Check cable connections physically

- Check whether the device that is not working is in the device manager or not
- Install the driver
- Check the device

H. Case 8. Photo Family

i) General description of the organization

This is a private sector whose sole business area is taking photographs and editing photos. The technicians use computers for photo edition. As the technician whom I contacted for the interview was not in a position to give details of the organization, only limited information was obtained.

ii) The findings of case 8

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there is one occupation in this organization related to ICT: Photo editor.

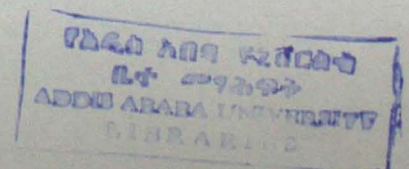
The second research sub-question is:

- What skills does the labor market require from ICT technicians?

Response from the interview with the ICT technician revealed the following.

Skills required of a photo editor

- ❖ Scan pictures
- ❖ Check whether the picture has scratch or not
- ❖ Remove the scratch using the Adobe tools



- ❖ Save the file using JPG
- ❖ Print the photo

The technician said that this skill can easily be acquired without formal training just with short term training as long as you have basic computer skill.

I. Case 9. Ethiopian Telecommunication Corporation (ETC)

i) General description of the organization

ETC is one of the large scale government organizations with a motto of “Connecting Ethiopia to the future”.

ETC provides the following services for the public:

- Fixed line services
- Mobile services
- DDN (Digital Data Network) services
- Broadband services
- Call center services

ETC has many professionals and technicians in the area of ICT.

ii) The findings of case 9

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there is occupation in this organization related to ICT: Network technician, communications technician, and computer technician

What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

a) Skills required of Network technicians

NWT4 said that network technicians should be able to troubleshoot network problems. She said that a network may fail when network cable is unplugged or when there is a loose in the outlet. According to NWT4, the first thing that a network technician should do is to check network light on the system unit. If there is no light, check whether the network cable is plugged or not. If it is plugged, he/she has to check whether there is a loose on the power outlet. If there is no change, check the connection on the switch. Change the port on the switch and check. If the problem still persists, ping and check the server.

In general, response to the interview questions and to the open-ended questions regarding skills that ETC requires from network technicians is summarized as follows:

❖ **Network installation**

- Plan the floor, position of the switch, rack and outlets, number of outlets
- Fix patch panel, switch and router to the rack
- Connect the switch with the router
- Connect switch and patch panel with jumper (UTP cable)
- Stretch cable from the outlet to patch panel or rack
- Configure the PCs
- Knowledge of internet protocol, IP address, subnet mask, and gateway

❖ **Troubleshoot network problem**

- Check network light on the system unit
- Check whether the network cable is plugged or not
- Check whether there is a loose on the power outlet
- Check the connection on the switch
- Ping and check the server
- Knowledge of pinging

b) Skills required of communications technicians

It was found that ITC requires the following skills from communication technicians:

- ❖ Install communication facilities such as telephone
- ❖ Maintain communication facilities
- ❖ Repair communication cable
- ❖ Identify fault locations on cables
- ❖ Splice fiber cable and copper cable
- ❖ Operate communication equipments such as telephone switch board and fax machine
- ❖ Install structured cabling infrastructures
- ❖ Maintain structured cabling infrastructures

c) Skills required of computer technician

PCT3 said that most of the problems in ETC are due to improper use of computers. He said:

You know, if you forget a floppy in the drive and if you try to start the computer, the computer doesn't start as by default the computer is set to boot from a floppy if there is floppy in it. If there is no floppy, it boots from the hard disk. It boots from the CD if and only if you set it to boot from a CD. Users do not know this and they leave their floppy there after they use it and they turnoff their computer. It is common that many users forget their floppy in the floppy drive and when they come in the morning and try to open, the computer fails to boot. They think that something wrong happened to their computer and they come to us to complain. When we go and check their computer, we find forgotten floppies in the floppy drive. Forgetting a floppy in its drive may also corrupt the boot system.

PCT3 continued,

...users frequently access untrusted websites. They visit different multimedia in the internet which may deliberately send viruses to their computers. When they think that their computer is affected by a virus, they borrow antivirus from somewhere and they load it in their PC. They don't understand that two or more anti-viruses in the same PC cause severe problem on the performance of the PC.

It is clear from what the technician said that PC technicians should know:

- ❖ about boot sequence
- ❖ how to set/configure computers to boot from CD or from hard disk
- ❖ how antivirus conflict affects the performance of a PC
- ❖ that access to unknown websites and opening some multimedia from internet may have danger of getting infected with viruses

PCT3 also mentioned that they fix some PC problems by remote access. It means that this is one skill that computer technicians should have.

In general, the following is summary of the response to the interview and open-ended questions regarding skills that ETC requires from computer technicians:

- ❖ Providing support to users about computers and peripherals
- ❖ Identify causes for no booting
- ❖ Knowledge of boot sequence
- ❖ Diagnose problems due to virus and fix problems due to viruses
- ❖ Fix problems on power supply
- ❖ Fix problems due to antivirus conflicts by deleting the old antivirus manually or by uninstalling it.
- ❖ Fix remote PC problems by remote access using someone's username and password
- ❖ Fixing printer problems

J. Case 10. National bank of Ethiopia (NBE)

a) General description of the organization

NBE is the central bank of the country that plays a key role in the Ethiopian economy by formulating and implementing the country's monetary policy. Its main objectives are:

- To foster monetary stability and a sound financial system.
- To ensure that credit and exchange conditions are conducive to the balanced growth of the economy of Ethiopia.

NBE has many ICT professionals and only few ICT technicians who are computer operators.

b) The findings of case 10

The first research sub-question is:

- What are the major occupations for ICT technicians in the world of work?

The major themes that came forward during the analysis of the data from the interview with the ICT technicians and from the open-ended questionnaire relevant to this research question revealed that there is one occupation in this organization related to ICT: Computer operator.

What skills does the labor market require from ICT technicians?

The major themes that came out during the data analysis process associated with this research question are presented as follows:

Skills required of computer operators

At the beginning of my discussion with the computer operator at the NBE, she opened one program and said:

This is software that helps us to access all users' computers which are connected to the servers. Now you can see that I am writing a code that helps me to log into any user's PC to check whether it is properly working or not. To login and check one PC, I have to write the user's ID and password. If the computer is working, the software displays the user's PC on my desktop. If there is problem with the PC, though I write the user's ID and password, the software won't display it. This is how we check whether all the PCs are working properly or not.

When she finished her explanation I asked her to tell me what other duties she has. She said:

I always leave this room after all the computer users finish their work. After I make sure that all have gone, I set the server down. Then in the morning, either I myself or my colleague will get the system online; i.e. we set the server up so that all users can use their computers. The other duty that we have is that we always take a backup. We take daily backup and weekly backup. We use DLT tape to take a backup. We also update and prepare reports.

Summary of the responses to the interview and the open-ended questions regarding the skills that NBE requires from computer operators is presented as follows:

- ❖ Get the system online (Making the server available to users every morning, checking whether all users are on from remote) and setting the server down every evening
- ❖ Update reports
- ❖ Prepare reports
- ❖ Take backup from a server (Back up before update and backup after update)
- ❖ Ability to follow instructions to identify users using their user id and password,
- ❖ Ability to work with Unix server,
- ❖ Ability to get the backup tool ready

The following table shows summary of name of the organization and the occupational titles for ICT technicians as identified through with-in case analysis.

Table8. List of organizations and types of occupations they have for ICT technicians

No	Name of the organization	Types of occupations identified
1	SNAP	Network technician, PC technician, PC assembler
2	HARON	Hardware technician, Office machine maintenance technician.
3	ETC	Network technician, computer technician, communications technician
4	Ethiopian airlines	Computer technician, data center operator, communications technician, communications operator
5	Ministry of works and Urban development	Data encoders
6	National bank of Ethiopia	Computer operator
7	EICTDA	Network operation technician
8	ROME computers	Office machine maintenance technician
9	Alta Computec	Hardware technician, Network technician, presales technician
10	Photo Family	Photo editor

In general, except EICTDA, which showed a demand for more network operation technicians, the other organizations found it difficult to tell their demand in the future in the area of ICT. The response from some government organizations shows that they are going to revise their labor force in ICT area in accordance with the new Business Process Reengineering and they couldn't make accurate projections of their future skill needs in any detail.

4.2. Cross-case analysis

4.2.1. Cross-case analysis of the occupational titles

Occupational titles for ICT technicians in each organization were obtained from two sources: from ICT technicians themselves and from response to the open-ended questionnaires. From the within-case analysis one can easily extract 14 occupations identified for ICT technicians:

- ❖ Network technician
- ❖ Network operation technician
- ❖ Hardware technician
- ❖ Presales technician
- ❖ PC technician
- ❖ Computer technician
- ❖ Computer operator
- ❖ Data center operator
- ❖ PC assembler
- ❖ Photo editor
- ❖ Communications technician
- ❖ Communications operator
- ❖ Data encoder
- ❖ Office machines maintenance technician

During cross-case analysis it was found that some organizations used the same name for some occupations. For example, the term Network technician is used in three organizations. The term office machine maintenance technician is used in two organizations. The term computer technician is also used in two organizations. Data encoder is used in one organization; PC technician is used in one organization; PC assembler is used in one organization; Network operation technician is used in one organization; communications technician is used in two organizations; communications operator is used in one organization; computer operator is used in one organization, and data center operator is used in one organization. Here even before the analysis of skills, it

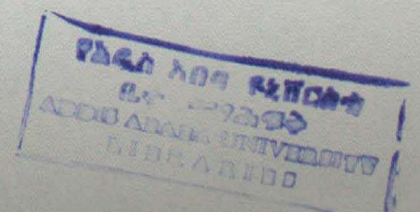
can be seen that there are occupations that have different names which could have been given the same name if standards are set. For example, PC technician and computer technician are the same occupations except the naming, as PC implies personal computers. Network technician and network operation technician are also two names for the same occupation. The use of different names for the same occupation creates confusion to workers as well as employers. Unless both the employer and the employee know that computer operator and data center operator are the same occupations with different names, the employee who worked as a computer operator for many years may hesitate to apply for a better job advertised as **data center operator** as he/she may think that it is a different job. This confusion calls for standardization and clustering of similar occupations.

4.2.2. Cross-case analysis of skills required from ICT technicians

As it was explained in the within-case analysis, the skills that the labor market requires from ICT technicians were also obtained from two sources: from the ICT technicians themselves and from the responses to the open-ended questionnaires. Cross-case analysis of skills required from the ICT technicians revealed that some occupations required similar skills and they can be clustered. It was found that all the skills that are required from data encoders are required from computer operators and data center operators. In fact computer operator and data center operator were found to be two different names of the same occupation. The following skills were identified to be common for data encoders and computer (data center) operators:

- skill to use all office application software
- skill to encode data in to a computer
- skill to generate report
- Skill to take back-up

Analysis of data showed that there are of course additional skills required from computer (data center) operators as compared to data encoders. In the literature review it was indicated that occupational analysis involves clustering of similar occupations. Based on this, the two occupations, i.e. data encoder and computer (data center) operator were clustered to computer operator.



The other occupations which were found to require similar skills are hardware technician, software technician, PC technician, PC assembler and presales technician. All these occupations were found to require the following skills.

- ❖ Diagnose hardware problems
- ❖ Troubleshoot hardware problems
- ❖ Install hardware components of a PC
- ❖ Assemble personal computer
- ❖ Upgrade hardware components
- ❖ Diagnose software problems
- ❖ Troubleshoot software problems
- ❖ Install operating systems, driver software, antivirus and application software
- ❖ Upgrade/repair operating system and other software
- ❖ Uninstall software
- ❖ Troubleshoot problems due to viruses

Of course it was found that presales technicians require additional skills such as writing technical specifications for computers and their peripherals to help customers know the type of material they purchase. It was known during the interview that the skill to write specifications can be acquired easily on the job. Presales technicians were also reported to require communication skill as they interact with customers.

In general I found that these occupations can be clustered in to one as they require similar skills. I clustered them to computer technician.

Network technician and network operation technician were also found to require the same skill, and they differ only in naming. Therefore, I clustered these two occupational titles as network technician as it was used in most of the organizations that have this occupation.

In some organizations it was found that there are two positions for ICT technicians in communications departments. These are communications operator and communications technician. Investigation of their job descriptions revealed that these two positions can be clustered. Therefore I clustered the two positions to communications technician.

During the interview, office maintenance technicians said that they graduated from electronics department and they were given trainings that helped them maintain and

repair office machines including computers, printers, fax machines, and photocopy machines. Therefore this position could be left for electronics department to avoid duplication, though it is related to duties of computer technicians.

In addition, photo editor is one occupation for ICT technicians which requires the skill to use photo editing soft wares such as Adobe Photoshop. During interview with one photo editor, it was explained that this skill can be acquired easily either by on-the-job training or taking short term training as long as you have basic computer skill. There fore I excluded this occupation from the list of priority ICT occupations.

The clustering that I made would leave us with at least four occupations: computer operator, computer technician, Network technician, and communications technician which have emerged as main themes in this analysis.

After identification and clustering of the occupations, the data was further reduced and coded using NVivo.

Here skills and knowledge for each occupation in one organization were compared with the skills and knowledge of the same occupation in any other organization. This was done using NVivo 7 software, as mentioned before. All the lists for one particular occupation were imported to the software from each category and they were compared using the software. Common themes for each occupation were identified, edited and exported to excel software for printing.

Results of the analysis are presented in tabular form by using Nvivo as follows:



Table9. Themes/skills for computer operators

	Sources
Connect to the internet	1
Knowledge of office applications	1
Prepare reports	3
Set the system down	2
Take backup from server per established procedure	2
update reports	1
Check and ensure that all the computers are operational/controls operations of computers	2
Test newly developed guides and procedures	1
Correct errors on reports	1
Download from internet	1
file management/ manage file	1
Knowledge of different server environments and operating system types	2
Remotely access user's computer and check whether it works properly or not	2
Work cooperatively with other workers	3
Comply with IT security, control policy and procedures	2
Write reports in proper format	1
Run program according to scheduled and operational requirements	1
Provide technical support and advice in computer use	2
Record problems encountered during operation and remedial actions taken	1

Table10. Themes/skills for computer technicians

	Sources
Ability to access someone's PC remotely, provided that the other user gives permission	2
Knowledge of problems due to antivirus conflict and removing the old antivirus	2
Problem during boot up if floppy is forgotten in its drive	2
Fixing printer problems	2
Formatting a hard disk	3
Identify signs of problems of virus	3
Install ,uninstall software & Operating System	2
knowledge of check disk SW	1
knowledge of SW that identifies memory problem	1
Solving problems due to virus	3
partitioning a hard disk	1
Knowledge of pinging to check connection with server and other workstations	2
Repair using OS or SW	2
Replace PC components such as VGA	2
Take backup	2
Upgrade SW & HW parts of PC	1
Replace capacitors for power supply problems	5
Use recovery tools(CD) to restore lost data	3
Diagnose problems of PC and its components, knowledge of signs of problems with power supply, motherboard, VGA card and memory	1

Table11. Themes/skills for Network technicians

	Sources
configure server and workstations	3
Connect PC to hub or switch	1
Crimp the network cable	1
Fix patch panel & switch to the rack	2
Give numbers for tracing	1
Limit user's access for resources	2
Map the measurement using Visio	1
Measure cables and area for Network installation	2
Punching the RJ-45 connector wall outlet	1
Identify required hardware	1
Stretch network cable	2
Test the cables for working	2
Test the network installation/ ping, check work groups	1
Trucking	1
Troubleshoot network connection problem	2
Knowledge of network security systems such as encryption and biometrics	1

Table12. Themes/skills for communications technician

	Sources
Install and maintain communication facilities such as telephone, telex, fax, satellite TV	1
file management	1
Maintain installed network and communication equipment and cables	2
Install equipments such as network interface card, computer hard ware and computer software	1
Repair communication cable and identify fault location	1
Splice fiber cable of copper cable	2
Review manufacturer's specification, organizational policy and procedures	1
Keeps maintenance records of all reported problems	1
Operate communication equipments such as telephone switch board, fax machines, telex, and computerized communications equipments	2
Install and maintain structured cabling infrastructures	1

4.3. OS gap analysis

The OS gap analysis helps to determine if the OS currently covers all the occupations and skills that the labor market demands. This technique was taken from an IT curriculum development toolkit prepared by National Workforce Center for Emerging Technologies (2003), which was intended to make IT skill standards-based curriculum development easier. According to National Workforce Center for Emerging Technologies(2003), implementing the toolkit helps to evaluate a curriculum, skill expectations of the labor market, identify gaps between the two and then make changes in the curriculum to address any gaps uncovered in the process. The process involves identifying the occupations and skills included in the OS and comparing these with the occupations and skills required by the labor market. As the description of the skills in the OS is a huge document, it was not included in this report. Rather, the OS gaps are identified here.

Comparison of the above occupations and skills (which were obtained from the analysis of the labor market demand) with the occupations and skills included in the OS for ICT technicians revealed the following gaps:

Gap1. The occupations identified from analysis of the collected data are computer operators, computer technicians, Network technicians and communication technicians. The occupations included in the occupational standard are hardware technician and software technician, which are obtained by clustering the following occupations: ICT technician (which is ambiguous as ICT is a broad concept), ICT system technician, Assistant software technician, and ICT application developer.

After the commencement of this research, a task force from MOE and EICTDA (the researcher was member of that task force) was established to develop an ICT curriculum framework for schools and to revise the OS that was already prepared. The revision was limited only to make some amendments so that the occupations for ICT technicians in the OS and the occupations in the Competency Certification for ICT technicians would match. This was because it was believed by higher authorities and some taskforce members that the original OS was developed with the involvement of consultants and other stakeholders and that it was verified by stakeholders.

During the revision process one occupation called systems administration professional was incorporated in the OS. The change was made only in the naming and the duties and skills that are required to perform the duties were almost the ones which were already there in the original OS.

As it can be seen here, there is no occupational title identified as network technician, computer operator and communication technician in the OS. The title network technician is clearly defined in four organizations from a total of 10 organizations which were subjects of this study. The title computer operator was also clearly defined in two organizations (in three organizations together with data encoder, which is clustered with computer operator). The title communication technician is also clearly defined in two organizations.

Here it can be noted that these three occupations which are generated during the occupational data analysis may be among the majority occupations which are needed across many organizations.

Gap2. Analysis of the skills and knowledge from the labor market and from the OS revealed that the following skills and knowledge are not included in the occupational standard.

a. Skills required from computer operators

According to this study, computer operators, particularly those who are working in data centers, should have the following knowledge and skills which are not included in the OS:

- Knowledge of different server environments
- Working knowledge of operating systems like Windows and UNIX.
- Knowledge of data security
- Skill to update data and correct errors
- Skill to refresh server for users (setting server up and down)
- Skill to remotely access users' computers to make sure that all the computers are operational
- Skill to use all office applications
- Knowledge of authentication

b. Skills required from computer technicians

According to this study, computer technicians should have the following knowledge and skills which are not included in the OS:

i. Fixing power supply problems

ICT technicians in almost all the organizations that the researcher visited explained that one of the major problems that PC users face is problem due to power supply. Computers cease to work or do not give the output if the power supply fails to work. All technicians said that the power supply is usually fixed by replacing the damaged capacitors. This important skill is not included in the occupational standard.

ii. Fixing problems due to viruses

ICT technicians responded that the other major cause for computers to fail is viruses. Computer viruses are common problems that users encounter now-a-days. Problems due to viruses can be fixed in different ways, according to the response from ICT technicians. The skill to detect viruses and the skill to fix problems due to viruses are the two most important skills that computer technicians should have but which are not included in the occupational standard.

c. Skills required from Network technicians

The missing of one very important and highly demanded occupation means the missing of skills that are required for that occupation. Actually, though the title network technician is not included as one occupation in the OS, some of the skills that are required for this occupation are in other occupations like ICT systems technician.

According to this study, Network technicians should have the following knowledge and skills which are not included in the OS:

- Skill to determine users' access right
- Knowledge of pinging, to check the connection between workstations and the server.
- Skill to diagnose and resolve network problems

- Technical knowledge of network security systems and best practices such as encryption and physical security options such as biometrics.

In addition to these skills, according to the interview response from one network technician in the national data center, network technicians in the national data center and WeredaNet operators who are working in different weredas are required to have skills that would enable them to operate with and troubleshoot video conferencing devices.

d. Skills required from communications technicians

Since this position is totally excluded from the OS, almost all the skills that are required from communications technicians are not included in it. The skills that are required for this occupation but not included in the OS are:

- Knowledge of communication tools and equipments
- Skill to install and maintain communication equipments
- Skill to operate communication equipments
- Skill to splice and terminate cables
- Skill to install and maintain structured cabling infrastructures (voice and data)

These findings imply that there is a gap between occupations and skills included in the OS and those required by the labor market.

4.4. What might have caused the gap?

Interview with the representatives of MOE and GTZ revealed that there were two consultants, both of them from Germany, who conducted a study on ICT occupational classification and clustering in Ethiopia. As the consultants were abroad during the study, any information about the consultants was obtained from the representative of MOE, from the representative of GTZ, and from analysis of a final report for clustering and classification of occupations in information and communication technology (ICT) in Ethiopia which was written by the consultants themselves.

4.4.1. Only one method used in the OS development process

Analysis of the final report for clustering and classification of occupations in information and communication technology (ICT) in Ethiopia (M.Rohs & T. Shroder, 2006) revealed that DACUM was the only job analysis method that was employed in the development of OS for ICT technicians. It was written in the report as follows:

Under the circumstances and aims as shown a complete set-up of the DACUM approach was neither possible nor necessary. Nevertheless some aspects of the approach are used: cooperation with expert workers, small group method, expert for task analysis, open questions.

((M. Rohs & Th. Schroder, 2006 p.8).

This shows that though the consultants did not employ it fully, they used DACUM in the development process of the OS.

Analysis of the interview response also revealed that DACUM was the method used in the development of the OS for ICT technicians. One of the interviewees said the following:

We used DACUM in the development process of the OS. Actually we didn't tell the participants that we were using this method since we felt that they do not understand the term. But we were actually using DACUM.

The other participant implicitly revealed that DACUM was used in the development process. The following is what she said in her own words:

We were invited to attend the workshop with a formal letter. Those persons who coordinated the workshop gave us a form. Then we were told to list down the major duties and the steps/tasks that software technicians follow to perform the duties. We filled in the form and that was taken by the coordinators.

As it was explained in the literature review, no single method is sufficient to develop OS. Different methods should be employed as one method complements the other. DACUM doesn't involve on-the-job observation. It relies on the explanation given by "experts". When job incumbents (practitioners) are interviewed about their job in their work places, everything around them such as the work environment itself, the equipments and tools they use, remind them many things about their job and I believe that they give better information to the job analyst. If they are away from their work environment, there is a chance of forgetting what they do. One thing that I noticed when I was conducting interview with the ICT technicians in their work place was that in the middle of their explanation they were bringing one tool or they were taking me to the machines that they use and they were trying to get me understand what they wanted to say. I am now convinced that job analysis, which is one stage in the development of OS, should involve at least either on-the-job interview or site observation. Therefore I completely argue that DACUM is not sufficient method to collect data about jobs performed by experts.

4.4.2. No involvement of ICT technicians in the OS development process

It was understood from the consultants' report that they interviewed professionals from the world of work. The document revealed that none of the interviewees were the ICT technicians. Some of them are General Managers, some are presidents, some are executive vice presidents, some are operation heads, and the remaining are directors.

The interview response given by the participants confirmed this. One participant said the following:

Most of the participants of the workshop were administrative people who manage or lead the represented organizations. I prefer to involve the ICT technicians themselves and those who have both industrial and teaching experience as they know both the working and the teaching environment.

As it was indicated in the literature review, the OS development process demands the involvement of job incumbents (ICT technicians themselves). This agrees with what is cited by Capelli (1992) in Bailey and Merritt (December 1995) about the findings of Myles Eno that there is substantial differences in workers' self-report of skill requirements in their jobs and those provided by expert raters. Norton (1993) also stressed that expert workers can describe and define their jobs more accurately than anyone else. It is therefore important to note that the ICT technicians themselves should be the ones who have to be interviewed if exact information is required about their jobs and about the skills and knowledge they require to perform their jobs.

4.4.3. Insufficient labor market information

Analysis of the final report for clustering and classification of occupations in information and communication technology (ICT) in Ethiopia (M.Rohs & T. Schroder, 2006) revealed that the consultants didn't gather sufficient labor market information for clustering and classification of ICT occupations in Ethiopia. It was written in the report as follows:

The challenging frame for the development of a methodological approach was the limited time resources. For preparation, carrying out and utilization there was a time window of only two weeks. For that reason an extensive survey wasn't possible.

(M. Rohs & Th. Schroder, 2006 p.8)

M.Rohs & Th. Schroder (2006) further indicated that "under restricted time it was necessary to put the main emphasis of the work on the core areas of information technology". P.8

Here one can argue that if the consultants didn't make sufficient survey of the labor market they can not identify the core areas of information technology in the country. They could say this and that are core areas of ICT in Ethiopia if they had sufficient data on that. If they don't have that data or if they rely on only few data

to generalize that this and that are core areas of ICT, it will only be their assumption which doesn't represent the actual situation in the country.

The other evidence for the fact that no sufficient labor market information was gathered came from the responses to the interview. One of the interviewees said the following:

"We did not go to them (the market), they came to us."

When I interpret this comment, it is to mean that they did not gather sufficient labor market information. They did not see what is actually being done in the world of work. The interviewee wanted to emphasize the need to go to the world of work to gather sufficient market information before developing the occupational standard.

One representative commented that, as there is lack of information about market demand, there should be national needs assessment even to forecast future market needs. He said that there is problem in getting appropriate information even from government bodies like MOLSA (Ministry of Labor and Social Affairs) about current state of the labor market and about occupations for technicians and professionals. What he said was quoted as follows:

Government organizations like Ministry of labor and social affairs and other big government organizations do not have adequate data about the occupations in the country. Once they sent a draft of occupational classifications to some organizations including the ministry of education to comment on it. As to me the occupational classifications they included for ICT technicians are not based on adequate market information. It seems that they took those occupations from ILO without making market assessment locally. I feel that there should be national data about labor market so that you could refer to that when ever there is a need.

In fact ILO prepares its own occupational classifications and based on that countries, depending on their local demand, prepare their own occupational classifications. These national occupational classifications serve as a base to develop occupational standards. But as it was mentioned by interviewee, local bodies like MOLSA do not have sufficient labor market information that serve as a base for the development of OS. It is therefore important to gather sufficient information from the labor market by using different methods before developing occupational standards.

Chapter Five

Summary, Conclusions and Recommendations

5.1. Summary

- ❖ The major objective of this study was to identify whether or not there is a gap between the OS for ICT technicians and the labor market demand, and to identify possible causes for the gap. To reach the intended objective, research questions were set. Related literature on points like why OS is prepared, how OS is prepared, what alternative methods are there to develop OS, who should involve in the development process were seen.
- ❖ In order to gather appropriate data multiple case study design was employed. Data was gathered using multiple tools from multiple sources. The informants were selected purposefully on the basis of their availability. The open-ended questionnaires were pilot-tested. The information collected was analyzed using different analysis techniques such as within-case analysis, cross-case analysis and gap analysis techniques. The analyzed data was organized and presented using mixed approach.
- ❖ After analyzing the research data, the following major findings were obtained, which are presented together with the research questions.
- ❖ The first sub-question for this research is about the skills that the labor market requires from ICT technicians. This study identified many skills that are required from ICT technicians in the world of work.
- ❖ The second sub-question of this research is about the occupations for ICT technicians in the labor market. Four major occupations were identified: Computer operator, computer technician, Network technician and communications technician.
- ❖ The third sub-question of this study was whether the OS for ICT technicians includes the major occupations that the labor market requires. It was understood

from this research that there are occupations which are required in the labor market but not included in the OS.

- ❖ The fourth sub-question of this study was about whether the skills included in the OS align with the skills that the labor market expects from ICT technicians. Analysis of the data obtained from the labor market and the data from the written OS revealed that there are skills that the labor market requires from ICT technicians but not included in the OS.
- ❖ The fifth sub-question of the research was about how the OS for ICT technicians was prepared. From this research it was found that the OS was prepared by undergoing job analysis with “experts” using DACUM method. This was preceded by clustering and classifications of ICT occupations in Ethiopia, which was done by a consultant.
- ❖ The sixth sub-question of this research is about those people who participated in the development of the OS for ICT technicians. It was found from this study that those who participated in the development of the OS were representatives from ministry of Education, representative from GTZ and representatives from industries. The research made it clear that ICT technicians did not participate in the development of the OS. It was found in this study that most of those “experts” who participated in the OS were managers, directors, presidents, vice presidents or department heads in their organizations. These people are engaged in managerial work and they are not practitioners. The other representatives who participated in the development of the OS were professionals with BSc degree and above in areas like computer science. They are not the job incumbents themselves.
- ❖ The seventh and the last sub-question of this research is about whether sufficient labor market was gathered during the development of the OS or not. Here also the research clearly showed that sufficient labor market was not gathered during the development of the OS. This could be attributed to the following:
 - ❖ Limited involvement of stakeholders in the development of the OS
 - ❖ The fact that job incumbents (ICT technicians, who are doing the actual job) were not involved in the OS development process

- ❖ The fact that only one method (DACUM) was employed to elicit information from "experts" about their job.
- ❖ It is therefore clear from the findings that there is misalignment between the occupations and skills which are included in the OS and the occupations and skills which are required by the labor market.

5.2. Conclusion

The following conclusions are offered based upon the results of the study of what skills and knowledge employers require from ICT technicians.

1. Though some of the skills that the labor market requires from ICT technicians were included in the OS, still there are skills that the labor market requires from the ICT technicians but not included in the occupational standard.

This doesn't imply that the skills identified in this research are the only skills that the labor market requires from ICT technicians, as the results of this study reflect the skills required by the selected 10 organizations. The skills identified in this research are only indications for the fact that there is misalignment between the skills included in the OS and the skills that the labor market requires from the ICT technicians.

2. Based on the findings in this research, the major occupations for ICT technicians in the world of work are network technicians, computer operators, computer technicians and communications technicians. The occupations included in the OS are software technicians and hardware technicians (As it was mentioned in chapter four of this report, very recently after the commencement of this research, one occupation- **System Administration Associate Professional**-was included when revising the OS). Duties that these technicians are expected to perform and the skills they need dictate that specially network technicians and communications technicians can not be clustered with these occupations. Therefore one can conclude that some major occupations that the labor market requires to have are missing from the OS though there is high demand for these occupations in the world of work.

As it was mentioned earlier, this research is based on the findings from 10 organizations and, hence, it can't be concluded that the four occupations which are identified in this research are the only occupations that are highly demanded by the labor market at national level. Further labor market needs analysis may reveal the demand for additional occupations for ICT technicians. However, it can be concluded from the findings of this research that the occupations which are included in the OS are not the only priority occupations that are demanded by the labor market.

From (1) and (2) one can conclude that there is a gap between the occupational standard for ICT technicians and the labor market requirement.

3. The occupational standard for ICT technicians was developed with the involvement of only few stakeholders.

There were stakeholders who were not consulted when developing the occupational standard. In the literature review it was indicated that different parties such as representatives from government, industry representatives including practitioners, representatives from training providers, representatives from trade unions and representatives from professional associations should be represented in the task force that develops the OS. Practitioners, professional associations (such as the Ethiopian Information Technology Professional Association) and Trade Union such as the chamber of commerce were not included in the taskforce. It can be concluded that the interest and expectations of some of these stakeholders were not considered during the preparation of the OS.

4. The OS was prepared without having sufficient labor market information.

This can be implied from the fact that the taskforce that takes the responsibility to develop the OS did not go to the industries, rather the industries (their representatives) came to them, as one member of the task force explained. The task force used only one job analysis method (DACUM). In the literature review it was indicated that a combination of multiple job analysis methods is preferred to get sufficient information to determine the various jobs in industries. In addition, as it

was explained before, practitioners (the ICT technicians themselves) were not included in the taskforce who developed the OS. From these facts it can be concluded that no sufficient labor market was gathered before embarking the development of the OS.

The use of only one job analysis method, no involvement of ICT technicians in the OS development process and insufficient labor market information are attributable to the gap between the OS and the labor market requirement.

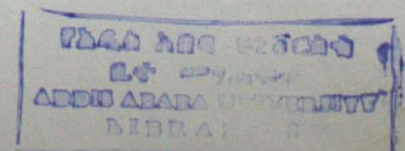
In general, it can be concluded from the research findings that the OS for ICT technicians does not fully respond to the requirements of the labor market.

5.3. Recommendation

The TEVT sector intermediates between the skills that the general educational sector provides school leavers and the skills that the labor market needs, providing technical and vocational training to facilitate the school to work transition for youth. As it is usually seen, the TEVT sector does not always address this skills demand-supply gap well. Occupational standards are developed to bridge the gap between training institutions and the labor market by setting standards for education and training that respond to the labor market demand.

The following recommendations are forwarded based on the findings of this research:

1. Ministry of Education and training institutions should fully involve employers and other stakeholders in developing occupational standards, which would ultimately determine the type of education and training to be delivered for TVET trainees.
2. Care should be taken in selecting representatives for developing occupational standard. Industry representatives who participate in developing occupational standards should include those practitioners who are doing the actual work in the industries.
3. The occupational standard should reflect, and even may go beyond the requirement of the world of work. For graduate technicians to get hired, they should be equipped with skills and knowledge that makes them fit to the world of work. This could only be possible if they are provided with education and trainings that would give them more



opportunity to industrial (practical) skills. This, in turn, is possible with appropriate occupational standard and curriculum.

4. A combination of different methods should be used in eliciting information from experts about their job. Using only one method, such as DACUM, may not help to get sufficient data about the skills required by the labor market.
5. The OS should be more responsive to the needs of employers. This will be possible by gathering sufficient market information and by involving large number of stake holders in the process.
6. The OS should also be responsive to future needs of employers.

Suggestions for future research

The research was conducted in Addis Ababa particularly based on the skill needs of 10 organizations. It is obvious that the number of organizations that require the skills of ICT technicians are not limited to ten and it is expected that this number will increase from time to time as organizations become aware of the advantage of using ICT in their organizational activities. Increase in the number of ICT using organizations implicitly means increase in the demand for ICT technicians and professionals.

As ICT is used more and more, additional skills will be required from the technicians and professionals. As ICT is dynamic by nature, new technologies emerge frequently. For organizations to be competent in this era of information-based economy, they should have technicians and professionals who could cope up with the new technologies. A lot is expected from education and training providers to equip their graduates with these skills, knowledge and attitudes. Education and training providers can do this if the occupational standard that determines the curriculum is prepared in such a way that it responds to the present and future demands of the labor market.

This study revealed that there is misalignment between the skills included in the OS and the skills that the labor market requires. It is believed that if more elaborate and in-depth studies are carried out, additional labor market requirements will be identified. It was indicated in the literature review that assessment of the labor market is the first task in

developing occupational standards. There fore I recommend that more elaborate and in-depth assessment of the labor market be made before embarking the development of the OS. I also recommend that practitioners be involved in the OS development process.

My last recommendation is that before implementing it at national level, which requires investing huge amount of money, the OS has to be revised so that it meets the requirement of the labor market.

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Appendix I
Open-ended questionnaires

የ ICT ቴክኒሻያኖችን ቀጥረው ለሚያሰሩ መስሪያ ቤቶች የሰው ሀይል አስተዳደር ክፍል የተዘጋጀ መጠይቅ

የዚህ መጠይቅ አላማ አሰሪዎች ከኮሌጅ ተመርቀው ከሚወጡ የ ICT ቴክኒሻያኖች ስለሚፈልጉት ክህሎትና እውቀት ለማወቅ ነው። ይህ መጠይቅ ለሁለተኛ ዲግሪ ማሟያ ጥናታዊ ፅሁፍ ለሚውል መረጃ ማሰባሰቢያነት የተዘጋጀ ሲሆን ጥናቱን መሰረት በማድረግ በትምህርት ሚኒስቴር በኩል ለ ICT ቴክኒሻያኖች የተዘጋጀው የስራ ብቃት ደረጃ (Occupational Standard) ምን ያህል ከአሰሪዎች ፍላጎት ጋር እንደሚጣጣም በማጥናት ክፍተት ካለም ለመጠቀምና ተመሳሳይ ጥናት ማድረግ ለሚፈልጉና የተዘጋጀውን የስራ ብቃት ደረጃ (Occupational Standard) መከለስ ለሚፈልግ አካል መነሻ ሊሆን የሚችል በጥናቱ ላይ የተመሰረተ ሃሳብ ለማቅረብ ነው። መጠይቁን በታቀደው ጊዜ በመሙላት የምታደርጉልኝ ትብብር ለጥናቱ መሳካት ወሳኝ ስለሆነ በጎ ፈቃዳችሁን በአክብሮት አጠይቃለሁ።

በመጠይቁ ላይ ስምዎትን መሙላት አያስፈልግም።

1. ሠልመሰሪያ ቤቱ አጠቃላይ መረጃ
 - 1.1. የድርጅቱ ስም _____
 - 1.2. የድርጅቱ አይነት ሀ) የመንግስት ለ) የግል
 - 1.3. የድርጅቱ መደብ ሀ) አነስተኛ (ከ 1-4 ሰራተኛ ያለው)
ለ) መካከለኛ (ከ 5-10 ሰራተኛ ያለው)
ሐ) ከፍተኛ (ከ 10 በላይ ሰራተኛ ያለው)
 - 1.4. ድርጅቱ የሚሰጣቸውን ዋና ዋና አገልግሎቶች ይጥቀሱ

2. በመስሪያ ቤቱ ለ ICT ቴክኒሻኖች ያሉትን የስራ መደቦች ይጥቀሱ

3. በሚቀጥለው ስንጠረገር ውስጥ በመስሪያ ቤቱ ላሉት የ ICT ቴክኒሻኖች የስራ መደቦች ዋና ዋና የስራ ዝርዝሮችን ይጥቀሱ

ተ. ቁ.	የስራ መደብ	ዋና ዋና የስራ ዝርዝር
1		
2		
3		
4		
5		

4. በሚቀጥለው አንድ አመት ውስጥ በመስሪያ ቤትዎ በኩል የ ICT ቴክኒሻኖችን በተመለከተ ሊኖር የሚችል አዲስ የስራ መደብ ካለ ይጥቀሱ

ይህንን መጠይቅ ለመሙላት ስላደረጉልኝ ትብብር ክልብ አመሰግንዎታለሁ።

Open-ended Questionnaires (English version)

(To human resource department of organizations that hire ICT technicians)

The objective of this questionnaire is to collect data about the skills and knowledge that employers require from ICT technicians. This questionnaire is prepared in an attempt to investigate the gap between occupational standard for ICT technicians and the labor market requirement. The study is being conducted as part of my partial fulfillment of the requirements for MA degree in Education.

Please note that your personal and organizational cooperation to provide me a genuine and timely data is very important to facilitate this study.

You don't have to write your name in the questionnaire.

1. General Information

1.1. Organization/company name.....

1.2. Specify sector of the organization/company 1. Public 2. Private

1.3. Your organization/company is

- a. Small-sized (1-4 employees)
- b. Medium –sized (5-10 employees)
- c. Large-sized (more than 10 employees)

1.4. Would you please explain the major business areas of your organization?

2. Would you please list down the occupational titles/job positions of the ICT technicians in your organization?

3. Specify summary of the job descriptions for each position of the ICT technicians in your organization in the table below.

No	Job Position	Summary of job description
1.		
2.		
3.		
4.		
5		

የአዲስ አበባ ከተማ አስተዳደር
የሥራ ምዕራፍ
ሰነድ ቁጥር: _____
ቀን: _____

4. Please specify any new position for ICT technicians within one year in your organization.

I thank you for your cooperation to fill in this questionnaire.

Appendix II

Interview questions for representatives from industries, from MOE and from GTZ

1. What procedures did you follow in developing the O.S. for ICT technicians?

2. Did you make any job/occupational analysis? If yes, which approach (type of job analysis) did you follow?

3. Who/ what was your source of labor market information?

4. Who participated in the development of occupational standards for ICT technicians?

5. What was the role of each participant?

6. What were their educational Backgrounds? (Optional)

7. For how long did you hold the workshop?

8. Do you think that sufficient data was obtained concerning the skill demands of employers?

9. What is your opinion to have better occupational standard that would respond to the skill needs of employers?

Appendix III

Interview questions (Expert interview protocols) for ICT technicians

Occupational title of the ICT technician _____

No	Type of activity performed by the technician	Steps to be followed					Knowledge and skills required
		Task 1	Task 2	Task 3	Task 4	Task 5	
1							
2							
3							
4							

Appendix IV

Participating organizations by Number of participants

Name of the organization	Human resource personnel	ICT technician	Expert	Total
EICTDA	1	1	2	4
ETC	1	2	-	3
Ethiopian Airlines	1	2	-	3
ROME Computers	1	1	-	2
National bank of Ethiopia	1	1	-	2
SNAP	1	3	-	4
HARON computers	1	1	-	2
Alta Computec	1	1	-	2
Ministry of Works and Urban development	-	4	-	4
Photo Family	-	1	-	1
MOE	-	-	1	1
GTZ	-	-	1	1
Total	8	17	4	29