TECHNOLOGY AND KNOWLEDGE TRANSFER: A CASE STUDY OF THE LIBYAN OIL AND GAS INDUSTRY

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TECHNOLOGY AND KNOWLEDGE TRANSFER: A CASE STUDY OF THE LIBYAN OIL AND GAS INDUSTRY

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Abstract

The goal of this research is to investigate the importance of technology and knowledge transfer in the oil and gas industry in Libya. It explores the key characteristics and behaviour associated with the foreign companies who are in a position to transfer a substantial amount of knowledge and technology to local partners. This research also aims at exploring the technology and knowledge processes, their significance and how transfers occur. The aim is to identify the most efficient and effective strategies and policies to support local partners. Further, it examines the nature of the transfer, showing the main barriers which might be faced by both parties.

Data for this research were collected via two main methods: questionnaires and interviews (unstructured interviews). Two types of questionnaire were prepared for this study. The first type was specifically written for use with the Libyan nationals, while the second was designed for the foreign personnel in the companies of the oil and gas industry in Libya. Each type of questionnaire was designed to seek different types of information. Unstructured interviews were also conducted with various individuals where more qualitative information was obtained.

The research findings indicate that both closed technology and tacit knowledge have become very important factors for the rapid development of companies. However, this study found that neither closed technology nor tacit knowledge was transferred widely to the oil and gas industry in Libya. It was discovered that tacit knowledge is held within the individuals, it is the skill that adds wealth to the value and significance of knowledge; it is also acquired via dialogue, discussion and exchange of ideas. However, the transfer of tacit knowledge is often difficult because of its nature. By contrast, explicit knowledge is easy to obtain and recognize, and it is usually acquired as a consequence of additional investigation. Hence, it is more easily communicated and shared with other individuals.

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My sincere appreciation also goes to my family, for their continuous prayers, encouragement and unlimited moral support, which have enabled me to achieve one of my main ambitions. It is to them that I dedicate this thesis.

Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work.

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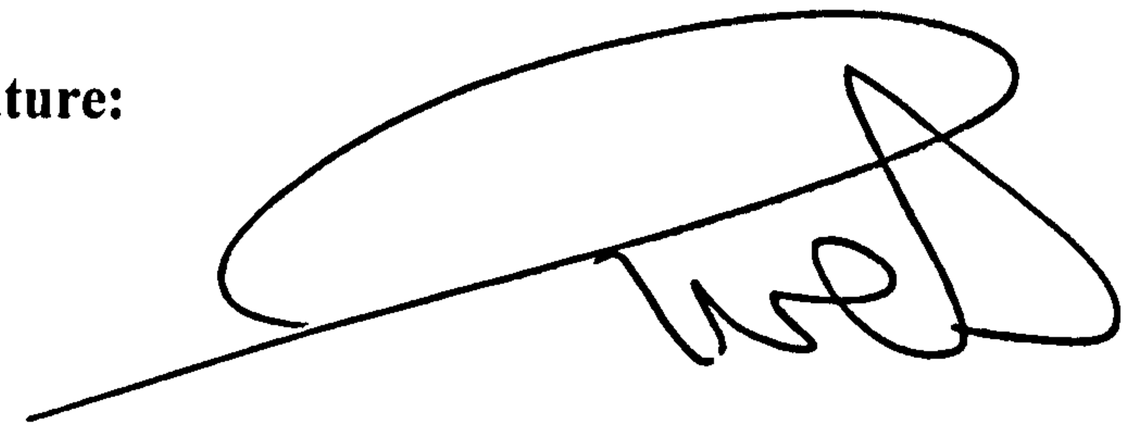
Signature: 

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Chapter One

Introduction

1.1 Introduction

This chapter explains the significance of technology and knowledge transfer in the oil and gas industry in Libya. It presents the problem addressed by this research as well as looking at its aim and objectives, its purpose and rationale. Methodological steps and structure of the research are also considered.

1.2 Background to the study

Technology transfer can be expressed as a flow of that complex collection of knowledge which includes a level and type of technology. Technology is transferred in various ways, for instance, as tangible assets, such as new products, plant and equipment, and also in intangible form via official methods, such as patents and licences, or unofficially through data and information flows and knowledge sharing (Menzler-Hokkanen, 1995).

Technology is becoming an important factor for companies considering international expansion particularly that via the joint ventures mode. Accordingly, technology transfer through international joint ventures is regarded as an important base from which to improve competitiveness, exploit opportunities and enhance economic growth and development. Therefore, the national governments of many countries depend on, and search for, methods of ensuring technology spillovers from foreign companies. This is a crucial factor in their national economic development programme. In addition, several countries require foreign companies interested in entering their markets to form joint ventures or to agree to other measures that assure the flow of technology from the foreign companies to local partners (Nakamura and Nakamura, 2004).

It has been argued by Virmani and Rao (1997, p. 39) that "technology transfer to developing countries poses a different set of problems, such as non-availability of forging exchange, high cost of transfer, problems in adaptation to local conditions, poor level of skills available, inadequate socio-economic infrastructure, new material quality, etc."

Knowledge is increasingly becoming very significant in obtaining and continuing competitive advantage and it is regarded as the main intangible asset a company owns. Managing knowledge involves building an environment within a company that makes it possible for the creation, transfer and sharing of knowledge (Kermally, 2002). Knowledge is one of the most central elements of core competence, and companies attempt to transfer as well as to absorb it in each communication and interaction with their environment. Knowledge transfer is required by companies for their development. Therefore, companies try to learn how to transfer knowledge as well as to acquire it in most of the interactions with their internal and external environments (Khamseh and Jolly, 2008).

Knowledge management plays a vital role in the development processes of companies. Thus, in order to decrease any difficulty and to make the most of competitive advantage, knowledge management is an obligation, especially for international companies. Sharing best practices across areas, tasks, functions and businesses will assist international companies to enhance productivity by reducing unproductive overlap of work and, hence, operating more efficiently (Ichijo and Nonaka, 2007). Knowledge management supports practices and technologies that assist the effective and efficient creation and sharing of knowledge (Frappaolo, 2006). With the rapid advances in technology and the unpredictable economic environment, knowledge management has become an even more essential and decisive element in the development of a company's capability. In this environment of rapid changes and ambiguity, the only way for a company to move ahead and acquire a competitive advantage is via knowledge accumulation (Chang and Lee, 2008).

Furthermore, Knowledge Management Systems (KMS) play an important role in the development of knowledge management competences. The term KMS usually relates to a wide group of information technologies for knowledge creation, acquisition, sharing, transfer and application (Alavi and Leidner, 2001). KMS allows both tacit and explicit

knowledge to be stored, created, transferred and shared using technology or other ways and strategies (Harlow, 2008).

For several decades, and particularly since the oil boom of the early 1970s, the Middle East has been among the regions of the world most influenced by deterritorialization and globalization. The oil-rich countries in particular have quickly cast aside traditional technologies and taken on and adopted new technologies, sometimes without any concern or consideration of long-term sustainability or aesthetics or of the social and cultural implications for either traditional producers or domestic consumers (Tapper and McLachlan, 2003).

In more than one Middle East and North Africa country, governments have made important attempts to support their science and technology strategies, increase resources dedicated to science and technology, establish priorities, create growth poles in the form of centers of excellence, and improve and increase technology parks (Aubert and Reiffers, 2003).

1.3 The rationale for the study

The Libyan economy depends primarily upon revenues from the oil sector, which contributes practically all export earnings. In addition, in recent years, Libya has made good progress on economic reform as part of a broader campaign to reintegrate the country into the international fold. This effort gained impetus after UN sanctions were lifted in September 2003. This progress has led several foreign companies to think about investing in Libya by forming joint ventures with the National Oil Corporation (NOC), which is responsible for the administration, development and exploitation of oil wealth locally and in other countries. It operates through joint ventures with foreign oil companies as well as having a number of subsidiary companies which are active in various areas of the oil industry through production sharing agreements.

The main motivation for choosing this topic is that Libya has become a great investment attraction to foreign companies in the oil and gas industry owing to its location and to the fact that its oil requires less costly refinery. As stated by Bahgat (2006, p. 197-198), there are "certain advantages the Libyan oil sector enjoys. First, Tripoli holds huge proven oil

reserves – estimated at 39.1 m b, or 3.3 per cent of world's total. Second, production costs are among the lowest in the world. Third, Libya produces high-quality, low-sulphur, "sweet" crude oil. Fourth, the proximity of Libya to Europe is a big advantage in terms of ease and cost transportation to large and growing market."

Libya should thus consider that these ventures have to be useful in terms of knowledge and technology transfer, so that the country can depend on their managers and personnel to acquire and obtain new knowledge and technology in order to improve and develop this important sector.

Furthermore, another reason for choosing this topic is that the area of technology and knowledge transfer regarding the oil and gas industry in Libya is still under-researched. There is little published material relating to this area, a reason that has motivated and encouraged the researcher to carry out this study.

1.4 Research problem

Many authors (e.g. Kogut and Zander, 1992; Grant, 1996; Nonaka, 1998; Zack, 1999; Roelof and Beijerse, 1999; Gupta *et al.*, 2000; Parent *et al.*, 2000; Conceicao and Heitor, 2002; Wagner, 2003; Van den Hoff and De Ridder, 2003; Aubert and Reiffers, 2003; Zarraga and Garcia-Falcon, 2003; Sharkie, 2003; Carrillo, 2004; Iles *et al.*, 2004; Ward, 2007; Parent *et al.*, 2007; Jakubik, 2007; Khamseh and Jolly, 2008) concur that knowledge is one of the key strategic resources and is becoming an increasingly important asset that can provide great competitive advantages for companies. In addition, several authors (e.g. Virmani and Rao, 1997; Valverde, 2003; Hemais *et al.*, 2005) confirm that technology has become an essential factor for companies in order to secure development and competitive advantage, especially for those situated in industries which require continuous advancements from their products and services/processes.

Many foreign oil and gas companies have been working in Libya for several years. These companies usually transfer their technology and knowledge to the country in order to be used either for the discovery or production of oil and gas or in other activities related to this industry. However, local partners have not benefited substantially from the technology and knowledge transferred. Therefore, local partners should adopt and create certain

policies in order to acquire transferred provision of technology and knowledge at the highest level and to be fully aware of the advantages and techniques of their transfer. In addition, local managers and personnel should be encouraged to acquire the maximum benefits from this foreign technology and knowledge, for the development of the infrastructure of the oil and gas industry in the country.

Specifically, the study addresses the following research questions:

1. What are the main reasons for transferring technology to the oil and gas industry in Libya?
2. Are closed technology and tacit knowledge the types being transferred by foreign companies to their local partners?
3. What are the main barriers facing the transfer of foreign technology and knowledge to the oil sector in Libya?
4. What are the technological facilities transferred by foreign partners to the oil and gas industry in Libya? And what is the level of local participation in completing projects?
5. What are the main channels provided in companies for transferring explicit and tacit knowledge?
6. What are the main methods of knowledge creation and knowledge sharing adopted in companies?
7. What are the main facilities and motivation provided by the foreign partners for knowledge sharing?
8. What are the key activities of knowledge management and the main functions of knowledge management systems in the companies?

1.5 Aim and objectives of the study

This study investigates the significance of technology and knowledge transfer via joint ventures in the oil sector in Libya; it attempts to discover the main characteristics and behaviour associated with the members of several foreign companies who are able to transfer a considerable amount of knowledge and technology to their local partners. This study also aims at examining the technology and knowledge processes, their significance as well as their channels, and at finding out the most efficient and effective strategies and

policies to support them. It also explores the nature of these transferences, indicating the main barriers that might be faced by both parties.

The essential objectives of this study are:

1. To understand the main principles, facts, and concepts related to knowledge and technology transfer.
2. To find out to what extent the managers and personnel of the foreign partners are seriously willing to transfer and share their knowledge and technology with their local partners.
3. To provide a comprehensive investigation of the sources on the topic of technology and knowledge transfer.
4. To discover to what extent the success of the transfer of technology and knowledge can be influenced by certain factors, notably the presence of cultural barriers.
5. To assess the validity of the research results and to state the policy implications of this study.

1.6 Data collection

Sources and materials used to carry out this study were collected via the following methods.

1.6.1 Secondary data

The researcher found the use of literature available at the library of Durham University, in conjunction with the library's on-line system giving access to the Internet, particularly useful when conducting the secondary research. Furthermore, the researcher visited several regional libraries, such as the libraries of Newcastle Upon Tyne University and Northumbria University, in order to search for what had been published regarding technology and knowledge transfer. It thus became apparent that there had been much research conducted upon this topic. Consequently, there were a large number of textbooks, journals and articles to be reviewed and utilised in order to cover the area of research.

1.6.2 Primary data

Primary data were gathered using two major methods: questionnaires and interviews (unstructured interviews). Two types of questionnaire were prepared for this study. The first type was specifically written for the Libyan nationals, while the second was designed for the foreign personnel in the joint venture companies of the oil and gas industry in Libya. Each type of questionnaire was intended to seek information different from the other.

After analyzing the questionnaires, the researcher discovered that answers to certain questions were unclear. Therefore, it was decided to carry out unstructured interviews, where more concise information could be obtained. Therefore, individuals at different levels of the companies were targeted. Originally, this was to guarantee that any findings were based on data coming from various parties concerned.

1.7 Research contribution

This study aims to contribute to the understanding of strategic matters of technology and knowledge transfer to the oil industry in Libya. The expected results of this research may help the National Oil Corporation of Libya, which is responsible for the upstream as well as the downstream of the oil and gas activities, to revise practices and determine an ideal method for dealing with the new parties interested to form ventures with it regarding technology and knowledge transfer. Further, it may help the NOC to find a better way to encourage their local managers and individuals to increase their efforts to access, acquire, and share the knowledge and technology transferred by the foreign partners, as it is considered that learning from the partner is one of the most crucial processes in the joint venture context.

Furthermore, this research will contribute new literature to the subject of technology and knowledge transfer in the oil and gas industry in Libya, about which subject there is a scarcity of literature. This may give better understanding to various parties, such as local oil and gas companies, foreign oil and gas companies, as well as researchers interested in this area of research.

1.8 Structure of research

This thesis is made up of eight main chapters. **Chapter 2** investigates some of the key issues relating to the concepts of "technology" and "knowledge". It shows the main elements in the area of technology, including its definitions, types, acquisition, and other important related factors. It also looks at certain fields of knowledge: its definitions, creation, and its transfer, sharing and types, with special concentration on tacit and explicit types. This chapter also introduces the concepts of knowledge management, as well as knowledge management systems, owing to their connection to the research area. **Chapter 3** examines the essential activities of technology and knowledge transfer in Libya. This chapter is divided into two main sections. The first section deals with the technology and knowledge transferred to different industries and sectors in the country, such as banking, telecommunications, electricity, the Great Man-Made River Project, and so on. The second section is totally devoted to the oil and gas industry in Libya; it gives an overview of this industry, indicating the main foreign companies involved in upgrading this important sector. **Chapter 4** presents in more detail the research methodology adopted for the study. It introduces perspectives that assist in understanding the aim and practices of the essential research methods. This chapter also shows the methods of data collection used (secondary and primary data), examining their types, sources and advantages for the data gathering. **Chapter 5** examines and puts together all the materials collected regarding technology. It commences by giving a clear idea and profile of the sample of participants and then introduces the term "technology", including its types, benefits, methods of selection and its sources, focusing on equipment, and the technological facilities transferred by the foreign partners involved in the oil sector in Libya. **Chapter 6** puts together and investigates all the findings and materials collected regarding knowledge transfer in the oil industry via joint venture in Libya, starting by introducing the term "knowledge", showing its significance, requirement, sharing, transfer, and types, concentrating on the two main types (explicit and tacit), indicating their main channels and their conversion processes. This chapter also looks at terms relating to knowledge management (KM) and knowledge management systems (KMS), presenting their significance, functions, and the accessibility of KMS, as well as the main activities of KM. **Chapter 7** concentrates mainly on the cross tabulations of the research results; it compares the key elements of the study in order to gain a clear idea about the research sample as well as to investigate the results obtained in each company involved. **Chapter 8** attempts to collate and summarise all the materials

collected for carrying out this research, and discusses some implications relating to technology and knowledge transfer in the Libyan oil industry. This chapter introduces some of the limitations regarding this study and gives some suggestions for further research in the area of technology and knowledge transfer.

1.9 Summary

This chapter has looked at the structure of the thesis. It has presented background information on technology and knowledge transfer. It has also introduced the research problem, as well as the rationale for conducting this study. This chapter has also indicated the main aim and objectives of the research. The essential methods for collecting the research data were illustrated in brief. Furthermore, some of the contributions to research were given, and the structure of this study was briefly outlined.

Chapter Two

Technology and Knowledge Transfer

2.1 Introduction

The concepts of technology and knowledge have received much attention from authors and researchers in recent years owing to their importance in the enhancement of economic growth and the gaining of competitive advantage. This chapter seeks to investigate some of the key issues related to the concepts of "technology" and "knowledge". It begins by examining the main elements of technology, including its definitions, types, acquisition, and other important related factors. It then proceeds to deal with certain fields of knowledge, including its definitions, types - with special focus on tacit and explicit types, creation, sharing and transfer. Finally, it seeks to introduce concepts of knowledge management and knowledge management systems, owing to their relevance to the research area.

2.2 Technology

Technology is a major factor in the development and growth of any country (Grosse and Kujawa, 1992; Virmani and Rao, 1997; Bennett, 1999; Hill, 2005). Technology has become a fundamental requirement for companies in their development and their striving for competitive advantage, especially for those situated in industries which require continuous advancement in their products and services (Valverde, 2003; Hemais *et al.*, 2005). Technology is an essential driver in accelerating momentum (Grosse, 1996; Malhotra, 2005). It is believed that the accessibility of technology and the capability to exploit it for the fast development of new processes and products have become

fundamental competitive elements, both for individual companies and for whole economies (Meyer-Stamer, 1997).

Technology is also important for companies because it is considered to be the main factor which paves the way for knowledge management, and also as a tool to help individuals and groups in the creation, capturing, spreading and sharing of knowledge (Riley, 2003). Technology may be categorized or classified as embodied or disembodied. Information may be embodied in the form of certain products, which may be reverse designed and engineered to find out the essential processes. It might be disembodied as know-how or codified technology (Maskus, 2004). Technology in general is a social process, which is practically and socially embedded and fixed. It is designed and created by human agency, societies, organisations, and individuals. The methods of using and employing technology, as well as its creation, are heavily dependent on social and economic context (Dicken, 1998).

Furthermore, Lin *et al.* (2002) argue that technology is vital for both countries and companies. In countries where natural resources are in short supply, technological development becomes a matter of urgency, enabling companies to continue to participate in international competition. However, Dicken (2003) believes that the selection and use of technology is affected by the drive for profit, capital accumulation and investment and increased market share, and the like. Nakamura and Nakamura (2004) state that the national authorities of numerous countries count on and search for methods of ensuring technology spillovers from foreign companies. This is the main plank of their national economic development programme. In fact, some countries insist upon foreign companies interested in entering their markets setting up joint ventures; or they make other plans that guarantee flows of technology from the foreign companies to local markets.

Technological innovation and transformation are at the centre of the process of economic growth and economic evolution and have enabled the integration of information so that multidimensional perspectives of an issue are available. The importance of technological

innovation is also an essential player in sustaining and enhancing competitive advantage (Dicken, 1998; Best, 2001; Tandon and Sonka, 2003). Therefore, the most successful and profitable companies are those that are in the forefront of technological innovations (Antoniou and Ansoff, 2004).

It has been argued that a company thinking to invest in a new technology must battle with hard tradeoffs of whether to buy technology or to produce it - supposing that the company has the ability to do so - (Karkalakos, 2005). Therefore, it is very important to plan adequately for the adoption of new technology so that the transformation from older to newer technology is easy and suitably timed. Sufficient planning for technology acquisition needs knowledge of several elements, such as the phase in the development of technology at which it will be adopted, the current phase of development and evolution, and the degree of development (previous and forecasted) (Mikhail *et al.*, 1999).

2.2.1 Definition of technology

Before the concept of technology can be defined, it is necessary to perceive how this term has been viewed and distinguished by engineers and social scientists. Vital distinctions have evolved in how the term "technology" is used in the field of engineering, social and applied social sciences. Engineers, technicians and technologists are always unanimous in their view of technology as the operation of material construction based on orderly engineering knowledge. This concept links with physical systems or machines. However, social scientists consider technology in wider concepts, widening what is comprehended of material construction to take social importance into consideration and analysis. The employment of technology, in their view, refers not only to the uses of material constructs but also to intellectual and social contexts (Luppicini, 2005).

The term "technology" is not an easy term to explain and define. It has proved difficult to give an accurate definition of this concept. Technology has been viewed from different aspects and angles (Chen, 1996). However, many authors have made their contributions to defining this term. For example, the Longman Dictionary of Contemporary English

(2003, p. 1704) defines technology as "new machines, equipment, and ways of doing things that are based on modern knowledge about science and computers". Furthermore, Maskus (2004, p. 9) defines technology as "the information necessary to achieve a certain production outcome from a particular means of combining or processing selected inputs." Bennett (1999, p. 201) indicate that technology means "the utilisation of the materials and processes necessary to transform inputs into outputs. Understanding technology requires knowledge; operating a technology requires skills." Moreover, Miles (1995, p.3) views technology as:

> "The means by which we apply our understanding of the natural world to the solution of practical problems. It is a combination of "hardware" (buildings, plant and equipment) and "software" (skills, knowledge and experience together with suitable organizational and institutional arrangements). Technology must be applied and maintained, which implies a demand for a further input of a suitable range of human resources and skills. It is this latter input that is at the root of the difficulty in transferring technologies between different environments."

Furthermore, the American Chamber of Commerce in Egypt (ACCE) (1995, p. 1) has provided a fairly comprehensive definition of technology and states that:

> "Technology, in its broadest sense means the knowledge used to produce goods and services. It includes everything from the manufacture of computers to the marketing of dress shirts, from the use of scientific measures to prevent pollution to the growth of better and more abundant crops. It also includes the knowledge of how to influence society in order to improve the standard of living and to cope with problems as they arise. It is the practical application of science."

Wilkins (2002) supports the vision of technology mentioned by Miles (1995) and believes that technology should be considered not only as the equipment, but also the skills, information and know-how which are required to finance, manufacture, fix, operate and maintain the equipment. Moreover, Martin and Nightingale (2000) add that technology is understood as more than physical capital. It includes skills, knowledge, capabilities and organisation, not just machinery. Accordingly, Meyer-Stamer (1997)

argues that, in the more limited sense, technology is the know-how needed to advance and apply technical processes.

2.2.2 Features of technology

Technology has a number of special features and characteristics which make it special and unique. Thus, Chen (1996) reveals that there are three main features of technology. Firstly, the appearance of technology is not fixed, technologies have different shapes. Secondly, technology does not need recreation in order to be applied and transferred a number of times. Thirdly, technology transfer usually refers to transfer of the right to use, instead of the right to ownership. Consequently, technology is a public good.

2.2.3 Technology acquisition

Technology is an essential operator heavily relied upon by most companies and manufacturing sectors for the majority of their daily activities (Riege, 2005). The ways in which technologies are employed – even their very creation are restricted by their social and economic contexts (Dicken, 2003).

There are several methods for introducing new technology. However, these methods are different from one country to another, owing to the systems, rules, and polices, as well as the different cultural and historical backgrounds. Chen (1996) determines four general models of technology acquisition and the methods for such acquisition. These models consist of: ***the migrant model***, which involves enticing and attracting expert, professional, and skilful talents from other countries; ***the hardware model***, which focuses on the intensive buying of manufacturing equipment; ***the software model***, which gives prime concern to the transfer and acquisition of technological information, such as licensing etc.; and, finally, ***the capital model***, which relies on attracting and taking advantage of foreign direct investment (FDI).

2.2.4 Technology types

There are many types of technology. Heydemann (1990) identifies four types of technology, which include: infratechnology; generic technology; proprietary technology,

and science base. The first type (infratechnology) is made up of technical information and services specifically prepared to serve industry and commerce; these include documentary standards, textbooks and teaching materials, patents, different types of engineering measurements, and so on. The second type (generic technology) is regarded as the basic engineering knowledge that is not proprietary in creation and nature. The third type (proprietary) refers to technical information to be incorporated in operations, processes, goods and products. This information is often patented and securely held, and it is not easily available to the public. The fourth and final type of technology (science base) is considered an essential source of information and includes all technical and scientific knowledge. This type generally leads to the creation of new products, services and processes; it is also accessible to everyone who is interested. It is non proprietary, worldwide, and available to the public.

On the other hand, Chen (1996) divides technology into three divisions or types: open technology; semi-open technology, and closed or secret technology. Open technology refers to various types of practical knowledge and technological theories that are published. These may include scientific articles, academic theses, and other open technology such as conferences, forums etc. Semi-open technology refers to patented technology where permission is required for the inventions to be seen and viewed, although keeping at least some essential parts secret. Finally, closed or secret technology mainly refers to know-how, where the essential data and technologies are unpublicized and strongly protected by laws and security rules and measures.

2.2.5 Technology transfer

The issue of technology transfer has been dealt with by many authors (e.g. Grosse, 1996; Virmani and Rao, 1997; Wilkins, 2002; Daghfous, 2004; Bennett and Zhao, 2004; Lockemann, 2004; Martz, 2005). Technology transfer is seen as the movement of technology and knowledge, through certain methods, from one person or company to another (Devine *et al.*, 1987; Gibson and Smilor, 1991). Technology transfer plays an important role in the innovativeness of a certain industry or the competitiveness of a national economy. Without technology transfer, the impressive progress of

biotechnology, the Internet, and materials science would have been unimaginable (Lockemann, 2004). Technology transfer helps business organisations to improve and enhance their competitive advantage. However, technology transfer is not restricted only to the business field; it covers different areas, activities, and disciplines, including economics and management (Kim and Kim, 2000; Martz, 2005).

The development of worldwide manufacturing has been noticeably increasing over recent years, and international technology transfer, coupled with cross-border manufacturing, is now seen as a useful method to access foreign markets and resources (Bennett and Zhao, 2004). Technology transfer often refers to any action or operation by which one party acquires instant access to the second party's data and information and effectively understands and absorbs it into its production task and function (Maskus, 2004). Therefore, technology transfer definitely has to be combined with supplier performance enhancement (Kotabe *et al.*, 2003).

2.2.5.1 Definition of technology transfer

Technology transfer means that any developer of technology within a country moves and transports the new technology for certain reasons related to production and commercial issues (Virmani and Rao, 1997). Technology transfer has been defined by many authors. For example, Wilkins (2002, p. 43) defines technology transfer as "the diffusion and adoption of new technical equipment, practices and know-how between actors (e.g. private sector, government sector, finance institutions, research bodies, etc.) within a region or from one region to another". It has also been defined by Bell (1997, p. 85) as:

> "A channel for acquiring more than just 'ready-made' product designs, machinery and production know-how for expanding, improving or diversifying production in the short term-though these elements have been recognized as essential. It has also been as a channel for acquiring deeper forms of know-how and expertise that will contribute to longer-term objectives about building up the firms' creative competences for generating their own paths of technical and organisational change."

Furthermore, Grosse and Kujawa (1992, p. 543) view technology transfer as "the diffusion of technology from the place of its introduction to other markets around the world". Finally, Maskus (2004, p. 7) has given a general definition of international technology transfer. He defines it as:

> "A comprehensive term covering mechanisms for shifting information across borders and its effective diffusion into recipient economies. Thus, it refers to numerous complex processes, ranging from innovation and international marketing of technology to its absorption and imitation. Included in these processes are technology, trade, and investment polices that can affect the terms of access to knowledge. Policy making in this area is especially complex and needs careful consideration, both by individual countries and at the multilateral level."

There are a number of reasons for technology transfer. Bennett (1999) argues that companies involve themselves in technology transfer for several reasons, such as to increase overall company profitability, to gain a competitive advantage, to obtain grants and subsidies from foreign governments, to overcome capacity restrictions in the home country, to take advantage of superior capital markets, to access experienced and skilled labour and other inputs in foreign states, and to enhance the capability and potential of foreign subsidiaries.

Technology transfer is often a two-way process: sender and receiver, and sometimes in between, an intermediary (Chatterji, 1990). In addition, technology transfer usually requires a number of stages. Virmani and Rao (1997, p. 18) claim that:

> "Technology transfer involves four main stages – negotiating, setting-up, starting-up, and sustaining growth. The negotiations for technology transfer involve the initial interaction among the buyers and suppliers, the country officials wherever applicable, the joint venture partners, etc. The setting-up involves detailed design, modifications and adaptations, while the start-up stage will involve proactive training, infrastructure development and redeployment. The sustained operations of a transfer will be reflected in the uninterrupted use of technology as well as in its successful adaptation and upgradation."

2.2.5.2 Channels of technology transfer

International technology can be transferred by several methods, ranging from turnkey operations to foreign direct investment and joint ventures (Di Benedetto *et al.*, 2003). Technology is transferred in a wide range of different forms and via several varieties of channels (Dichter *et al.*, 1988; Chantramonklasri, 1990; Meyer-Stamer, 1990; Chen, 1996; Grosse, 1996; Radosevic, 1997; Bennett, 1999; Di Benedetto *et al.*, 2003; Maskus, 2004; Hoekman *et al.*, 2004). Therefore, Chen (1996) identifies numerous channels through which international technology transfer may occur, including methods such as joint ventures, direct foreign investment, franchising, export of high-technology products and capital goods, academic conferences on science and technology, cooperative research arrangements and co-production contracts, licensing, sale of turnkey plants, reverse engineering, exchange of scientific and technical personnel, training programmes, subcontracting, exhibits and trade shows, open literature, government assistance programmes, commercial visits, etcetera.

On the other hand, Maskus (2004) divides the channels of technology transfer into two main categories: market channels and non-market channels. Market channels include several methods of transferring technology, such as, foreign direct investment, licensing, joint ventures, exports, and cross-border movement of personnel. By contrast, the non-market channels also involve many methods such as imitation (competitor organisation learns the technological and key secrets of another organisation's products); departure of employees; data in patent applications and test data (patent applications which are registered in a country and registered outside the country are available and competitor organisations can read such applications and learn the main technologies); and temporary migration (this may include students, managerial and technical personnel briefly at university, scientists, conferences, laboratories, and so on). Moreover, Hoekman *et al.* (2004) believe that international technology transfer can happen via various ways, such as trade in goods and services; multinational corporations (transferring technology to their subsidiaries); and also via direct trade in knowledge through technology licensing.

It is useful to determine the transferring channels to be used to convey technology to the host country or organisation. Miles (1995) believes that there are three optional methods to carry out this transferring. The first method is to purchase technology in order to be used in a licensed plant, or in a wholly owned mode. The second method is to set up certain agreements, such as entering on a contractual agreement between the recipient of technology and the licensee/developer for the use of technology in a plant which is jointly owned. The third and final method is to use technology in an activity or plant wholly owned by the technology holder or owner for the recipient's interest and benefit.

2.2.5.3 Impact of technology transfer

Technology transfer can have positive as well as negative effects on recipient companies and countries (Dichter *et al.*, 1988; Virmani and Rao, 1997; Hill, 2005). Virmani and Rao (1997) summarise the main positive and negative aspects of technology transfer, including the direct or indirect effects. The positive elements include aspects such as opening up new markets, availability of quality goods at cheaper prices, offering new facilities for innovation and the accessibility to research and development. In addition, technology transfer may provide the foundation for human resources development, such as the upgrading of educational and training centres to equip individuals with the skills required. By contrast, the negative aspects of technology transfer are several: for example, it may act as a disincentive to local entrepreneurs as imports are cheaper, as well as reducing any motivation for indigenous research and development (R&D). Table 2.1 summarises both the positive and negative effects of technology transfer:

Table: 2. 1 Impact of technology transfer

No.	Positive	Negative
1.	Policies to give direction to industrial investment in high technology/sophisticated technology.	Disincentive to local entrepreneurs (imports are cheaper).
2.	Increase in demand and opening up new markets.	Reduced incentive for indigenous R & D.
3.	Availability of quality and cheaper products.	Redeployment problems due to the new technology and new skill requirements – resulting in redundancies in some sectors and shortages in others.
4.	Increased competition leading to new product improvements and innovation as well as better service to customers.	Emergence of new competition in domestic markets.
5.	Long-term employment generation due to spurt in industrial investment and growth.	Problems due to restructuring of organisations because of technological changes.
6.	Increase in demand for sophisticated skills, need for establishment of education and training institutions.	Human resources related issues: - Obsolescence - Wage disparity - Employee alienation and resistance
7.	Ultimate boost to the economy, more employment, better living standard and more export earning.	

Source: Virmani and Rao (1997, p. 32).

2.3 Knowledge

Knowledge is becoming as an increasingly important source of competitive advantage and a fundamental driving force behind economic growth (Nonaka, 1998; Roelof and Beijerse, 1999; Gupta *et al.*, 2000; Parent *et al.*, 2000; Conceicao and Heitor, 2002; Wagner, 2003; Sharkie, 2003; Van den Hoff and De Ridder, 2004; Aubert and Reiffers, 2003; Iles *et al.*, 2004). Knowledge can be found at individual, group, and organisational levels (De Long and Fahey, 2000). It usually originates from exceptional and distinctive experiences and organisational learning (Bhagat *et al.*, 2002). In order to acquire competitive advantage, new knowledge must be produced, created and also applied to improve new distinct value-adding processes, products and perspectives (Jackson and Erhardt, 2004).

The word "knowledge" has several meanings. According to Nickols (2000), knowledge means three essential things. The first meaning refers to a state of knowing and also means to be familiar with or to realise, to be aware of, to recognise methods, techniques, facts and principles. This universal usage matches or corresponds to what is usually referred to as to "know about". The second meaning of knowledge refers to what is called "the capacity for action" a perception and understanding of methods, facts, techniques and principles sufficient to use them in the way of making things occur or happen. This matches or corresponds to "know-how". The third and final meaning of the word "knowledge" refers to accumulated, codified and captured methods, principles, facts and techniques. When knowledge is used in this manner, it is generally referring to "a body of knowledge" which is captured, articulated and written in the form of procedures and rules, papers, books, catalogues, etcetera.

Knowledge is described as the ability for efficient and effective action that is available either focused on individuals, or circulated and shared throughout organisations, and which goes hand in hand with information about knowledge, i.e. about that ability (Hofer-Alfeis and Van der Spek, 2002). However, the effectiveness of knowledge may be problematic in some circumstances. Riley (2003) argues that for knowledge to be effective, it must be able to be applied within a functional and practical context.

"Knowledge is of intangible nature" (Bornemann and Sammer, 2003, p. 22). Knowledge resides either in people's heads or in storage machines and devices from which it can be regained (Mokyr, 1999). Knowledge occurs in human beings; a computer cannot make it. The only support advantage of an organisation is what individuals know and what they do with that knowledge. It is the most significant asset an organisation has and its value is greater than that of land, labour and capital and, unlike those traditional resources, knowledge does not decrease in value (Civi, 2000).

Knowledge is used continuously in human activity, usually in a way that means knowledge is being developed as we progress, through collected and accumulated experience or reflection (Kalling, 2003a). Managing knowledge as an intangible resource and asset is seen to be a crucial ability for success in competition (Haldin-Herrgard, 2000). Knowledge is usually experiential in creation, and may be instantiated only in practice (Munir, 2002).

2.3.1 Definition of knowledge

Defining knowledge precisely is a difficult task (Davenport and Prusak, 1998; Bhatt, 2000; Spiegler, 2003). "Knowledge is easy to talk about but hard to define" (Boyett and Boyett, 2001, p. 104). However, a plethora of definitions of knowledge can be found in the literature. For example, Bhatt (2001, p. 70) defines knowledge as "meaningful information. It is an organized combination of data, assimilated with a set of rules, procedures, and operations learnt through experience and practice. In a sense, knowledge is a "meaning" made by the mind therefore without meaning knowledge is information or data". Probst *et al.* (2000, p. 24) also define knowledge as:

> "The whole body of cognition and skill which individuals use to solve problems. It includes both theories and practical everyday rules and instructions for action. Knowledge is based on data and information, but unlike these it is always bound to persons. It is constructed by individuals, and represents their beliefs about causal relationships."

Knowledge is also defined by Burton-Jones (1999, p. 5) as "the cumulative stock of information and skills derived from use of information by the recipient. Where the

recipient is a human being, knowledge thus reflects the processing (thinking or cognition) by the brain of the 'raw material' supplied in the form of information". It has been also viewed by Funes and Johnson (1998, p. 26) as "true justified belief". Davenport and Prusak (1998, p. 5) have given a comprehensive definition of knowledge and state that:

> "Knowledge is a fluid mix of framed experience, values, contextual information, expert insight, and intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates in individual minds but is often embedded in organizational routines, processes, practices, systems, software, and norms."

Furthermore, the origin of knowledge as an asset is in the minds of individuals. Bender and Fish (2000, p. 126) claim that:

> "Knowledge originates in the head of an individual and builds on information that is transferred and enriched by personal experience, beliefs and values with decision and action-relevant meaning. It is information interpreted by the individual and applied to the purpose for which it is needed. The knowledge formed by an individual will differ from another person receiving the same information. Knowledge is the mental state of ideas, facts, concepts, data and techniques, recorded in an individual's memory."

However, Holden and Von Kortzfleisch (2004) believe that knowledge is not only transferred by methods of transcoding from head to head, but also into the networks of knowledge receivers. This is consonant with one of the primary aims of knowledge management: to have the required knowledge diffused into firms' internal and external networks. Nevertheless, Minbaeva and Michailova (2004) assert that the behaviour of knowledge senders relies on individual features which involve the senders' former knowledge and experience, as well as their inclination and willingness to transfer knowledge. The decision to transfer knowledge is highly individual, and is driven by at least three factors: ability, inclination, and willingness.

Knowledge becomes embedded in organisations via several methods, such as documents or repositories, practices and norms, organisational routines and organisational processes,

and these, in turn, are configured to create technologies and products (Boisot, 1999; Gray, 2000). Furthermore, the knowledge assets residing in companies and organisations can take the form of explicit sources (e.g. reports, documents, messages) that include information and captured experiences corresponding to operational activities, and tacit sources (e.g. experiences, insights, wisdom) of qualified and expert individuals who have enhanced certain natural knowledge of specific operational processes (Kudyba, 2005).

2.3.2 Knowledge components

Knowledge includes many elements; these usually consist of various key components, and each component has its own characteristics (Gray, 2000; Davenport and Prusak, 2000; Tiwana, 2002). These components can be briefly explained as follows:

2.3.2.1 Experience: Knowledge is usually acquired via experience (Liebowitz, 2005). Experienced individuals are often valued in an organisation (Tiwana, 2002). Experience has several advantages, and one of its main advantages is that it gives a historical background against which events and situations can be viewed and understood (Davenport and Prusak, 2000).

It is often thought that knowledge develops over time, and it is not acquired immediately. Nevertheless, it enables individuals to make contacts. In other words, it sets new conditions, incidents, and events into context regarding what occurred before. When experience is not present the ideal would be to attempt to acquire it by employing or hiring specialists or professionals in order to acquire their knowledge, understanding and insights (Gray, 2000).

2.3.2.2 Values and beliefs: Values and beliefs are often necessary to knowledge (Davenport and Prusak, 2000). Organisations are usually formed by the beliefs of a few key individuals working for them (Tiwana, 2002). Although in the same circumstances or positions, individuals who have dissimilar values will perceive things differently. Therefore, beliefs and values influence what an individual knower views, receives,

accomplishes and concludes from an event and, consequently, this affects what the organisation perceives and knows (Gray, 2000).

2.3.2.3 Complexity: We usually need to concentrate on answers to clear up complex problems. Regarding knowledge, we can deal with complexity in a complex manner. In many circumstances, we just do not know. Thinking that the answers and solutions we have will work in all situations is often too simplistic (Gray, 2000). Accordingly, Davenport and Prusak (2000) argue that the essential indication of knowledge's ability to deal with complexity is the significance of experience in knowledge.

2.3.2.4 Judgment: Unlike information and data, knowledge includes judgment (Davenport and Prusak, 2000; Tiwana, 2002). Hence, judgment is necessary, especially to react to up-to-date situations and recent information. When knowledge stops developing, it turns into point of view and opinion, which is perilous and risky (Gray, 2000).

2.3.2.5 Ground truth: This term refers to the reality and facts generally gained from experience at the ground stage or level, rather than from beliefs and theories. Therefore, we know what in reality worked, not what belief and theory say should work (Gray, 2000). Consequently, experience shifts plans and ideas regarding what should occur into knowledge of what does occur (Davenport and Prusak, 2000).

2.3.3 Knowledge characteristics

Understanding knowledge features and characteristics is crucial to understanding knowledge transfer, flows, storage, and the lack thereof (Salk and Simonin, 2005). Consequently, McDermott (1999) has identified six main characteristics of knowledge, which are: firstly, knowledge is a human act. Secondly, knowledge is the residue of thinking. Thirdly, knowledge is created in the present moment. Fourthly, knowledge belongs to communities. Fifthly, knowledge circulates through communities in many ways. Sixthly, new knowledge is created at the boundaries of the old.

Furthermore, Gray (2000) believes that knowledge as a source or as an asset is different from physical sources or assets in that it has the following characteristics: it has extraordinary leverage and increasing returns (knowledge assets are not intended to be considered as decreasing returns); fragmentation, leakage, and the need to be refreshed (as knowledge develops, it fragments and branches); uncertain value (the value of investing in knowledge can be difficult to predict); and uncertain value of sharing (there are several sources of uncertainty connected with sharing knowledge: for example, it is a difficult asset to trade, and also, knowledge is embedded in individuals' minds).

2.3.4 Information and data

"Knowledge is neither data nor information, though it is related to both, and the differences between these terms are often a matter of degree" (Walters, 2000, p. 427). Forthcoming knowledge, in the form of information and data, can be saved in a variety of methods accessible to all individuals. It is also transferred by many methods, for instance, the Internet, groupware, e-mail, and videoconferencing. In this sense, information technology should be taken into consideration as an essential tool, but technology and its use is not, of itself, knowledge management or knowledge transfer (Bender and Fish, 2000).

A main aim of organisations is to upgrade, collect, identify, categorize, organise and update those documents available (explicit knowledge) which contain essential company process-specific information and save them in a central repository that users can access. This advantage commonly needs management to set up knowledge employees whose task it is to carry out those functions which would help to make a value-added information repository easily available to those seeking it (Kudyba, 2005).

The distinction between data and information has recently received much attention from several authors (e.g. Liebowitz, 1999; Gary, 2000; Walters, 2000; Davenport and Prusak, 2000; Boisot and Griffiths, 2001; Boisot, 2002; Tiwana, 2002; Knight and Howes, 2003; Spiegler, 2003; Fu *et al.*, 2006; Girard, 2006). Walters (2000, p. 428) has discussed differences between data and information, and believes that "data becomes information

when its creator adds meaning. We transform data into information by adding value in various ways."

Information is defined by Gamble and Blackwell (2001, p. 43) as "data that are endowed with meaning and purpose". Furthermore, Davenport and Prusak (1998, p. 3) define information as "a message, usually in the form of a document or an audible or visible communication". However, data is defined by Tiwana (2002, p. 39) as "a set of particular and objective facts about an event or simply structured records of a transaction". It has also been defined by Davenport and Prusak (1998, p. 2) as "a set of discrete, objective facts about events."

Information is at the heart of knowledge. The essential component of information is in the form of data that is integrated and positioned into a significant context to supply information. Information and data remain in a designed or structured form in databases or in unstructured form (pictures, drawings, presentation slides etc.) in document management systems, on file systems, and elsewhere (Janev and Vranes, 2004).

Furthermore, Boisot (1999, p. 20) believes that "information is data that modifies the expectations or the conditional readiness of an observer. The more those expectations are modified, the more informative the data is said to be." Chua (2003) argues that information can be without difficulty detached and transferred from its origin without losing its main meaning. Information is also viewed by Burton-Jones (1999, p. 5) as "data which are intelligible to the recipient". However, Tiwana (2002) professes that data can be converted to information via contextualization, correction, condensation, and categorization.

2.3.5 Types of knowledge

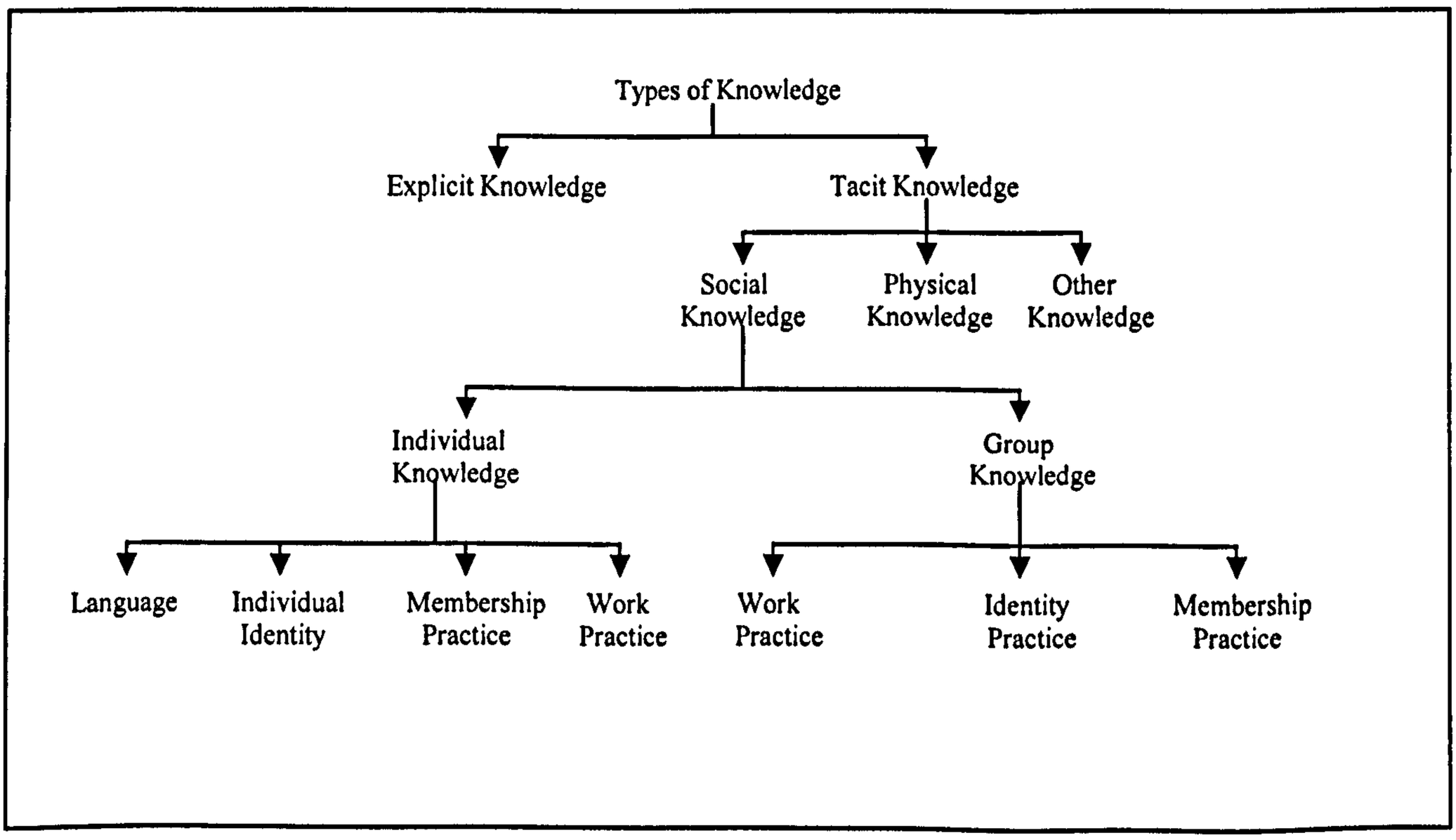
There are several types of knowledge (Collins, 1995; Linde, 2001; Tiwana, 2002). Tiwana (2002) classifies knowledge into four fundamental dimensions, which are: complexity, which includes the primary types of knowledge (tacit and explicit); focus

(operational and strategic); perishability (low and high); and type (technological, business, and environmental).

On the other hand, Collins (1995) identifies three types of tacit knowledge: firstly, embodied knowledge, which cannot be quickly and easily shared and transferred from one mind to another. Secondly, embrained knowledge, which is determined by the exceptional physicality of the individual brain. Thirdly, encultured knowledge, which illustrates a kind of knowledge that is embedded in a social context and that cannot be found separate from it.

Furthermore, other types of knowledge have been mentioned by Linde (2001), who divided knowledge into two main types, tacit and explicit knowledge. Special emphasis was placed on tacit knowledge, which was divided into three types (social knowledge; physical knowledge; and other knowledge). The following figure (2.1) shows these types of knowledge as described by Linde (2001):

Figure: 2. 1 Types of knowledge



Source: Linde (2001, p. 161)

From all that has been mentioned about knowledge types, it can be recognised that there are two fundamental types of knowledge: the first type, that is revealed in an individual's internal state, as well as in the same individual's ability for action, and the second type, which is articulated and often registered and recorded (Nickols, 2000). This leads us to attempt further explanations of the tacit and explicit as fundamental types of knowledge.

2.3.5.1 Tacit and explicit knowledge

Knowledge can be either tacit or explicit (Polanyi, 1966; Nonaka *et al.*, 1998; Hansen *et al.*, 1999; Bukowitz and Williams, 1999; De Long and Fahey, 2000; Gladstone, 2000; Goh, 2002; Hicks *et al.*, 2007). It has been argued by Cavusgil *et al.* (2003, p. 9) that "it is rare to find absolute tacit knowledge or absolute explicit knowledge." Tacit knowledge can be an essential source of sustainable competitive advantage in companies (Teece, 1996; Jashapara, 2003; Chen and Edgington, 2005). The two types of knowledge (explicit and tacit) were explained first by Michael Polanyi, the eminent philosopher and chemist, who was one of the first theorists to talk about these types (Dixon, 2000; Li and Gao, 2003; Meyer and Sugiyama, 2007).

Valuable knowledge is often of a tacit nature (Minbaeva and Michailova, 2004). Valuable tacit knowledge is usually produced, created and shared via social interactions with clients, with specialists and experts, and even with rivals and competitors (Jackson and Erhardt, 2004). It has been argued by Koulopoulos and Frappaolo (1999) that tacit knowledge can possibly constitute great value to the organisation; it is, by its very nature, far more difficult to spread, share and also to capture. For this reason, Marwick (2001) insists that tacit knowledge is actionable and effective knowledge, and hence, the most valuable knowledge.

The concept of tacit knowledge is at the heart of knowledge management (Mooradian, 2005). Tacit knowledge is not easily visible and expressible. This makes it very difficult to share or communicate with others (Bonache and Brewster, 2001). It refers to "knowledge held in physical skills, which are learned through practice, and cognitive skills, learned through experience and implicit learning" (Sanderson, 2001, p. 8).

Therefore, Marwick (2001) believes that the ideal methods through which tacit knowledge is used, built and shared are face to face meetings and shared experiences, and these meetings are often held informally.

Both tacit and explicit knowledge have to be transferred in order to make actual knowledge sharing occur. Accordingly, Gibbert *et al.* (2002) report that tacit knowledge is often transferred by individuals sharing knowledge and exchanging knowledge via social interaction; for instance, during discussion groups, meetings, or through videoconferences. Therefore, transferring codified knowledge by means of codification strategy is understood as gaining, capturing and storing knowledge in files, reports, documents, and papers, which are eventually transferred through databases or similar methods. Halden-Herrgard (2000); Wagner (2003); Janev and Vranes (2004) and Robinson *et al.* (2005) summarise that tacit knowledge is personal, embedded in individual experience, insights, and skills. It is viewed as content and context in particular and, hence, difficult to communicate and formalize. By contrast, explicit or codified knowledge involves anything that can be shared and externalised (transferred from the human brain into databases and electronic form), it also relates to information and relies on norms, attitudes, information flows, and methods of making decisions that shape people's agreements and dealings with one another, hence, it is easily communicated or shared with other individuals or sides of an organisation. Therefore, explicit knowledge is based on universally objective and accepted criteria. It has the nature of public goods (Cavusgil *et al.*, 2003).

Furthermore, Eliasson (1996, p. 35) argues that "tacit knowledge is always present when human competence is heterogeneous and/or unevenly distributed, meaning that some messages cannot be received by others, because they do not possess the required receiver competence."

Tacit knowledge is deeply involved in organisational innovation. Individuals enhance and use tacit knowledge before they are able to structure or codify (Horvath, 2000). To reach innovation success, an active interaction between tacit knowledge and innovation

management is essential (Alwis and Hartmann, 2008). As a result, Marcotte and Niosi (2000) and Stover (2004) point out that tacit knowledge is crucial to every organisation. It is a form of knowledge created from special expertise that a certain organisation has needed over the years and that cannot be transferred merely by schemes or documented information and instructions. However, codified or explicit knowledge is described and articulated and, more often, caught in the shape of tables, texts, product specifications, and diagrams, and comes out in written reports, databases, and other types of media. In addition, Koskinen (2003) argues that tacit knowledge deals with how things work, while explicit knowledge has the ability to make clear why things work.

Table: 2. 2 Comparing tacit and explicit knowledge

Characteristic	Tacit	Explicit
Nature	Personal, context-specific	Can be codified and explicated
Formalization	Difficult to formalize, record, encode, or articulate	Can be codified and transmitted in a systematic and formal language
Development Process	Developed through a process of trial and error encountered in practice	Developed through explication of tacit understanding and interpretation of information
Location	Stored in the heads of people	Stored in documents, databases, Web pages, e-mails, charts, etc
Conversion Processes	Converted to explicit through externalization that is often driven by metaphors and analogy	
IT support	Hard to manage, share, or support with IT	Well supported by existing IT
Medium Needed	Needs a rich communication medium	Can be transferred through conventional electronic channels

Source: Tiwana (2002, p. 45)

Furthermore, Caddy (2001) argues that it is not necessary for the tacit knowledge to remain tacit for all time. Therefore, Baumard (2001) maintains that the conversion of tacit knowledge into explicit knowledge is comprehended every day in organisations. Ardichvili *et al.* (2003) claim that the essential method to help individuals internalize tacit knowledge and share it is to permit them to speak about their experiences, and to exchange and share their knowledge while working on certain problems. Hence, Riley (2003) reports that the main reason for transforming tacit knowledge into explicit knowledge is that it then becomes an asset, facility, and resource that can be recorded, catalogued and re-used, so that it can be shared among individuals in the organisation.

2.3.6 Knowledge creation

Possessing knowledge and being able to create new knowledge are the keys to organisational competitiveness, new product development, and sustained competitive advantages (Boisot, 1995; Spender, 1996; Sveiby, 1997; De Holan and Phillips, 2005; Fong, 2005; Salmador and Bueno, 2007). Knowledge creation is mainly related to "know how", understanding and perception obtained from working with a perceived chance or problem. Accordingly, the acquired knowledge at this phase is considered to be new knowledge for the organisation, and mostly to be in the shape of tacit knowledge (Merali, 2001).

Despite the fact that knowledge creation is a significant activity, knowledge has to be influenced and exploited to be effectible and useful (Goh, 2002). Furthermore, Bhatt (2000) argues that the assessment of a knowledge creation process is based on its originality and adaptive flexibility in helping to find solutions to an issue in various contexts. Yoo *et al.* (2007, p. 104) argued that "the fundamental outcome through managing organisational knowledge within organisations is the knowledge organisation that enables every employee, namely knowledge workers, to create and share their knowledge in a very autonomous and continuous manner".

"Tacit and explicit knowledge are complementary, which means both types of knowledge are essential to knowledge creation" (Alwis and Hartmann, 2008, p. 134). Irrespective of

the knowledge type (tacit or explicit), knowledge creation is continuously required and involves some direct interaction and communication between those individuals who would like to use and employ expertise and those individuals who have it (Jackson and Erhardt, 2004).

2.3.6.1 Four modes of knowledge creation

In their book *The Knowledge Creating Company*, Nonaka and Takeuchi (1995) established a dynamic model of knowledge creation. In their model, they investigated crucial beliefs, hypotheses, and assumptions that human knowledge is made and developed via social interaction between explicit knowledge and tacit knowledge. They indicate that there are four modes of knowledge conversion. These modes are: externalisation, internalisation, socialisation and combination (Civi, 2000; Stover, 2004; Weir and Hutchings, 2005). However, Soliman and Spooner (2000) argue that when choosing to apply knowledge management activity, the organisation needs to be ready and to plan for each conversion mode.

The literature on this model (knowledge conversion model) has been reviewed and discussed by many authors (e.g. Magalhaes, 1998; Von Krogh *et al.*, 1998; Nickols, 2000; McAdam and MaCreedy, 1999; Gladstone, 2000; Harryson, 2000; Civi, 2000; Marwick, 2001; Alavi and Leidner, 2001; Stover, 2004; Weir and Hutchings, 2005; Sarabia, 2007; Endres *et al.*, 2007), who describe this model, including the following sequence of steps.

2.3.6.1.1 Tacit to tacit (socialisation)

The conversion of tacit to another tacit knowledge provides an excellent value to the organisation (Haldin-Herrgard, 2000). "Socialisation is sharing of tacit knowledge between individuals, by spending time, activities, and actively working together on solving problems" (Endres *et al.*, 2007, p. 93). The concept of socialisation in this regard means the steps and processes of sharing and transferring tacit knowledge to other individuals, who encode the new knowledge in tacit form (Walczak, 2005). It is also the method of sharing experiences, and it occurs via imitation, practice, observation, and

includes the shared formation and communication of tacit knowledge among individuals (Nickols, 2000; Civi, 2000; Marwick, 2001).

2.3.6.1.2 Tacit to explicit (externalization)

In reality, tacit knowledge is difficult to share and convert to explicit knowledge (Marwick, 2001). "Explicit knowledge without tacit insight quickly loses its meaning" (Alwis and Hartmann, 2008, p. 134). The externalization concept means knowledge creation processes where tacit knowledge can be encoded into some forms of explicit knowledge such as organisation correspondences (Civi, 2000; Walczak, 2005). The ideal processes by which the conversion from tacit to explicit occurs are in talks and dialogues between group members, in answering questions, or via the elicitation of stories and ideas (Marwick, 2001).

2.3.6.1.3 Explicit to explicit (combination)

Explicit knowledge is generally related to things and materials that can be formalised, such as statistics (Edenius and Styhre, 2006). Combination mode means the processes of translating explicit knowledge to a new shape of explicit knowledge (Walczak, 2005; Endres *et al.*, 2007). This type involves combining various systems of explicit knowledge to form new explicit knowledge; for example, collecting data and writing a report that examines these data; hence, the report produced presents new explicit knowledge (Nickols, 2000). This type can be shared in meetings, through documents, e-mails and so on; hence, the ideal method to share in this regard is to fix or put a document into a shared database (Marwick, 2001).

2.3.6.1.4 Explicit to tacit (internalisation)

Internalisation means learning by doing (Civi, 2000). It can be acquired from the conversion of explicit knowledge into the company's tacit knowledge (Endres *et al.*, 2007). Internalisation also means the processes of getting access or entry to explicit knowledge, where this knowledge is understood by individuals and develops into or becomes an important element of their tacit knowledge assets (Walczak, 2005). Therefore, individuals have to read documents from several sources and understand much

information from different databases in order to create their own and special tacit knowledge (Marwick, 2001).

Figure: 2. 2 Four modes of knowledge conversion

From Tacit Knowledge / To Tacit	To Explicit
Socialisation	Externalization
From Explicit Knowledge / To Tacit	**To Explicit**
Internalization	Combination

Source: (adapted from Nonaka and Takeuchi, 1995, p. 62)

In conclusion, Riege (2005), summarizes and encapsulates this model as follows. Firstly, creating tacit knowledge from tacit (socialization step), which starts with sharing experiences and techniques, often via imitation and watching. Secondly, converting tacit knowledge into explicit (externalisation step), which involves using certain models, metaphors, and concepts, usually via books. Thirdly, transferring the existing explicit concepts (combination step); this happens by investigating and rearranging data and information within the company from area to area. Fourthly, transferring explicit to tacit knowledge (internalisation step); this occurs by using actual simulation models and real experience.

2.3.7 Knowledge sharing

Knowledge sharing has become a main interest of organisations and it is crucial to their success (Davenport and Prusak, 1998; Marouf, 2007). The objective of knowledge sharing can either be to produce new knowledge by differently merging existing knowledge or to become better at making use of existing knowledge (Christensen, 2007). Knowledge receives value when shared with other individuals (Bertels and Savage,

1998). Knowledge sharing is a fundamental process in several knowledge management fields and activities, including the transfer, capture, and creation of knowledge, and has been commonly regarded as an essential source of sustained competitive advantage (Von Krogh, 2005; Riege, 2005; Hall and Sapsed, 2005).

Feghali and El-Den (2008, p. 95) argued that "knowledge can be captured socially, through sharing and interactions using "a" technology as a platform or using a cognitive/representational approach. Therefore, it is necessary to provide the appropriate support for groups to capture and transform knowledge where group members are dispersed over time and space".

Knowledge sharing has been defined by Chua (2003, p. 118) as "the process by which individuals collectively and iteratively refine a thought, an idea or a suggestion in the light of experiences". Therefore, knowledge has to be shared within a certain context for its nature to be grasped. Since knowledge is intimately bound up with understanding and is socially embedded in organisational ways, it is not readily followed, traded, or replaced (Chua, 2003). This view is also supported by Effron (2004), who believes that the undeniable and acceptable fact is that knowledge is intrinsic to human beings and is acquired only by sharing and taking part in experience or having contextual perception of that experience.

Knowledge sharing is also defined by Christensen (2007, p. 36) as "being about identifying existing and accessible knowledge, in order to transfer and apply this knowledge to solve specific tasks better, faster and cheaper than they would otherwise have been solved". Connell and Voola (2007, p. 55) argued that "knowledge sharing does not, of course, occur in isolation. Mechanisms need to be in place to assist the sharing of information and ideas between individuals and they need to possess the skills whereby they learn about and from each other." Knowledge sharing allows managers and individuals to continue learning and to combine this in practical and useful applications throughout the organisation (Yang, 2007).

Despite the widespread and growing perception of the advantages of knowledge sharing, the accessibility of knowledge remains restricted because most knowledge remains in the brain of individuals (usually referred to as tacit knowledge) or in repositories or documents (sources of explicit knowledge) not easily available to others (Riege, 2005). Accordingly, it is often thought that sharing tacit knowledge is often difficult because of the loss of its main context (Sanderson, 2001).

2.3.8 Knowledge transfer

Knowledge transfer plays a vital role in the successful application of knowledge management activities and has become a critical element in the competitiveness and success of any organisation (Argote and Ingram, 2000; Sundaresan and Zhang, 2004; Syed-Ikhsan and Rowland, 2004; Fink and Holden, 2005; Narteh, 2008). Therefore, successful technological evolution rests upon the capability to transfer knowledge, ideas, hardware, and skills across many organisational and cultural borders (Ryan, 2004).

Knowledge transfer has been defined by several authors. For example, Wang *et al.* (2004, p. 173) define knowledge transfer as "a process of systematically organised exchange of information and skills between entities". Major and Cordey-Hayes (2000, p. 412) define it as "the conveyance of knowledge from one place, person, ownership, etc to another". Furthermore, Kalling (2003b, p. 116) defines knowledge transfer as "the processes by which members within an organisation learn from each other, without interacting with the environment", while Argote and Ingram (2000, p. 151) see knowledge transfer as "the process through which one unit (e.g. group, department or division) is affected by the experience of another". Transferring knowledge between units and individuals can create important knowledge advantages, and it is agreed by Argote (1999, p. xvii) that it is a "powerful mechanism for improving an organisation's productivity and increasing its survival".

Knowledge transfer needs the willingness of a group or individual to work with the other and share knowledge to their common benefit. This means that knowledge transfer will not happen in an organisation unless its individuals and work teams show a high level of

co-operative manners and behaviours, unless individuals and groups have a regular tendency to co-operate, collaborate and share with each other. Without sharing, it is impracticable for knowledge to be transferred (Goh, 2002; Syed-Ikhsan and Rowland, 2004).

The actual transfer of knowledge within organisations remains a problematic matter for directors and managers (Jacob and Ebrahimpur, 2001). As a result, Canestrino (2004) argues that transferring knowledge among organisations is a challenging and usually misunderstood process. It implies a wide range of various characteristics so that those working on the advancement of the subject of knowledge transfer and international learning process have to think about how the entire characteristics might affect the efficiency of cross-border transfer of organisational knowledge, as well as about the methods they enact.

"The creation and transfer of knowledge in organisations provide a basis for competitive advantage in firms" (Argote and Ingram, 2000, p. 151). Knowledge transfer across global boundaries has been regarded as an essential competitive advantage for organisations looking for success in the international arena (Fink and Holden, 2005). However, Javidan *et al.* (2005) argue that transferring knowledge cross border is a very complicated issue owing to cultural factors and cultural dissimilarity, which can have a great influence, especially on the issue of tacit knowledge, such as management know-how and leadership skills.

Transferring tacit knowledge is different form transferring explicit knowledge; while explicit knowledge can be easily transferred, tacit knowledge is difficult to share and transfer. Bukowitz and Williams (1999, p. 4) contend that "transfer of explicit knowledge is relatively straightforward. Transfer of tacit knowledge can be achieved either by first converting it into explicit knowledge and then sharing it, or by using approaches in which it is never made explicit".

There are many factors that can help to transfer knowledge effectively. Minbaeva (2005) mentions that training, staffing, promotion, compensation and appraisal are expected and required in order to increase knowledge transfer to departments. Moreover, Minbaeva (2005) insists that by using organisational practices that get rid of conventional boundaries, dissolve the bureaucratic structures and support learning, organisations may set up the environment that helps knowledge transfer. Therefore, Smith (2001) believes that valuable knowledge assets are squandered unless management widely and openly accepts and supports efforts to collect, arrange, sort, transform, record and share knowledge.

Knowledge transfer is strongly influenced by the relationship between source and recipient (Albino *et al.*, 2004). The higher grade of knowledge transfer is anticipated when closer relationships between knowledge senders and receivers are set up within both inter- and intra-organisational contexts (Minbaeva, 2005). However, Goh (2002) argues that the kind and nature of the relationship between the source and recipient of knowledge can often be an obstacle to an active knowledge transfer owing to the recipient's lack of motivation, retentive capacity, and absorptive capacity, which can cause weak knowledge transfer.

2.3.8.1 Barriers to knowledge sharing and transfer

Several barriers, such as the national culture, partners' cultural characteristics, potential organisational features, and other informal factors, have an important influence on the knowledge sharing and knowledge transfer process within and among the companies and can also affect the management of technological knowledge flows inside organisations (Boisot, 1999; Malik, 2004; Canestrino, 2004; May, 2005; Finestone and Snyman, 2005; Yih-Tong Sun and Scott, 2005; Moitra and Kumar, 2007).

Culture has been described by Hofstede (1993, p. 81) as "the collective programming of the mind which distinguishes one group or category of people from another". Culture mainly refers to the beliefs and values of the employees within the company as well as the firm in general. Unless a company has a - knowledge sharing - culture, knowledge

management activities and projects are unlikely to succeed (Lam and Chua, 2005). Most cultures, including the Libyan culture, are usually linked to religion, values, ancient beliefs, language, and history. Therefore, Hussain (1998) states that, at the national level, perceptions belonging to a nation's culture, and its beliefs and values help to determine possible barriers.

The dissimilarity of communicational and cultural factors between the supplier and the recipient organisations may create many problems and make the transfer more difficult, because this involves considerable face to face communication among the individuals of these organisations (Marcotte and Niosi, 2000). In addition, Finestone and Snyman (2005) acknowledge that language difficulties can easily result in misunderstanding, hence, language barriers affect knowledge sharing and transfer because individuals will find it difficult to share if they cannot understand at least the main concepts or convey their views in a better manner.

There are several reasons why individuals do not like their knowledge to be shared with fellow workers and colleagues. Some of these reasons have been stated by Drummond-Hay and Saidel (2004) and include the following: there is no motivation and reward or recognition for sharing knowledge, there is no mechanism or vehicle for storing and categorising knowledge, or the available vehicle may be difficult to apply and use, individuals sometimes find it hard to know anyone who would be interested in what they know, particularly in professional services, individuals do not share their knowledge because they are not aware of what they know, and finally, individuals do not like their knowledge to be shared because they are competitive and believe that keeping their knowledge increases their position and power.

Furthermore, Riege (2005), has divided the barriers to sharing knowledge into three potential barriers groups: potential individual barriers; potential organisational barriers; and potential technology barriers.

2.3.8.1.1 Potential individual barriers: A dozen barriers to knowledge sharing at the individual level have been determined by Riege (2005); he summarises these barriers to include: age and gender differences, differences in experience and education levels and differences in national culture or ethnic background, lack of social network, trust in people, trust in the accuracy and credibility of knowledge and general lack of time to share knowledge, weak written/verbal communication skills, application of strong hierarchy and formal power, low realization and awareness of the value of possessed knowledge to other individuals, and apprehension of fear that sharing knowledge might decrease or risk an individual's job security.

2.3.8.1.2 Potential organisational barriers: Yih-Tong Sun and Scott (2005, p. 87) indicate that "the organisational level sources of barriers (i.e. organisational climate, organisational relationships, and systems and structures of the organisation) are primarily bound in the culture of the organisation". The main barriers among potential organisational barriers have been outlined by Riege (2005) and these barriers include: lack of a managerial direction and leadership regarding the values of knowledge sharing practices, lack of motivation system that would motivate individuals to share more of their knowledge, the size of business units is usually not small and, thus, increased sharing is not easily managed, the available corporate culture does not supply enough support for sharing practices, shortage of either formal or informal spaces to share and produce new knowledge, shortage of sufficient infrastructure to back sharing practices, knowledge flows and communication are limited to certain directions, layout of workplaces and physical work environment limit efficient sharing practices, and hierarchical organisation structure decreases most sharing practices.

2.3.8.1.3 Potential technology barriers: According to Riege (2005), the main potential technology barriers include: lack of employees' training regarding new Information Technology (IT) processes and systems, lack of technical support and maintenance of IT systems, lack of integration of processes and IT systems, lack of communication and explanation of all features of any recent systems different from the

available systems, avoiding the use of IT systems owing to lack of experience with them, and the unawareness of the advantages of technology.

2.4 Knowledge management

The discipline of Knowledge Management (KM), which is a dynamic process, has recently emerged as a field of interest in academia, among individual practitioners and in organisational practice and has become one of the most frequently debated subjects in the business literature. KM has progressed from its original conception as one of the most important and inspiring new organisational activities and practices and has very quickly come to mean many different things to different individuals; nowadays, many organisations have experimented with KM initiatives and advantages in order to enhance their achievements and performance (Spender, 1998; McAdam and McCreedy, 1999; McCampbell *et al.*, 1999; Hull, 2000; Bender and Fish, 2000; Mische, 2001; Coakes *et al.*, 2002; Sage and Stanbridge, 2003; Skyrme, 2003; Fuller, 2002; Wong and Aspinwall, 2004; Easterby-Smith and Lyles, 2005; Foss and Mohnke, 2005). "Knowledge management is a discipline that recognizes the importance of knowledge and assists organisations in optimally using the knowledge that is present in the organisation" (Slagter, 2007, p. 82).

KM is the series of procedures that aims to change the organisation's present pattern of knowledge processing to strengthen both it and its results and outcomes. Therefore, the subject of KM is the study of such procedures and processes and their consequences for knowledge and operational processing and outcomes (Firestone and McElroy, 2005). In addition, KM as a subject is designed to present strategy, process, and technology to enhance organisational learning (Satyadas *et al.*, 2001).

2.4.1 Definition of knowledge management

There are already several definitions of KM in the extant literature. However, defining KM accurately can be difficult and contentious. Nowhere in the writing on KM is there one, individual, unified definition of the term (Egbu, 2004).

KM has been defined by Gray (2000, p. 10) as "the organisational process for acquiring, organising, and communicating both tacit and explicit knowledge so that others may use the knowledge to be more effective and productive". Furthermore, Jarrar (2002, p 322) defines it as:

> "The process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and develop new opportunities. It is a systematic process of underpinning, observation, instrumentation, and optimisation of the firm's knowledge economies. Its overall purpose is to maximise the enterprise's knowledge-related effectiveness and returns from its knowledge assets and to renew them constantly."

KM is also defined by Civi (2000, p. 169) as "the acquisition, sharing and use of knowledge within organisations, including learning processes and management information systems". Whereas, Bukowitz and Williams (1999, p. 2) define it as "the process by which the organisation generates wealth from its intellectual or knowledge-based assets". Darroch (2003, p. 41) has also defined KM as "the process that creates or locates knowledge and manages the dissemination and use of knowledge within and between organisations".

KM is a comprehensive and general concept used and applied to most activities organisations perform and carry out. This concept originated to transfer, preserve or exploit knowledge from one side of the organisation to another side (Gamble and Blackwell, 2001). However, Kakabadse *et al.* (2003) believe that there are different disciplines that have affected and informed the field of KM reasoning and praxis, prominent being philosophy, in defining knowledge, and cognitive science (in understanding knowledge employees), as well as social science, management science, information science, knowledge engineering, artificial intelligence and economics.

2.4.2 The significance of knowledge management

Knowledge management is very important for organisations which are keen on gaining competitive advantage. KM is also considered as "an integrated systematic approach for

identifying, managing, and sharing all the information assets of the organisation, including databases, documents, policies and procedures as well as previously unarticulated expertise and experience held by individuals, groups and departments" (Singh *et al.*, 2006, p. 110). Martensson (2000) and Civi (2000) argue that KM is essential for organisations because what worked yesterday may or may not work tomorrow. To stay allied with the dynamically changing requirements of the business world, organisations need continuously to evaluate their internal theories of business in order to increase efficiency. On the other hand, KM helps continuous and in progress processes of learning and unlearning, thus making sure that the requirement for imposing top-down radical change may be reduced. "Knowledge management deals with the production, application, and distribution of knowledge within and between organisations" (Edenius and Styhre, 2006, p. 86). Moreover, Koulopoulos and Frappaolo (1999) add that KM is important because it is the force and strength of collective understanding and knowledge to enhance innovation and responsiveness.

KM is a method of taking an advantage, or transforming knowledge as an asset for organisational use to further constant enhancement (Robinson *et al.*, 2005). It is also "the process for acquiring, sorting, diffusing and implementing both tacit and explicit knowledge inside and outside the organisation's boundaries with the purpose of achieving corporate objectives in the most efficient manner" (Magnier-Watanabe and Senoo, 2008, p. 22).

KM makes an organisational strategy to accomplish an ideal knowledge flow to the appropriate individuals at the exact time. Furthermore, it assists individuals to demonstrate and share knowledge, capabilities and skills in order to enhance organisational work. Therefore, KM involves acquiring and creating knowledge and institutionalizing knowledge-based resources in an organisational formation that paves the way for personnel access to these resources, as well as supporting the constant creation of knowledge (Ordonez de Pablos, 2004).

2.4.3 The objectives of knowledge management

KM has several aims and objectives for organisations. It is stated by Bender and Fish (2000) that KM includes a wide variety of interdependent purposes; these include, the valuation, creation, mapping and indexing, transport, storage, distribution, and sharing of knowledge. Wiig (1997) believes that the main objectives of KM are to make the organisation act as brightly as possible to secure its viability and overall objectives and success, and to realize the best value of its knowledge resources and assets. Furthermore, Sage and Stanbridge (2003) state that KM is aimed at influencing and designing processes of knowledge integration and creation, involving and including processes of knowledge sharing.

Moreover, Gupta *et al.* (2000) and Gamble and Blackwell (2001) add to the aforementioned aims and objectives of KM that it aims to manage, arrange, disseminate and organise a climate in which individuals are willing to share, develop, consolidate and combine knowledge. Furthermore, Wiig (1997) determines the general aim of KM, which is to increase the organisation's knowledge-related effectiveness from its knowledge resources and assets and to renew them continuously.

To strengthen organisational performance is also regarded as an essential purpose of KM; this can be achieved by explicitly implementing tools and designing systems, processes, cultures, and structures to develop and enhance the creation, transfer, sharing utilisation of all types of knowledge that are vital and serious for decision making (De Long and Fahey, 2000). Therefore, Russell Records (2005) points out that KM has access to capturing, finding out, and reusing both the concepts of explicit and tacit knowledge, in addition to technological and cultural methods, to enhance the success of the KM process.

2.4.4 Knowledge management activities

KM includes many activities; these activities cover different areas in organisations, such as, sharing best practices, establishing corporate libraries, building databases, measuring intellectual capital, building intranets, installing groupware, leading training programmes, leading cultural change, fostering collaboration, creating virtual organisations (Malhotra,

2005). "Knowledge management focuses on ways of sharing, storing and maintaining knowledge, as a means of improving efficiency, speed, and competency of individuals within an organisation, and therefore, increasing the profitability, flexibility and adaptability" (Slagter, 2007, p. 84).

Greiner *et al.* (2007, p. 4) summarise that "knowledge management includes all the activities that utilize knowledge to accomplish the organisational objectives in order to face the environmental challenges and stay competitive in the market place". Carrying out KM activities allows firms to learn from corporate memory, share knowledge, and recognize abilities and skills in order to become a leading reasoning and learning organisation (Robinson *et al.*, 2005).

Furthermore, Civi (2000) claims that KM entails determining and investigating the accessibility and necessity of knowledge to individuals or users, and the successive planning and control of actions to enhance knowledge assets so as to achieve the aims of the organisation. In addition, McCampbell *et al.* (1999) believe that KM needs collaborative team support. Software implements and tools are accessible which allow individuals to build communities and become involved in practical teams; enhance, brainstorm, supply and present knowledge; share applications and documents; investigate and analyse; and organise activities.

2.4.5 Barriers to knowledge management

The application of a KM programme in an organisation may face several blockades and barriers that this organisation has to deal with in order to apply this programme successfully and gain its competitive advantage. Apart from organisational culture, which is regarded as the main factor in the success of a KM plan, organisations have to tackle other barriers to avoid any failure in their system. Thus, Robinson *et al.* (2005, p. 439) identify other barriers as including "initiative overload, bureaucracy associated with KM, poor IT infrastructure, lack of top management support, conflicting priorities between KM and other business functions and the difficulties associated with communicating the benefits of KM".

2.5 Knowledge management systems

The concept of Knowledge Management Systems (KMS) has attracted several authors to write about it (e.g. Gray, 2000; Huosong *et al.*, 2003; Leung, *et al.*, 2004; Feng *et al.*, 2004; Xu and Quaddus, 2005; Kudyba, 2005; Blackman and Henderson, 2005; O'Sullivan, 2007; Khalifa *et al.*, 2008). This concept leads to an efficient and an effective knowledge acquisition, creation, storage, and access or transfer (Blackman and Henderson, 2005). However, Leung, *et al.* (2004) claim that maintaining an efficient Knowledge Management System is also a prerequisite to creating and retaining competitive advantage.

KMS usually relates to a set of information systems concerned in dealing with and improving the organisational processes of knowledge creation, storage, recovery, application and transfer (Alavi and Leidner, 2001; Rezgui, 2007). Typical KMS technologies comprise database, groupware, intranet, search engines and other materials (Khalifa *et al.*, 2008). "A knowledge management system is one that allows both tacit un-codified and explicit codified knowledge to be created, stored and shared using technology or other methods" (Harlow, 2008, p. 150).

KMS involves cultural, organisational, and technical issues. In many organisations, presenting these systems entails vital cultural shifts about sharing (Gray, 2000). Olla and Holm (2006, p. 3) have asserted that "any organisation implementing a KM System (KMS) must appreciate that the most critical factor in the success of KM implementation is cultural acceptance". Furthermore, Kudyba (2005) points out that KMS would essentially involve the incorporation of an online collaborative mechanism (e-mail based) that would allow the searcher for knowledge the resources to inquire or ask questions of organisational experts or knowledge sharers.

2.5.1 The purpose of knowledge management systems

KMS is necessary and important for organisations seeking development and competitive advantage. The objective of KMS is "to support creation, transfer, and application of knowledge in organisations" (Alavi and Leidner, 2001, p. 107). It mainly deals with

knowledge and setting up programmes. "KMS is simply a way of allowing employees to access the information they need instantly" (Sasson and Douglas, 2006, p. 81).

Furthermore, Gray (2000) identifies the main purpose of KMS, which is to concentrate on gathering, creating, organising, and disseminating an organisation's knowledge, rather than its information and its data. In addition, Alavi and Leidner (2001) give three main purposes and functions of KMS. Firstly, to construct a knowledge infrastructure, secondly, to proactively search and present knowledge, and finally, to make knowledge visible and show the position and function of knowledge in companies.

2.6 Summary

This chapter has focused on the key concepts and definitions in relation to technology and knowledge activities. Other terms, such as, knowledge creation, sharing, data, information, and other concepts relating to the topic have been examined in order to give a general understanding of the area of research.

This chapter has also looked at the types of knowledge, focusing on tacit and explicit types, indicating their definitions and other relevant aspects. Feghali and El-Den (2008 p. 92-93) summarise both types of knowledge thus: "explicit knowledge is the knowledge in books, files, databases, and others. Tacit knowledge exists in two forms: embodied and not-yet-embodied knowledge. Embodied knowledge is associated with an individual's awareness of his/her know-how, his/her ability to articulate it (verbally or textually) in understandable form to others, and his/her ability to make others master it in an effective way. Embodied knowledge is embodied in the consciousness of the individual and accumulated through expertise, experiences, work practices, and learning by doing. The not-yet embodied knowledge is unconscious knowledge, which lies dormant until articulated in an understandable form because it is based on the individual's perception, mental analysis, instincts, design ability, innovation, and creativity."

The four different ways in which knowledge is converted or developed, as indicated by Nonaka and Takeuchi (1995), has also been illustrated in this study. These ways or

modes can be summarized as: socialization, which means sharing tacit knowledge among individuals; externalization, which refers to how tacit knowledge is made explicit; combination, which relates to the combination of two or more parts of explicit knowledge to form another part of explicit knowledge; and, finally, internalization, which involves transformation of explicit knowledge into tacit knowledge.

Knowledge transfer and sharing have been discussed, showing how these concepts are useful in gaining and increasing an organisation's competitive advantage. Barriers and factors affecting knowledge sharing and transfer were then examined, including culture, which is considered as the main barrier in this regard. Therefore, dealing with different cultures successfully will help in providing a good work environment in which individuals are involved and motivated to increase their performance, to the success of their organization.

This chapter has also looked at technology transfer, indicating its main key concepts and its essential channels, which include: joint ventures; direct foreign investment; franchising; exports, and cross-border movement of personnel; academic conferences on science and technology; cooperative research arrangements and co-production contracts; licensing; sale of turnkey plants; reverse engineering; exchange of scientific and technical personnel; training programmes; subcontracting; exhibitions and trade shows; open literature; government assistance programmes; commercial visits; scientists and laboratories.

KM and KMS are also included in this study, revealing their aims and objectives. KM is very important for organisations and for enabling knowledge to flow. It can be found in any organisation and can successfully influence most of the organisational aspects of any type of organisation, while KMS assists in the creation and transfer operations of knowledge by providing certain tools, strategies and techniques.

Chapter Three

Technology and Knowledge Transfer in Libya

3.1 Introduction

This chapter examines the main activities relating to technology and knowledge transfer in Libya. It is divided into two main sections. The first section deals with the technology and knowledge transferred to various non-oil industries and sectors in the country, such as energy, banking, telecommunications, the Great Man-Made River, and heavy industries, such as cement and iron and steel. The second section is totally devoted to the oil and gas industry in Libya; it gives an overview of this industry, indicating the key international companies engaged in upgrading this important sector. This section also looks at the National Oil Corporation (NOC), which is responsible for the upstream and downstream of the Libyan petroleum industry. Furthermore, it shows some of the joint venture agreements which have been signed between the NOC and the foreign companies involved in the country.

3.2 Technology and knowledge transfer in non-oil economic activities

Libya actively encourages foreign investment in order to obtain modern technology and also to improve certain underdeveloped areas. Therefore, with this in mind, several laws have been passed to help to diversify the country's economy as well as assist its internal markets. In accordance with these laws, foreign investment has been approved in certain sectors and industries in Libya, such as energy, telecommunications, agriculture, service sectors, equipment, tourism, and heavy industries, such as cement and iron and steel (Economist Intelligence Unit, 2006). Hence, technology and knowledge have been transferred to most Libyan industries, and, through various international companies, from different countries in the world. The following section considers some of these transfers in the non-oil sector.

3.2.1 Technology and knowledge transfer in energy (electricity)

Libya is the fourth largest electricity producer in Africa and the second largest power consumer in the continent (Library of Congress - Federal Research Division, 2005). The General Electricity Company of Libya (GECOL) represents the country's electricity utility. It is exclusively responsible for the generation, transportation, and distribution of electrical power throughout the entire country. This company aims to bring state of the art technology and knowledge to improve all its fields of activity: generation, transmission, as well as other vital elements (Annual Report of the General Electricity Company of Libya, 2005).

Libya currently has an electric power production capacity of about 4.6 GW. However, the power demand in the country is expected to continue rising by 6% annually (Power Predictor Report, 2004). Hence, the power sector in Libya requires substantial investment, particularly from foreign companies. According to Thompson (2004), the GECOL is looking to have about 5,550 MW of additional generation capacity by 2010 and 10,000 MW by 2020. Therefore, it has released around US$ 3,500 million, for a 10 year investment scheme, including the building of eight new plants.

The GECOL has awarded many power contracts to international companies in order to develop the country's electrical facilities. For example, the Spanish consortium of Abengoa and Cobra has been offered a contract of about US$ 343 million to install transmission lines and also to construct some substations in order to develop and upgrade Libya's power infrastructure, as well as to connect the country's electricity network (Middle East Economic Digest, 2003a). Moreover, in August 2003 a contract worth an estimated US$ 300 million was awarded to India's Bharat Heavy Electricals Limited (BHEL) for the 625 MW Western Mountain power plant, whereas a US$ 280 million contract was given to Hyundai Engineering & Construction for the expansion of the 800 MW Azzawiya power plant (Middle East Economic Digest, 2004a). The aim of such upgrading and development is to convert the Azzawiya power station, close to Tripoli, to gas and to enlarge its capacity from 660 MW to 810 MW (Economist Intelligence Unit, 2005).

Furthermore, in order to upgrade and modernise Libya's electricity gird, a contract signed by the GECOL worth approximately US$ 240 million was awarded to Germany's Siemens in October 2004, this being the largest order gained by the power systems control business in the Siemens Group. This project aimed to install and supply control centres to serve five regions in Libya (Tabruk, Benghazi, Tripoli, Azzawiya, and Sebha) (George, 2005).

Moreover, two contracts worth about US$ 360 million were awarded to Spanish companies Actividades de Construccion Y Servicios (ACS) and the engineering company Abengoa. The first contract, which was awarded to ACS, was worth about US$ 100 million, and aimed to build a 500 kilometres, high tension 400 kV line from Al-Raweis to Wadi al-Rabia, whereas the second contract, which was worth about US$ 260, was given to Abengoa in order for the company to construct four *400/220 kV* substations (Economic Intelligence Unit, 2004). Moreover, there are also other international companies investing in Libya and bringing new technology to this important sector, such as the Russian company Tekhnopromexport, which has been constructing the 650 MW power plant in western Tripoli (Ford, 2005).

Furthermore, the GECOL signed a contract for the Zuweitina, Sebha and Sarir power plants. This puts in a total of 2,105 MW to Libya's installed capacity. A consortium of South Korea's Hyundia Heavy Industries and the local Global Electrical Services Company (GESCO), which is a joint venture of GECOL and South Africa's Eskom, has signed the contract for engineering, procurement and construction of the largest of the plants. The Sirir plant, whose estimated cost is around US$ 500 million will add a total capacity of 855 MW, using three 285 MW Siemens gas turbines. Regarding the Sebha plant, the GECOL awarded that project for the 750 MW power plant to the consortium of Turkey's Enka Teknik and the GESCO. In addition, the two companies will work together on a 500 MW plant at Zuweitina, with Enka Teknik performing as a subcontractor to GESCO; Enka Teknik will be involved in designing the plant (Middle East Economic Digest, 2007a).

The GECOL also awarded contracts for the 1,400 MW extension to the Tripoli West power plant and the construction of the Al – Khaleej power plant. South Korea's Daewoo Engineering & Construction was awarded the civil work package for Tripoli West, while Hyundai Engineering & Construction of South Korea will carry out the installation of the

steam turbine and undertake the electromechanical work, whereas Doosan Heavy Industries & Construction will provide the boiler, while the responsibility for the offshore work was allocated to Archirodon of Greece. Regarding the Al-Khaleej plant, this project was awarded to Hyundai and Doosan of South Korea, together with Gama of Turkey, which won the civil work, while Geocean of France was awarded the offshore works package (Middle East Economic Digest, 2007b).

The GECOL has been encouraging its personnel in training and development in order to acquire modern knowledge and technology and share these for the improvement of this sector. Therefore, the company has been organising several training courses and programmes, and these courses usually take place either internally or externally (abroad) and are organised by experienced foreign and local organisations. Table 3.1 below shows the number of trainees in the company in 2004 and 2005.

Table: 3. 1 Number of GECOL trainees

2004		2005		Total
Internal	External	Internal	External	
6037	374	6741	608	13760

Source: Annual Report of the General Electricity Company (2005)

3.2.2 Technology and knowledge transfer in telecommunications

Telecommunications in Libya are state-owned, and also run by the state-owned General Post and Telecommunications Company (GPTC), which was established by law No. 16 of 1984. This company controls both mobile and fixed networks, as well as the Internet systems.

The GPTC drew up a plan in 1990 for the upgrading of the country's telecommunications sector. This plan was scheduled to cover the period from 1993 to 2020, taking into consideration certain objectives, such as, the adoption of modern digital technology, applying fully automatic telecommunication services, gaining improved connectivity and services to remote areas, tele-density of 10 per cent by 2000 and 37 per cent by 2020, provision of data transmissions, such as the Internet, and provision of a global system for

mobile communication (GSM) services. Financing for this plan comes from the government fund, foreign investment partners, the GPTC's revenue, and commercial borrowing (Terterov and Wallace, 2002). Table 3.2 shows the budget for the plan of telecommunications from 2000 to 2020.

Table: 3. 2 Telecommunications budget 2000-2020 (US$ million)

	2000-2010	2011-2020	Total
System expenditure			
Subscriber equipment	1,376.71	2,207.79	3,584.50
Cable networks	2,390.57	1,989.07	4,379.64
Exchanges	903.25	1,320.43	2,223.68
Carrier networks	1,497.57	1,085.07	2,582.64
Construction & auxiliary services	1,335.04	1,359.25	2,694.29
Total	7,503.14	7,961.61	15,464.75

Source: Wallace and Wilkinson (2004, p. 173)

Libya is endeavouring to encourage foreign investment for the transfer of state of the art technology in the telecommunications sector. As a result, the country has been carrying out several strategic infrastructure projects in this important industry. These projects have been allocated to several international companies which have wide experience in this field. Most of the infrastructure projects have been taken on by European and South Korean companies. For example, to roll out network coverage of 2.5 G and 3 G services, the GPTC awarded separate contracts worth a total of approximately US$ 220 million to France's Alcatel and Finland's Nokia. Alcatel's contract is worth around US$ 100 million and aims to provide a mobile radio access network which serves GSM/EDGE. This network is intended to cover approximately 75 per cent of Libya, while Nokia's contract is worth almost US$ 120 million, and aims to cover the supply of GSM/EDGE and wireless code division multiple access. This will be available to about 60 per cent of the area around Tripoli and in the western part of Libya (Middle East Economic Digest, 2004c). Therefore, according to the Economist Intelligence Unit (2004), the two networks together aim to supply about 2.5 million new mobile phones.

According to the Economist Intelligence Unit (2007, p. 24) "Libya's mobile-phone market is growing rapidly. Mobile-phone penetration is about 26%, with around 2.3 m mobile –

phone subscribers divided between two brands, Libyanna and al-Madar. In principle, competition exists between the two companies, following the creation of Libyanna in 2004 as a second operator. However, both are ultimately owned by the General Post and Telecommunications Company (GPTC), the state – owned telecoms operator."

Furthermore, in July 2007, Alcatel-Lucent signed a contract with the GPTC to provide Libya with an extensive fibre optic telecommunications network. Under the conditions of this contract, Alcatel-Lucent will install a fibre optic network throughout the country, linking all major cities, with more than 4,400 kilometres of fibre optic cable infrastructure. The GPTC will gain great benefits from Alcatel-Lucent's knowledge and expertise, because the advancement thus achieved will enable the GPTC to offer better products and more effective services as a result of the change of their telecommunications system. The GPTC will also benefit from Alcatel-Lucent's well-known knowledge and experience in turnkey project management, whereby the most efficient products and services are transferred and integrated to effectively transform the network (Alcatel-Lucent, 2007; Engedi, 2007).

There are also other foreign companies which have entered Libya in order to develop its telecommunications industry. For example, Chinese companies have recently found a place in the country. Zhongxing Technologies (ZTE) of China, for instance, was awarded a US$ 42 million contract from the GPTC to construct a new global system for mobile communications (GSM) network covering 46 cities and towns around Libya (Economist Intelligence Unit, 2004). In addition, a contract of about US$ 70 million was signed by the Swedish telecommunications giant Ericsson with the GPTC to provide Al-Madar, the state-owned subsidiary dedicated to mobile telecommunications, with about one million mobile lines, as well as to supply it with GSM technologies, including ancillary support and training (Economist Intelligence Unit, 2006; U.S. & Foreign Commercial Service and U.S. Department of State, 2006).

3.2.3 Technology and knowledge transfer in banking

The banking sector in Libya is made up of the Central Bank of Libya, six state-owned commercial banks (National Commercial Bank, Sahara Bank, Umma Bank, Wahda Bank,

the Libyan Arab Foreign Bank, and Gumhouria Bank), many private banks and many state-owned development banks, and other specialised banks, which have been established to assist in developing certain sectors, such as, the Agricultural Bank, the Industrial Bank, and the Savings and Real Estate Investment Bank (Wallace and Wilkinson, 2004).

Gumhouria Bank, which was established in 1943 as Barclays Bank, before being nationalised in 1971, is the largest bank in Libya as regards assets, having about 83 branches around the country and capital of about 100 million Libyan Dinars (US$ 75 million). Next in size come Wahda Bank, Sahara Bank, Umma Bank and National Commercial Bank. Gumhouria, Umma and National Commercial banks are 100% owned by the Central Bank of Libya, while Wahda and Sahara banks have some degree of private ownership. However, the private banks in the country are still new and the laws and legislation permitting the establishment of private banks were passed only in 1993 (Luxford, 2005a).

Furthermore, there is also the Libyan Arab Foreign Bank, which was established in 1972, and has capital of almost US$ 1 billion. This bank has subsidiaries of affiliates in about 20 countries, including a 30% stake in the Arab Banking Corporation (ABC) Bahrain, a 25% stake in the London-based British Arab Commercial Bank, a 15% stake in Jordan's Housing Bank for Trade and Finance, and a 20% stake in the Suez Canal Bank (Luxford, 2005a).

The General People's Congress of Libya issued Law No. 5 for the year 1997 regarding the Central Bank of Libya. This law concerns the encouragement of foreign capital investment, and its aim is to attract investment of capital in investment projects within the framework of the general policy of the country and its objectives of economic and social development; in particular:

- Transfer of modern technology
- Training of Libyan technical personnel
- Diversification of income resources
- Contribution to the development of national products so as to aid their entry into international markets
- Realisation of local development

This law also regulates the investment of foreign capital brought to Libya in any of the following forms:

- Machinery, equipment, tools, spare parts and the raw materials needed for the investment projects
- Transport means that are not locally available
- Intangible rights, such as patents, licenses, trademarks and commercial names needed for the investment project or operation thereof

Furthermore, several laws have been passed in order to improve the banking system in Libya, and to allow foreign banks to come in and invest in the country in order to bring new technology and knowledge to the banking sector. Law No. 1 of 2005, for example, gives the Central Bank more freedom, and this will lead to improved supervision of banking activities. This law also eases bans on investing domestically and internationally (Luxford, 2005b). In addition, in March 2005, the General People's Congress of Libya approved legislation to allow foreign banks to open branches in Libya for the first time ever (Economist Intelligence Unit, 2005). As a result, many foreign banks have been considering investing in Libya, and banking reform law has raised interest among foreign banks. Therefore, there are now seven foreign banks which run representative offices in the country. These banks include Malta's Bank of Valleta, Italy's UBI, Austria's Bawag, and the Libyan Arab Foreign Bank affiliates: British Arab Commercial Bank (which is 46.5% owned by HSBC), the Housing Bank for Trade and Finance, Suez Canal Bank and ABC (Luxford, 2005b). Moreover, Krebsbach (2005) states that under the new laws other essential foreign player banks want to come and invest in the country, such as the Italian banks, especially Intesa and Monte dei Paschi, as well as the French-based BNP Paribas, Societe Generale, Calyon and Natexis.

As a result of the development in regulations regarding the upgrading and modernisation of the Libyan banking system so that it may be more effective in supporting the investment programme, the Central Bank of Libya has asked several consultants and banks to bid for a contract to present, design, and introduce the latest technology and banking facilities in order to replace the banking applications currently in use by the country's commercial and development banks, as well as by its Central Bank. These plans for upgrading include

development in several systems within the whole, such as, the treasury, retail banking, international payments and trade finance, and these developments are based on electronic transfers and a developed telecommunications network (Business Middle East, 2004). Moreover, the Central Bank of Libya has started to receive technical help from the World Bank in reforming and improving the country's public corporations and civil service (Economist Intelligence Unit, 2004).

Regarding training and knowledge in the banking sector in the country, the Central Bank of Libya has organised several training programmes to train the employees of its subsidiary banks. These training programmes are intended to improve the ability of the employees and to bring in a new knowledge that can be shared for the development of the sector. These programmes are taking place internally and externally (abroad), and organised by several well-known organisations and institutes. For example, the Central Bank of Libya has signed an agreement with the Institute of Banking Studies (IBS), which is based in Amman Jordan, to allow the Banking Training Centre of the Central Bank of Libya to benefit from the facilities and experience of the IBS in all areas of finance and banking. As a part of this agreement, the IBS has organised many training programmes for the Central Bank and other banks in the country. It has also sent several qualified and experienced teams to carry out training courses, and these courses have been attended by about 217 trainees from the Libyan banking sector; also several of the Central Bank of Libya's cadres participated in these training courses (Annual Report of the Institute of Banking Studies, 2005).

3.2.4 Technology and knowledge in the Great Man-Made River Project

With 95 per cent of Libya consisting of desert, water is in short supply in the country for everything from drinking to irrigation. However, there are massive underground basins containing enormous water reserves; these basins were discovered in the desert during the search for new oilfields in the 1950s. Therefore, in order to exploit the water for drinking, as well as for agricultural purposes, the Great Man-Made River Project (GMRP) had to be instigated.

The GMRP is a network of pipelines which brings water from the desert south of Libya to the coast in the north, involving approximately 1,300 wells and about 2,000 miles of pipelines and aqueducts. This is one of the largest water transport projects ever undertaken, it carries more than five million cubic metres of water per day across the desert to the coastal regions, vastly increasing the amount of arable land (Engineering News-Record, 2003).

The main objective in carrying out this project is to make the country a source of agricultural abundance, able to produce enough food and water to supply its own needs and, thus, be self-sufficient. According to the Engineering News-Record (2004), this project will eventually irrigate around 387,000 acres and bring water to many major cities and towns in Libya. The total cost of this massive project is estimated to exceed US$ 27 billion. Started in 1984, it is considered to be the longest running of such projects worldwide, with completion expected some time between 2025 and 2030. The implementation of this giant project is in four essential phases. Wallace and Wilkinson (2004) summarise these phases as follows:

3.2.4.1 Phase 1

This phase, designed to convey about 2 million cubic metres of water per day, included the constructing and operating of pipe plants, with all the essential aggregate production. This phase was completed in September 1993, and its total cost was about US$ 5.2 billion. The contract was given to Dong Ah Consortium from South Korea as contractor, and to Brown & Root of Houston, Texas, as consultant for this phase (Wallace and Wilkinson (2004).

3.2.4.2 Phase 2

This phase was designed to transport around 2.5 million cubic metres of water per day. The total cost of this phase was almost US$ 7.4 billion, and the contract was awarded to the same group as in phase 1. However, the consultancy work was carried out by Brown & Root's UK branch. Both phases 1 and 2 are now providing potable water to Tripoli and Benghazi cities as well as to the towns close to the pipeline routes (Wallace and Wilkinson (2004).

Phases 1 and 2 are frequently being developed. The Great Man-Made River Authority (GMRA) has been carrying out all the maintenance works for these two stages in association with other foreign parties. This authority awarded a joint venture contract worth an estimated US$ 130 – 140 million to Oztas from Turkey and to the local North General Contracting Company for the design and construction of a water conveyance system of about 116 kilometres of pipeline, which is an extension of phase 1 between Abu Ziyyan and Al-Ruhaybat, close to Tripoli (Thompson, 2005a).

3.2.4.3 Phase 3

This phase cost approximately US$ 6 billion, and it was carried out almost entirely by Libyan staff after being well-trained by foreign partners internally and abroad. This phase involved construction of a pipeline of about 390 kilometres between Sedada and Sirte, linking phases 1 and 2 (Wallace and Wilkinson, 2004). However, according to the Middle East Economic Digest (2003b), the consultancy work for this phase was carried out by the UK arm of Japan's Nippon Koei.

3.2.4.4 Phase 4

The final phase of this project is made up of two water supply systems. The first system was designed to convey drinking water from Ghadames in the south-west of Libya to more than 1.25 million residents in Zawara and Azzawiya in the north and to other towns near the route of the pipeline, which is about 700 kilometres long, while the second system takes water from Al-Jaghboub in the south-eastern to Tobruk and other northern towns (around 500 kilometres) (Wallace and Wilkinson, 2004). According to the Middle East Economic Digest (2004b), the local company Al-Nahr formed a 75:25 joint venture between Tripoli and the South Korean company Dong Ah, and won a contract of about US$ 950 million to carry out the fourth phase.

There are several foreign companies working for this project, particularly on phases 3 and 4. For example, Canada's SNC Lavalin was awarded a contract of about US$ 1,100 million. This contract is to supply pipes in phase 3, and also grants a four year extension to operate the concrete pipe manufacturing plant at Sarir city, as well as to supply pipes for a pipeline of approximately 383 kilometres which runs from Kufra wellfield to Sarir in

south-east Libya. Moreover, the UK-based Brown & Root North Africa was awarded a four-year project management consultancy to supervise the construction of the project's phase 4 (Thompson, 2005a, Economist Intelligence Unit, 2005).

Furthermore, there are other foreign companies which have been awarded contracts to participate in the constructing of this enormous project. For example, EB Engineering of Norway was awarded a contract of around US$ 75 million to design and install a permanent communication and control system. Moreover, a contract of about US$ 65 million was awarded to Enka and one of almost US$ 85 million to STFA (both Turkish contractors) to construct end reservoirs at Benghazi and Sirte. In addition, a contract worth around US$ 65 million was given to Japan's C Itoh and a consortium of Dong Ah of South Korea for the design and building of a 90 megawatt gas turbine power plant at Sarir in the south. In addition, there are numerous other contractors associated with the GMRA, such as, Marubeni, Ameron, Siemens, Price Brothers and Nippon Koei UK (Wallace and Wilkinson, 2004).

Moreover, in relation to the end-use of water supplied, the GMRA awarded two main contracts. The first went to Brown and Root North Africa, a UK-based company of US origin. This one-year contract was to manage the completion of the largest reservoir on the GMRP, which supplies water for agriculture in the region of Benghazi in the east. The second contract was awarded as a joint venture between two Indonesian companies, Citra Megah Karya Gemilang and Inti Karya Persada Tehnik. The aim of this contract was to design, supply and build five 86,000 cu. metre water storage tanks (Economist Intelligence Unit, 2005)

3.2.5 Technology and knowledge transfer in the cement industry

Libya is still in need of cement, owing to its high consumption by the local construction market and the GMRP, which alone takes about 2,500 tonnes of cement a day from the state-owned Arab Cement Company for pipe manufacturing. Libya now has seven cement plants. The Libyan government was allocated about US$ 1,587 million in 2004 to build about 200,000 – 250,000 homes by 2014, at an average of about 35,000 – 40,000 annually. This strategy requires international investment plus good calibre knowledge and

technology in order to succeed, and this can also attract international contractors (Thompson, 2005b).

The Libyan cement industry has been running at about 50% capacity. This percentage does not meet the current demand for cement, which is about 5 million tonnes per year, but further demand to go up to 8.5 million tonnes per year by 2010 has been agreed. Therefore, the country finds itself unable to supply market demands, because the capacity of all the seven available plants is struggling to reach 6.3 million tonnes per year (Economist Intelligence Unit, 2005).

Furthermore, this scheme has impelled the country to think about developing and modernising cement company facilities, and building new plants in order to accommodate the demands of the Libyan market. According to the Economist Intelligence Unit (2002), a contract of about US$ 156 million to build a plant in Zliten for Libya's state-owned Arab Union Cement Company was awarded to Denmark-based FL Smidth, a subsidiary of FLS Industries. As part of this contract, FL Smidth is responsible for providing and installing equipment and for the building of the plant as well as for organising training programmes for the Libyan personnel. In addition, in order to tackle the major shortages of cement the country faces, Libya has attempted to reform this sector by encouraging foreign expertise to enter the country and help improve this industry.

The state-owned cement producer, the Libyan Cement Company has been looking for foreign investment and also carried out several meetings with many international investors regarding strategic stake and sale (Middle East Economic Digest, 2005). In addition, Mobbs (2001) confirms that the Libyan government proposed a number of state company projects for which joint ventures would be considered. These included an expansion of the Arab Cement Co. at Libda cement plant (US$ 242 million) as well as an expansion of the Libyan Cement Co. at Fataih cement plant (US$ 166 million).

3.2.6 Technology and knowledge transfer in iron and steel

Encouraging the development of heavy industry has become a high priority for Libya. Apart from looking at the oil and gas industries, the country has looked at other sectors which could be improved through the acquisition of state of the art technology and

knowledge. The iron and steel industry is one of the key heavy industry sectors to which most attention has been paid.

The site of iron ore deposits at Wadi ash Shati in Libya, about 65 kilometres north of Sebha, is apparently one of the largest in the world. It is estimated to contain around 1.6 billion metric tons of oolitic hematite, limonite, chamosite, and siderite with a grade range of 30% to 40% iron. Development of the deposits would allow Libya self-sufficiency in iron and steel (Mobbs, 2000).

The state-owned Libyan Iron and Steel Company (LISCO), which was formed to exploit the deposits, is responsible for manufacturing steel in Libya. This company is located near the city of Misurata on the coast of Libya, which is about 200 kilometres east of Tripoli. The Misurata complex is owned by the LISCO and has been constructed by several foreign firms, including Austria's Voest-Alpine, Kobe Steel of Japan and Germany's Krupp Hoesch Stahl. This complex started production in 1988 (Economist Intelligence Unit, 2002).

This complex is designed to produce about 1,324,000 tons of liquid steel annually. The complex is made up of a direct reduction plant, two steel melt shops, a three-line bar and rod mill, a light and medium section mill, a hot strip mill and a cold strip mill with a galvanizing line and a coating line. In the last ten years, the LISCO's products have met most of the country's needs for rolled steel. Therefore, the LISCO's products have entered foreign markets, and this company has started to export its products to such diverse countries as Egypt, Italy, Tunisia, Spain, Morocco, France, Qatar, Greece and Turkey, as well as to other countries (Annual Report of the Libyan Iron and Steel Company, 2005). Table 3.3 indicates the international sales of steel.

Table: 3. 3 International sales of steel

Qty in MT

Product Type	2001	2002	2003	2004	2005	2006
Hot Briquetted Iron (HBI)	325,933	369,711	339,434	476,675	427,785	384,435
Bars and Rods	150,815	119,854	71,804	19,935	--	--
Sections	11,306	9,985	10,428	20,437	10,542	25,310
Hot Rolled Coils & Sheets	270,744	350,395	286,048	257,123	337,464	438,831
Pickled Coils	18,857	4,704	1,294	2,570	--	1,214
Cold Rolled Coils & Sheets	2,569	--	1,706	271	124	--
Galvanized Coils & Sheets	2,177	1,848	7,387	2,778	772	--

Source: Annual Report of the Libyan Iron and Steel Company (2006)

The LISCO has signed several agreements with many experienced foreign companies. These agreements aim to develop and bring in new technology to LISCO, as well as to train local personnel. In October 2003, the LISCO and Global Infrastructure Holdings Ltd (GIHL), the holding company of ISPAT industries Ltd. of India, completed the signing of a partnership agreement concerning technical assistance. This agreement was aimed at developing value added steel products and improving activities and procedures, as well as implementing modern management techniques in order to reduce production costs. Moreover, this partnership allows GIHL to contribute to process and equipment improvement, as well as the training of the LISCO's workforce. In addition, the LISCO has signed several contracts with a number of foreign partners. For example, a contract in 2002 was signed with the Italian company Techint for the extension of pickling line in order to raise line production capacity from 157,000 to 300,000 tons annually (Annual Report of the Libyan Iron and Steel Company, 2005).

Furthermore, a contract was signed in 2004 with the Austrian Company Vai Pomini and the Italian Company Techint for enlargement of current plant capacity to 1.1 million tonnes annually of liquid steel, in order to supply the need at long rolling mills and export excess billets (Annual Report of the Libyan Iron and Steel Company, 2005).

3.3 Technology and knowledge transfer in oil and gas activities

The economy of Libya relies mainly upon revenues from the oil industry, which contribute almost all the export earnings and around one quarter of the country's GDP (Ghattour, 2004). Oil exploration efforts in Libya started in 1953 with the issuing of the essential Petroleum Law No. 25 of the same year, which was amended in 1961, then in 1965, and later in 1971. In 1959 the first fields of oil (at Amal and Zelten, now known as Nasser) were discovered, and the exports of oil started in 1961 (Wallace and Wilkinson, 2004).

Libya is currently the second biggest oil producer in the African continent and one of Europe's largest North African oil providers (Terterov and Wallace, 2002). The majority of Libyan oil is exported to European countries. Italy remains the largest importing country, with 562,000 barrels per day (bbl/d) in January – October 2005, Germany follows (285,000 bbl/d), then France (101,000 bbl/d) (Energy Information Administration, 2006). Table 3.4 shows the production and export of crude oil:

Table: 3. 4 Production and export of crude oil

Per million barrels

Years	Production		Exports	
	Daily average	Total	Daily average	Total
1998	1.507	550.9	1.154	421.3
1999	1.445	527.7	1.069	390.3
2000	1.420	519.8	1.036	379.2
2001	1.416	516.8	1.053	384.3
2002	1.297	476.5	0.941	343.6
2003	1.534	560.0	1.184	432.3
2004	1.615	591.3	1.256	459.9
2205	1.693	618.0	1.336	487.5
2006	1.761	642.8	1.423	519.3
2007	1.791	653.8	1.471	536.8

Source: Annual Report of Central Bank of Libya (2007)

The Libyan oil industry is controlled by the state-owned National Oil Corporation (NOC), which is responsible for the upstream and downstream of the country's petroleum industry. There are several domestic oil companies, which together constitute around half of Libya's oil production. In addition, the country has been very keen to attract foreign oil companies to invest in Libya in order to increase the country's oil production capacity from 1.6 million barrels per day to 2 million barrels per day by 2008-2010 and 3 million barrels per day by 2015. Therefore, Libya has been looking for an investment of about US$ 30 billion to cover the period so that this target can be accomplished. As a result, many foreign oil companies are engaged with the NOC in forming production and exploration agreements (Africa Energy, 2005; Energy Information Administration, 2006).

Foreign technology and knowledge is always required in Libya in order to develop and upgrade the infrastructure of the oil and gas industry in the country. There are also other reasons for seeking foreign investment. For example, Townsend (2001) mentions that some of these reasons include boosting crude production capacity through an expansion strategy which is targeted at the following: using modern technology and knowledge in exploration work and concentrating investment efforts towards the unexplored regions, such as Cyrenaica, Kufra and remote areas and basin margins.

Foreign investment in the oil sector in Libya is only approved for certain activities. The activities allowed cover areas such as exploration and survey of land, drilling and maintenance of wells, examination and analysis of data and geological studies, cementation work and design, installation and maintenance of oil and gas pipes, installation of tanks and pumping stations, installation of sea platforms, installation and maintenance of drilling equipment and plunge pumps, installation and maintenance of safety systems, mud servicing (Ghattour, 2004).

3.3.1 Libyan oil reserves

Libya is estimated to own the largest known oil reserve potential in Africa (Javan and Bahar, 2000), followed by Nigeria and Algeria (see Table 3.5). Libya's total proven oil reserve, as of January 2007, was around 41.5 billion barrels, up from 39.1 billion barrels in 2006 (Energy Information Administration, 2007). The country is capable of producing even more, but it requires modern technology and the latest knowledge, as well as the

capital resources from international oil companies, to carry out this task. Nearly 80 per cent of Libya's reserves were discovered prior to 1970 (Rusk, 2001).

Table: 3. 5 Top 5 African proven oil reserve holders, 2007 (billion barrels)

Libya	Nigeria	Algeria	Angola	Sudan
41.5	36.2	12.3	8.0	5.0

Source: Energy Information Administration (2007)

Libya has 12 main oilfields with reserves of about 1 billion barrels each, and two with reserves of around 500 million to 1 billion barrels. However, the country is still largely unexplored and offers tremendous opportunities for more oil discoveries (Energy Information Administration, 2005). Table 3.6 indicates the recoverable reserves of the major Libyan oilfields:

Table: 3. 6 Recoverable reserves of major Libyan oilfields (million barrels)

Field	Date of Discovery	Reserves (mb)
Baha	1958	600
Dahra/Hofra	1958	700
Amal	1959	4,250
Nasser (Zelten)	1959	2,200
Waha	1959	1,200
Beda	1959	900
Mabruk	1959	385
Defa	1960	1,800
Sarir "C"	1961	3,650
Gialo	1961	4,000
Raguba	1961	1,000
Samah	1961	500
Sarir "L"	1964	1,080
Nafoora/Augila	1965	1,500
Intisar "D"	1967	1,200
Intisar "A"	1967	750
Bu Attifel	1968	1,000
Mesla	1971	1,500
Bouri	1977	670
Murzuk	1984	750
Elephant	1997	1,000

Source: Horsnell (2000, p. 64)

Oil discovery and exploration activities in Libya initially started in 1958; in this year, the number of discovery groups increased to around 80. Esso oil company was the first oil company to discover oil in the country, that was in January 1958 at El-Atshan oil well but the quantity was small. In 1959, for the first time the same company discovered oil in greater quantity which could be used for commercial purposes and this was from Zelten oil well (Jahangir, 1982). Table 3.7 presents a summary of the first oil discovery activities during 1958-1959:

Table: 3. 7 Summary of the first oil activities during 1958-1959

Name of Company	Field name	Completion date	Production (b/d)	Depth/m
Esso Standard	El-Atshan	20 January 1958	508	2200
Oasis	El-Bahi	27 January 1958	500	5840
C.P.T.L.	Oued Tahara	26 December 1958	100	4580
Oasis	Dahra	30 April 1959	1061	3200
Esso Standard	Zelten	13 January 1959	17500	5500
Esso Sirte	Mabruk	30 July 1959	500	5700
Gulf	Emgaget	07 September 1959	888	4100
Amoseas	Beida	26 September 1959	3650	4000
Shell	Bir Tlacsin	30 October 1959	700	8900
Mobil	Amal	01 November 1959	990	9900
Oasis	Dahra B.	14 November 1959	36	2800
Oasis	Waha	27 December 1959	226	1500

Source: Farley (1971, p. 123)

Furthermore, revenues from Libyan oil exports have gone up dramatically in recent years: to US$ 28.3 billion in 2005, up from only US$ 5.9 billion in 1998 (Africa Energy, 2005; Energy Information Administration, 2006). Eni-Agip, Wintershall, Petro-Canada- Veba, OMV, Total, and Repsol are the main international companies producing oil in the country. Of these, Eni (formerly Agip) is the leader, producing about 180,000 barrels per day, next comes Repsol, with around 158,000 barrels per day, Wintershall, with approximately 105,000 barrels per day, and then Veba, with about 82,000 barrels per day. The entire production of the international oil companies in Libya is around 500,000 barrels per day, corresponding to about 38 % of the entire production, whereas the NOC and its subsidiary companies Waha Oil Company (Waha), Arabian Oil Company, Zuweitina Oil Company, and Sirte Oil Company (Sirte), produced around 800, 000 barrels per day about 62 % of Libya's oil production (Wallace and Wilkinson, 2004). Table 3.8 presents the production of crude oil (2000-2007) by operating groups:

Table: 3. 8 Production of crude oil by operating groups

Per million barrels

Operating Groups	Years								NOC %
	2000	2001	2002	2003	2004	2005	2006	2007	
Eni Oil	64.6	65.4	62.8	65.2	70.0	75.2	104.5	108.4	62.5
Arabian Gulf	144.3	136.8	134.0	158.1	152.3	159.6	159.3	158.8	100.0
Sitre	40.5	42.1	38.3	40.5	39.5	38.5	36.7	35.1	100.0
Veba	32.7	32.6	31.0	36.5	36.5	35.5	35.4	34.5	51.0
Waha	108.2	107.2	79.4	114.8	134.6	129.8	124.2	127.2	51.0
Zuweitina	25.4	26.0	23.1	22.0	21.3	22.0	21.8	20.2	66.0
Wintershall	39.0	39.9	38.3	41.1	40.3	41.9	40.7	41.8	51.0
Total	6.4	6.5	6.7	7.8	16.9	18.4	18.4	20.7	80.0
O.M.V	0.6	0.6	0.5	0.4	0.3	0.3	0.3	0.3	65.0
Repsol	58.1	59.7	59.4	73.6	77.0	88.0	93.3	99.9	75.0
Eni Gas	–	–	–	–	2.6	8.8	8.2	6.9	50.0
Total	**519.8**	**516.8**	**473.5**	**560.0**	**591.3**	**618.0**	**642.8**	**653.8**	

Source: Annual Report of the National Oil Corporation (2005) & Annual Report of the Central Bank of Libya (2007)

3.3.2 Gas industry

Gas in Libya was discovered in the late 1950s at El-Atshan field in the south-west of the country. The main fields producing gas include Defa-Waha, Hatiba, Zelten, Sahl, and Attahadi. The country has substantial natural gas reserves. According to some studies, which were carried out by the NOC and its foreign partners, the Libyan basins contain potential gas reserves of about 115 trillion cubic feet. These are mainly in the deep horizons of Ghadames, Murzuq, Cyrenaica Platform, offshore and the Sirte Basin. The unproven reserves of gas in Libya are estimated to be as much as double the proven reserves (Townsend, 2001; Middle East Economic Digest, 2005a). Furthermore, in December 2000, the NOC confirmed that a new discovery of about 472 billion cubic feet had been declared in its Sirte gas and oil unit north-west of the El-Sumud gas field, and that around 293 billion cubic feet of gas was recoverable from the field (Townsend, 2001). Table 3.9 indicates the production and exports of gas and petrochemicals in Libya:

Table: 3. 9 Production and exports of gas and petrochemicals

Production and Exports	2003	2004	2005	2006	2007
Gas produced (in billions of cubic feet):	493.4	527.1	765.4	948.1	1024.4
Used	365.1	379.2	415.4	410.3	405.1
Flared	128.3	147.9	350.0	537.8	619.3
Petrochemical exports (000, M. T):	2326.1	2039.9	2131.3	2395.4	2308.7
Methanol	659.0	600.0	594.5	640.6	617.6
Ammonia	196.3	137.6	128.8	135.0	179.5
Urea	775.0	758.0	701.8	777.6	663.1
Etheeline	140.0	91.0	140.4	150.0	121.0
Broobline	167.9	136.1	167.4	188.9	167.5
Mixed of fourth carbon	83.9	95.8	127.2	123.1	120.9
Polyethylene	99.3	74.4	69.3	155.3	78.7
Heat gasoline	204.7	147.0	201.9	264.9	232.0
Sulphur	–	–	–	–	128.4

Source: Annual Report of the Central Bank of Libya (2007)

The gas industry in Libya requires substantial development and upgrading, owing to the sanctions imposed on the country by the United Nations (UN) in 1992. Many gas facilities have faced upgrading problems. For example, the liquefied petroleum gas plant which was built by Esso has been operating for many years at half-capacity, owing to technical problems (U.S. & Foreign Commercial Service and U.S. Department of State, 2006). However, when sanctions were lifted in 2003, Libya invited international oil companies to bring their modern technology and knowledge and invest them in the country in order to modernise its oil and gas sector. As a result, several foreign companies have found their place in the country and won substantial contracts from the NOC. According to the Energy Information Administration (2006), recent entrant to the Libyan market has been the giant

Royal Dutch/ Shell, which signed a contract with the NOC to upgrade Libyan oil and gas resources, including liquefied petroleum gas export facilities, and build a new liquefied petroleum gas export facility. In addition, other foreign companies are contributing greatly to developing and modernising the country's gas facilities; for example, Repsol, which has been working on upgrading the country's liquefied petroleum gas export potential.

Furthermore, a partnership agreement was signed between British Petroleum (BP) and the NOC. In accordance with this agreement, BP will invest at least US$ 900 million in exploration in one deep-water offshore area in the Gulf of Sirte, and in two onshore areas in Ghadames. The company (BP) will also take the development of the local workforce into consideration, and will spend about US$ 50 million on training and education projects during the exploration and appraisal phase, which aims at upgrading the training process and utilizing international expertise regarding data transfer technology in the fields of exploration and production in order to develop local individuals' expertise and skills in these fields (Economist Intelligence Unit, 2007).

Libya's first gas export plan is the Mediterranean's most ambitious, the country favoured gas exports to Europe through a sub-sea pipeline. The NOC and its partner, Italy's Eni Gas, have been investing over US$ 6 billion in upgrading the Bahr Essalam field, 110 kilometres offshore from the capital (Tripoli) and the Wafa field, south-west of Tripoli (Beckman, 2005). The two fields, hold recoverable reserves of roughly 1,750 million boe, and will have a target production of about 240,000 boe/day, around 10 billion cubic metres/ year of natural gas, 8 billion of them reaching European markets via the underwater Greenstream gasline, 520 kilometres long and linking Mellitah on the Libyan coast to Gela in Sicily, Italy (Annual Report of Eni, 2004).

Furthermore, a 50:50 joint venture consisting of the NCO and the Entreprise Tunisienne d'Activites Petrolieres "ETAP" (Tunisian State Oil Company) has been set up. The main activity of this venture is to link Mellitah in Libya to Gabes in Tunisia by a gas pipeline about 285 kilometres in length. The budget of this project was estimated at US$ 250 million (US$ 100 million for the procurement of pipeline; US$ 80 million for gas turbines & compressors, and US$ 70 million for pipe construction). The UK's Penspen International is responsible for project management, while the design and engineering was carried out by France's Sofregaz (Middle East Economic Digest, 2006d).

3.3.3 Oil refineries

Libya has a total of five main oil refineries, with a total capacity of about 380,000 barrels per day. Therefore, Libya is considered as the third largest country in the refining industry in North Africa (Townsend, 2001). Two of the refineries are large, these are located at Ras Lanuf (in the Sirte Gulf), and Zawia (55 kilometres west of Tripoli). The other three, which are relatively small refineries, are located at Sarir, Marsa El-Brega and Tobruk. Table 3.10 shows these refineries, including their capacity, as well as their start-up date:

Table: 3. 10 Refineries and refining capacity of Libya

Refinery	Capacity	Start-up
Ras Lanuf	220,000	1965
Azzawiya	120,000	1974
Tobruk	20,000	1986
Sarir	10,000	1989
Marsa El-Brega	10,000	1965
Total	380,000	

Source: Wallace and Wilkinson (2004, p. 135).

Owing to sanctions, the country's refineries have suffered from a shortage of modern technology, as most of these refineries were opened in the early 1980s or late 1970s. As a result, the country has needed a quick and immediate expansion and modernisation of the infrastructure of the available refineries since sanctions have been lifted (Townsend, 2001). The NOC is aware of the fact that the infrastructure of the oil industry in Libya requires substantial investment to modernise and improve it. According to Mr Ghanem, the Chairman of NOC, Libya's petrochemicals plants, refineries and fertiliser plants were in dire need of refurbishment and it was judged that the most urgent up-dating of the country's downstream infrastructure would demand substantial investment of up to US$ 9 bn (Economist Intelligence Unit, 2007).

The NOC has been studying a proposal to build a new refinery at Sebha, about 700 kilometres south of the capital Tripoli; this refinery will be built near Murzuq oil and Wafa gasfields. It is estimated that this building project will cost around US$ 150 million and the

refinery constructed will produce about 20,000 barrels per day of liquefied petroleum gas, heavy fuel oil, kerosene, diesel and gasoline (Middle East Economic Digest, 2005b).

The state-owned Azzawiya refining company has been involved in several development activities. For example, in 2002, the NOC signed a contract worth about US$ 280 million with South Korea's LG Petrochemicals in order to develop and upgrade the refinery (U.S. & Foreign Commercial Service and U.S. Department of State, 2006). This company has also been seeking for the expansion and upgrading of its refinery's facilities. This expansion will raise the available refining capacity from 120,000 barrels per day to about 215,000 barrels per day (Ford, 2005a). Therefore, a contract for construction, engineering and procurement estimated at around US$ 350 million to US$ 400 million will be offered. This contract includes the installation of a new continuous catalytic reformer unit, naphtha and gas/oil hydrotreaters and an isomerisation unit, as well as infrastructure development. The naphtha hydrotreater and light naphtha isomerisation unit will utilise technology from France's Institut Francais du Petrole. The sulphur recovery plant will use technology from Lurgi of Germany (Middle East Economic Digest, 2006a).

Furthermore, Azzawiya refining company has awarded a four year project management consultancy contract to the COWI of Denmark to carry out the construction management and engineering design of a new fully-protected port at Azzawiya. This contract includes development of new port plans, design of new breakwaters, a jetty with three berthing points, two piers, each with one berthing point, port infrastructure, including buildings and roads, multiproduct pipelines, and fire-fighting facilities and treatment facilities in the port area. This project is linked to the planned expansion and development of Azzawiya refinery (Middle East Economic Digest, 2006b).

On the other hand, the NOC has been working to spend around US$1.900 million to develop Ras Lanuf refinery. This development project includes adding butadiene, butane-1, methyl ether, tert-amyl methyl ether and iso-octane units to the available petrochemicals complex at Ras Lanuf (Middle East Economic Digest, 2005b).

Furthermore, Libya has been upgrading its petrochemicals industry, which includes ammonia, urea and methanol production from the Marsa El-Brega petrochemicals complex, as well as planning to expand and develop petrochemicals production at Ras

Lanuf (Thompson, 2005c). According to the Middle East Economic Digest (2007d), the NOC has signed two joint venture contracts with foreign investors in order to upgrade and develop Libya's petrochemicals facilities. The first venture contract was signed with Yara International of Norway, which will refurbish a fertiliser plant at Marsa El-Brega. This plant was built in the late 1970s, and produces around 700, 000 tonnes a year of amomonia and about 900,000 tonnes a year of urea. The second venture contract was signed with Dow Chemical Company of the USA in order to upgrade and develop the petrochemicals facility at Ras Lanuf, assisting it to meet its target of becoming a world-class supplier of polyethylene and polypropylene. This joint venture will also modernise the complex, which is made up of a naphtha cracker plant, an ethylene plant and polyethylene plants, and produces approximately 220,000 barrels a day.

3.3.4 National Oil Corporation (NOC)

The NOC was established on 12 November 1970, under the Law No. 24/1970. It was later recognised by decision No. 10/1979 of the General Secretariat of the General People's Congress, to begin carrying out the objectives of the development system in the areas of oil and gas industry. The NOC is backing the national economy via increasing, upgrading, developing and exploiting the oil reserves, as well as operating and investing in those reserves. The NOC has been engaging in several investment plans in order to fund its activities, including joint ventures and participation agreements with other foreign companies and corporations undertaking similar operations (Annual Report of the National Oil Corporation, 2004).

The NOC is a state-owned incorporated company involved mainly in the oil and gas industry. Its main activities range from refinement, production, transportation and exploration of crude oil and natural gas to oil services, as well as signing contracts and agreements with foreign oil and gas companies. It also controls Libya's oil, and is responsible for the entire upstream and downstream of the Libyan petroleum industry. The NOC has several subsidiary companies, such as the ***Waha Oil Company***, which conducts exploration, as well as production of oil and gas, the ***Sirte Oil Company***, which carries out the exploration and processing of oil and gas, as well as production operations, and the ***Zueitina Oil Companies*** and the ***Arabian Gulf Oil Company***, which latter both operate in

the drilling and pumping of crude oil from wells, as well as carrying out the exploration and production process (Datamonitor, 2005).

Furthermore, the NOC carries out its functions as laid down in the laws and regulations governing the establishment via its wholly owned companies, which differ in activity: from operating and producing companies, to refining, processing and local/ global marketing companies, to various service companies. Additionally, the NOC fulfils some of its duties via joint ventures with foreign production, exploration and specialised oil service companies. Furthermore, the NOC manages and supervises, via its specialised companies, a number of refineries, petrochemical plants, and their connected units and facilities (Oleynik *et al.*, 2005). Table 3.11 shows all the NOC affiliated companies:

Table: 3. 11 The National Oil Corporation and its affiliated companies

Companies 100% Owned by NOC	Joint Ventures and Participation Companies with NOC
- Arabian Gulf Oil Company - Sirte Oil Co. for Production & Processing of Oil and Gas - Zuetina Oil company - Waha Oil Company - Zawia Oil Refinery - Ras Lanuf Oil and Gas Processing Company - Brega Petroleum Marketing Company - National Drilling Company - Jowfe Oil Technology Company - Hamada Pipeline Company - National Oil fields and Terminals Catering Co. - Umm Al Jawaby- London - Med Oil Dusseldorf	- Eni Oil Company - Veba Oil Operations Company - Repsol Oil Operations Company - -OMV Exploration & Production Co. - Lasmo Grand Magber Ltd. Company - Eni Gas Company - International Petroleum Libya Ltd. Company - Total/ Fina/ Flf Company - Wintershall AG Company (Concession Holder)
Companies with Exploration and Production Sharing Agreements	**Research and Development**
- Agip North Africa B.V Company - Repsol Exploration Company - Veba Exploration Co. - Total/ Fine/ Elf Company (Exploration) - Turkish Petroleum Company - REMSA Group (Repsol/ Total/ Elf/ OMV)	- Petroleum Research Centre - Petroleum Training and Qualifying Institute - Petroleum Training Centre

Source: Annual Report of the National Oil Corporation (2004)

3.3.5 Joint ventures in the oil industry

Joint venture is defined by Lee and Carter (2005, p. 173) as "an arrangement where a firm is required to share equity and control of a venture with a partner from the host country". Joint ventures in the oil industry are always required in the Libyan oil sector. The NOC seeks to form joint ventures with foreign oil partners to operate the country's oilfields as well as to gain considerable knowledge, know-how, and technology.

The joint venture agreements in Libya usually require the international oil company to fund all exploration operations. However, the NOC has the right to contribute to funding the development cost and bearing its share of the operating cost, in proportion to its share of joint venture, in the case of discovery of commercial quantities. The international company will also be entitled to repayment of part of the exploration cost (Townsend, 2001).

The NOC encourages foreign companies to invest in Libya via joint ventures. This method can bring to the country the much-needed technology, knowledge, and other advantages, which can help in modernising the country's oil and gas infrastructure. The essential condition for companies interested in forming a joint venture with the NOC is that the majority of the company's board of directors, as well as its director, must be Libyan citizens (U.S. & Foreign Commercial Service and U.S. Department of State, 2006).

Certain joint venture agreements may be termed 'negotiated nationalisation': the NOC became a 50% partner of the existing concession and concluded joint venture agreements on new areas whereby it shared both financial burdens and benefits equally. The NOC would participate in the management via equal numbers of members on the management committee (Townsend, 2001)

There are several responsibilities under Libyan petroleum law for sharing the benefits of doing business in the oil industry between the NCO and the foreign oil companies. These responsibilities obligate mainly the international companies to adhere to certain rules, such as to perform all petroleum operations in conformity with the rules set out in Regulation No. 8 of the Libyan Petroleum Law regarding safety measures and conservation of petroleum resources and in compliance with sound and reasonable standards; to fulfil the requirements of Regulation No. 9, dealing with the financial, administrative and technical control for the preservation of oil wealth; to take all practical precautions in order to avoid danger to human life, property, natural resources, archaeological sites, beaches, religious or tourist sites, cemeteries, and public installations, as a result of petroleum operations, and, finally, to ensure that the machinery, equipment, and materials used in petroleum operations are in conformity with the safety and efficiency standards existing in the oil industry (Oleynik *et al.*, 2005).

3.3.6 Training in the oil industry

Because technology and knowledge are vital assets for development in Libya, the country has been working tirelessly in order to attract state of the art technology and knowledge. In this connection, training in most of the Libyan institutions is viewed as an essential factor in the development of the country, and Libya considers the training of its personnel by foreign partners as the key factor for gaining new knowledge.

It is believed that a successful transfer of knowledge and technology includes good planning and training of individuals. Hence, there are several foreign companies which receive plans to increase training opportunities for Libyan individuals, especially in the technical areas. Therefore, there is a sharply growing market for educational exchange programmes, and supplies and facilities related to institute administration (U.S. & Foreign Commercial Service and U.S. Department of State, 2006).

Furthermore, it has been argued by Wallace and Wilkinson (2004) that Libya has the highest number of professionally and academically trained and highly qualified individuals compared with neighbouring North African countries. This is mainly attributed to the substantial educational and training programmes that the country has undertaken, which involve sending large numbers of students for short and long training courses, as well as for postgraduate studies, to various countries abroad, especially to western countries. The goal of this strategy is to increase the sum of well-qualified professionals in all industries, as well as to bring new knowledge and technology to the country.

The NOC provides high quality training programmes for its individuals. There are many educational and training centres around the country such as the Petroleum Training and Qualifying Institute and the Petroleum Training Centre, and these centres are provided with state of the art technology. The aim of these training centres is to supply local industry with the latest educational programmes, ranging from advanced technical training programs to higher academic courses. Moreover, these programmes are intended to increase the level of skill and effectiveness of the manpower, both technically and administratively. This guarantees an understanding and adaptation to technological developments, techniques and work systems used in the oil industry at an international level (Oleynik *et al.*, 2005).

Training courses are usually run by foreign and national experts, who share their experience and knowledge with trainees. Moreover, many training courses are taken abroad in order to develop qualified individuals in such professions as engineering, administration and accounting. These courses are often organised by companies based abroad which belong to the NOC, such as Umm Al Jawaby Oil Service Company Limited London, which has been running since 1983 and arranges training courses and conferences for the personnel of the Libyan oil industry in different places in the world, such as the UK, North America, the Middle East, and various countries in Europe. It spends about £ 30 million annually to provide the trainees of the NOC with a variety of courses, including short managerial training courses and conferences, as well as longer technical training courses in different disciplines. It also organises around 400 training courses a year for the requirements of over 1000 trainees per month. In addition, along with the training programmes, Umm Al Jawaby Oil Service Company provides all the requirements of the Libyan oil industry. It spends around £500 million a year to supply Libyan oil companies with a wide range of production and exploration equipment, materials, goods and services (Annual Report of the Umm Al Jawaby Oil Service Company, 2004).

Furthermore, the oil industry is distinguished by a complex technology and management system which has seen many modifications and a steady development. Therefore, the NOC has instigated other training programmes in order to meet varied needs in different fields. These programmes are held both locally and externally. For the local training, the NOC has established a number of training centres throughout the country to develop the skills and knowledge of its manpower. These centres include: the Centre of Administrative and Technical Development of the NOC, which conducts several specialised training activities domestically, such as drilling, geology, maintenance, supervision, reservoir and production engineering, management and finance. There is also the Oil Institution for Training and Development, which equips Libyan trainees to work comfortably in the fields of maintenance, operations and drilling. Finally, there is the Azzawiya Training Centre, which aims to train nationals to meet the requirements of both maintenance and operations in the refineries and petrochemical plants (Oleynik *et al.*, 2005).

3.3.7 Exploration and Production Sharing Agreement (EPSA)

The Exploration and Production Sharing Agreements (EPSAs) constitute the first crucial commitment initiated by the NOC in oil exploration contracts which shared direct engagement in management and financing, while leaving the exploration risks to the foreign partner (Townsend, 2001). According to the UK consulting firm, Robertson Research, Libya was the best exploration place in the world for the third year in succession (Economist Intelligence Unit, 2002).

Petroleum licensing in Libya has gone through three broad developments since its primary inception in 1959. The first was an opening period of concession agreements with different adjustments including a sealed bidding round. This was followed by a second development of joint venture agreements in the late 1960s, and, finally, the setting up of a third stage of Exploration and Production Sharing Agreements (EPSAs), which was first launched in 1974. In these early concession agreements, Libya was divided into geographic sectors and a system of hires was applied, with altering relinquishments according to the position of the concession. The EPSA agreements were then offered, the agreements of EPSA-I were easier in outline than the previous concession agreements. Generally they gave the international company a percentage of the oil produced, free of taxes and royalty payments. All exploration and international company costs were met by the international company. In 1980-81, the EPSA-I agreements were updated by a new set of EPSA-II agreements, which were similar to the previous version (EPSA-I) except that the terms and conditions were harder, the contractor oil percentage varying according to the position of the concession and the probability of finding hydrocarbons. Moreover, a new set of contracts was drawn up, termed EPSA-III agreements. The terms and conditions of the new contracts varied but were more favourable to the international oil companies (http://en.noclibya.com.ly/index.php?option=com_content&task+view&id=118&Itemid+7 1, no date).

The NOC is the main body responsible for all EPSA activities and agreements. According to decision No. 10, article 5 (1979) of the General Secretariat of General People's Congress concerning the re-organisation of the NOC, the NOC is considered to be the first party in all EPSA agreements or any other contracts concerning investment of oil wealth,

and the NOC invests it in accordance with the provisions and conditions laid down in those contracts and the agreements.

Libya has been working hard to increase its oil production. As a result, the country has allocated many areas and blocks to discovery, and has invited several foreign oil companies to carry out the exploration for oil, bringing in their modern technology to boost production from the fields. According to the U.S. & Foreign Commercial Service and U.S. Department of State (2006), in 2000, the NOC opened around 137 oil blocks for international investment, and in October 2005, about 26 areas and blocks were awarded for exploration under EPSA IV. Moreover, the EPSA IV-2 blocks were also opened for exploration and many companies from different nations, including the USA, won contracts for these blocks. Table 3.12 shows the winning foreign oil companies in EPSA IV-2:

Table: 3. 12 Areas and blocks won in the EPSA IV-2

Area and blocks	Winning Companies
Area 2 Blocks 1 & 2	Nippon/ Mitsubishi
Area 17 Block 3	Pertamina
Area 17 Block 4	CNCP
Area 40 Blocks 3 & 4	Nippon/ Mitsubishi/ Japex
Area 44 Block 1-4	Exxon
Area 42 Blocks 1 & 3	NB
Area 42 Blocks 2 & 4	Total/ Impex
Area 94 Blocks 1-4	Statoil
Area 81 Block 1	ONGC
Area 81 Block 2	Mitsubishi/ Tekuku
Area 82 Block 3	Mitsubishi/ Tekuku
Area 82 Block 4	Techneft
Area 102 Block 3	NB
Area 102 Block 4	Oil India-India Oil
Area 121 Block 2	NB
Area 123 Block 1	BG
Area 123 Block 2	BG
Area 123 Block 3	PT Pertamina
Area 146 Block 1	Norsk Hydro
Area 147 Blocks 3 & 4	Turkish Petroleum Co.
Area 161 Block 1	Eni
Area 161 Blocks 2 & 4	Eni
Area 176 Block 3	Eni
Area 176 Block 4	Japex
Area 171 Blocks 1-4	Statoil/ BG
Area 186 Blocks 1-4	Eni

Source: U.S. & Foreign Commercial Service and U.S. Department of State, 2006

Furthermore, the NOC offered another block for exploration and production sharing agreements, which is known as (EPSA-4). According to Ford (2005b), the American companies were the biggest winners of contracts for this block. For example, US

Occidental was awarded a total of five out of fifteen blocks on its own and was a member of four others with consortia, whereas the US Amerada Hess and Chevron Texaco won one block each. The other successful oil companies were Brazil's Petrobras, the UAE's Liwa, Canada's independent operator Verenex Energy, Energy International of Indonesia, India's Oil India, Indonesia's Medco Energy International, and Algeria's Sonatrach. In addition, the Economist Intelligence Unit (2004) reports that a contract of US$ 56 million was agreed by the German's RWE to work in six blocks located in Cyrenaica and the Kufra and Sirte basins. This contract is aimed at seismic operations and the drilling of ten exploratory wells.

3.3.8 Major and recent oilfield discoveries

Several oilfields have been discovered by foreign oil companies. For example, in October 1997, an international consortium led by British company Lasmo (purchased by Eni in 2001) along with five South Korean companies and Eni, declared that it had discovered large recoverable crude reserves (approximately 700 million barrels) at the Elephant field in Murzuq Basin in the NC – 174 Block, 465 miles south of the capital city Tripoli. Elephant started production in February 2004 at about 10,000 bbl/d, and in 2006 Eni indicated that this field was producing around 125,000 bbl/d (Energy Information Administration, 2007). In addition, in October 2005, the NOC announced the discovery of oil in two fields in the same basin (Murzuq). The explorations are run by Repsol, with other partners (France's Total, Norway's Norsk Hydro and Austria's OMV). The collective capacity of production from the two fields is around 7,650 barrels a day (Middle East Economic Digest, 2005c).

On the other hand, the French Company Total announced in August 2003 that it had begun production from Block 137 at Al Jurf offshore oilfield. The NOC holds a 50% share in the field, along with Total at 37.5%, and Germany's Wintershall at 12.5%. In addition, Libya had proposed a contract worth about US$ 90 million for the exploration of oil and gas in the areas in the Sirte, Murzuq, and Al-Kufrah basins, and in the summer of 2003, this deal was won by Repsol YPF and Austria's OMW as well as Germany's RWE-Dea, which also won a deal in the same area worth almost US$ 57 million. Moreover, Spain's Repsol YPF and France's Total have played a key role in the exploration of oil and gas in the country. In December 2001, Repsol YPF, along with Total and two other companies (OMV and

Saga Petroleum), announced that it had discovered a considerable new oil deposit in Block NC-186 of Murzuq. The same company, Repsol YPF, declared in April 2002 its first discovery in NC-190 Block (Murzuq Basin) (Energy Information Administration, 2005). In addition, in February 2007, a significant discovery in area 47 in the Gadames Basin was announced by Canada's Verenex Energy (Economist Intelligence Unit, 2007).

3.3.9 Development of the oil and gas fields

As well as searching for new oil discoveries, Libya has been placing a high priority on developing the performance of its available blocks and fields. The NOC has determined around 17 fields where technology and knowledge are specifically required (Middle East Economic Digest, 2005a). Libya needs to develop and upgrade its existing discoveries via the introduction into its infrastructure of advanced technology and knowledge. The country invites international oil companies to assist in the revival of these oil and gas fields that have fallen into disrepair after several years of use and a shortage of modern technology and knowledge during those years in which international sanctions were imposed on the country, from 1992 to 2003.

Mabruk oilfield is one of the main fields which has seen several development programmes. According to the Middle East Economic Digest (2004d), a contract was awarded to Athens-based Joannou and Paraskevaides in order to boost output at the Mabruk field from around 18,000 barrels per day to 40,000 b/d. This contract also includes building of a gas-oil separation plant with two process trains. Joannou and Paraskevaides will also need to construct three oil storage tanks, facilities for oily water treatment, oil metering and power generation, and also an export pump. In addition, the Middle East Economic Digest (2007c) reveals that the Bu-Attifel field in the east Sirte Basin has seen several development activities. The local Italian joint venture Eni Oil has been awarded two contracts in order to upgrade ageing facilities at the field.

Furthermore, in 1993, a 35-year production sharing agreement was signed between Total of France and the NOC, permitting Total to use its own developed-recovery technology in the Mabruk field. Total afterwards agreed in 1994 to farm out 25 per cent of the field to the Norwegian Company Saga Petroleum to invest about US$ 36 million during the initial development (Javan and Bahar, 2000). In addition, Occidental Petroleum Corporation has

signed agreements with the NOC in order to upgrade a number of its existing oilfields. The duration of the new agreements will be 30 years. This will allow the NOC and Occidental to design and apply key field redevelopment and exploration programmes in these contract areas in the productive Sirte Basin. In addition, the new agreements cover fields with about 2.5 billion barrels of recoverable high-quality oil reserves. Over the next five years, about US$ 5 billion in capital investment is expected to enhance the gross production to more than 300,000 barrels per day from the current level of approximately 100,00 barrels a day (Gulf Oil and Gas, 2007).

Moreover, several development operations have been carried out on the offshore oil and gas fields. The French company Compagnie Generale de Geophysique (CGG) has been given a 12- month contract to carry out an extensive seismic data survey of Libya's entire offshore land. This contract requires a 2D seismic, gravimetric and magnetic information programme within the entire licensed and open offshore land. The essential offshore development in Libya is at Bouri field in Block NC-41, this field is run by the Italian company Agip the longest established foreign company operating in the country (Middle East Economic Digest, 2004f). This company (Agip oil) also awarded a sub-contract of approximately US$ 61 million to France's Technip in the Bouri east development area. This contract includes engineering, procurement and installation work (Economist Intelligence Unit, 2004).

The gasfields have also seen many development projects in recent years. For example, the Attahadi field is being developed to produce about 270 million cf/d of gas. This development project involves a field processing facility and a gas pipeline to link the north-south trunk gas pipelines to the east of the field. South Korea's Hyundai was awarded a contract of about US$ 247 million to construct the gas processing plant and other related facilities. In addition, the Bahr Es-Salam field, Block NC41, offshore, Pelagian Basin, has also seen substantial development. In June 2002, Agip affiliate Saipem was given a contract of around US$ 550 million to construct and install the Sabratha drilling and production platform. Moreover, in February 2002, a contract of about US$ 1.0 billion was awarded to a consortium led by JGC, Sofregaz and Technimont. They are working to develop the Al-Wafa field in the desert and the coastal gas and condensate processing plant close to Mellitah, on the sea. This contract aims to carry out work on oil

and natural gas processing plant and other development and upgrading work (Wallace and Wilkinson, 2004).

The Waha Oil Company, the NOC subsidiary awarded the Athens-based Joannou and Paraskevaides a contract of about US$ 125 million. The contract aims to develop phase 2 of the Faregh gasfield. It involves the construction of a 180 m cu. ft/day gas processing plant next to the existing oil production facilities in the field (Middle East Economic Digest, 2006f; Economist Intelligence Unit, 2006). In addition, British Petroleum is engaged in a key gas development project at In Amenas, which recently started production with a capacity of 9 bn cu. metres a year of gas and substantial quantities of liquids (Economist Intelligence Unit, 2007). Moreover, the NOC and Agip Nord Africa B. V. (a subsidiary of Eni S. P. A. of Italy) have carried out the development of two natural gas fields in western Libya – the C structure in offshore Block NC – 41 and the Wafa field in Block NC – 169. The total venture is planned to cost almost US$ 4.5 billion (Townsend, 2002).

3.3.10 Dominant international oil companies in Libya

Several international oil and gas companies are engaged in exploration and production in Libya. These include companies such as Repsol-YPF, Total, Royal Dutch/ Shell, Petrobras (Brazil), Red Sea Oil Corporation (Canada), Agip-Eni, Indian Oil Corporation, Petro-Canada, Veba, Norsk Hydro, Medco Energy (Indonesia), Nimr Petroleum (Saudi Arabia), Canadian Occidental, Pedco (South Korea), Lundin Oil, ONGC, Petronas (Malaysia), CNPC, Liwa (UAE), Husky Oil, Woodside (Australia), OMV, Naftogaz Ukrainy, Verenex (Canada), Wintershall (Germany), Occidental, Amerada Hess, Exxon, Chevron Texaco, and other companies (Africa Energy, 2005; Energy Information Administration, 2006). However, the main dominant foreign oil companies working in Libya are:

3.3.10.1 Eni Oil and Gas

Eni is an energy company involved in oil and gas exploration and production, natural gas distribution, petrochemicals, refining and marketing, oilfield services and engineering industries (Datamonitor, 2008f). There are two Eni companies in Libya: Eni Oil company,

whose main activities include exploration, production and oil transportation, and Eni Gas, whose main activities in the country are the development and production of gas.

Italy's Agip-Eni is the leading international oil company producer in Libya (Africa Energy, 2005). It is also one of the oldest foreign oil companies in the country. It entered in 1959, when it was awarded a contract from the Libyan Petroleum Authority, which is now called the National Oil Corporation (NOC). This corporation awarded two companies of the Eni group, CORI SpA and Agip SpA, exploration contracts to search for hydrocarbons in the Sirte Basin (Sarir area). As a result, two oilfields were discovered by CORI in Sarir and Agip discovered the enormous Bu-Attifel oilfield in the Sirte Basin. Through the Exploration Production Sharing Agreement, which Agip had signed with the NOC, it carried out extensive exploration activities in the NC-41 area, and 12 discoveries were made in the 1970s: 11 gas and condensate, and one oilfield. In addition, the NOC and Agip signed a contract in 1996 to put together the onshore and offshore discoveries into one project; this is intended to convey gas at a plateau rate of 10 billion cubic metres annually for twenty years (Townsend, 1999).

3.3.10.2 Repsol

Repsol is an integrated oil and gas company, operating in more than 30 countries. It is mainly involved in the exploration, development and production of crude oil, as well as in natural gas. It is also engaged in the transportation of oil products, oil refining, liquefied petroleum gas and natural gas, as well as the production and marketing of petroleum products (Datamonitor, 2008a).

The Spanish oil group Repsol has been working on exploration and production of oil in Libya for several years. Repsol is also one of the main foreign oil producers in the country. It has mining rights to 17 blocks in Libya, 15 of these blocks are for exploration, with a total area of about 56,517 square kilometres, and 2 blocks are for development, with a net area of around 1,413 square kilometres. In 2005, Repsol operated a net production of nearly 25,000 barrels per day in Libya (Rigzone News, 2006).

3.3.10.3 Total

Total is one of the largest integrated oil and gas companies in the world. It is engaged in several activities throughout the world, such as exploration, production and transportation of oil and gas, marketing of petroleum products, refining, and international crude oil and product trading (Datamonitor, 2008b).

Total has been heavily involved in the exploration and production of oil in Libya. This company has many partnership agreements with the NOC on several projects, among which are the development of the Mabruk field and of the Al Jurf field, at the sea, close to the border with Tunisia. In addition, Total and the NOC of Libya have signed agreements of exploration and production for areas NC 191-192 in the Murzuq and Sirte regions, as well as for area A 42 in Cyrenaica (National Oil Corporation, 2008).

This company has discovered many oilfields in the country. In 2005, Total and its partners in Libya (Repsol YPF, OMV, and Saga) made its sixth oil discovery; the oilfield thus discovered has since produced around 4,650 barrels per day. In addition, Total operates the offshore Al Jurf and the Mabruk fields in the Sirte Basin. This company is also a partner in the group that works the neighbouring El-Sharara fields, which produce around 200,000 barrels of light oil per day (Total, 2005).

Total made its seventh oil discovery in Libya in 2006 at Murzuq Basin, in Block NC. This discovery was carried out by Total and its partners. This new oilfiled produces about 2,300 barrels per day. This discovery supports and reinforces the company's position in Libya, whereby the group is the main operator of the Mabruk and Al Jurf fields in the Sirte Basin (Mena Report, 2006).

3.3.10.4 Veba Oil operations and Petro-Canada

Veba Oil operations is a joint venture between the NOC and Petro-Canada. It discovers and produces oil in eight concessions, most of which are onshore in the Sirte Basin. Currently, production from the joint venture is from the combined operation of more than 20 fields. The company has an equity at Ras Lanuf Terminal, which is located in the Gulf of Sirte in the north of Libya about 650 kilometres east of the capital of the country, Tripoli, and services an average of 15 tankers a month, while handling more than 480

thousand barrels of oil a day (Veba Oil, 2008). On the other hand, Petro-Canada has been engaging in exploration and production in Libya for over 40 years. This company is one of Libya's largest producers (through its 49 % interest in Veba Oil Company, a joint venture with the NOC). Petro-Canada runs Amal oilfields and carries out development activities at En-Naga field (Petro-Canada, 2006).

3.3.10.5 Wintershall

Wintershall is active in the exploration and production of oil and gas as well as in the trading of crude oil and natural gas (Datamonitor, 2008c). Wintershall has been operating in oil exploration and production in Libya since 1958. This company is one of the largest foreign operators in the country, producing oil from five main fields: Nakhla, Sarah, Jakhira, Hamid, and Tuama in the Sahara's Sirte Basin; and also, in a group that consists of the NOC and Total of France, from Al Jurf offshore field in the Mediterranean sea (OilVoice, 2004). Moreover, there are a considerable number of Libyan nationals working for Wintershall, they constitute about 70 per cent of the company's staff in Libya (Libyan Investment, 2005).

3.3.10.6 OMV

OMV engages in discovery and other activities. It discovers natural gas and crude oil, refines crude oil, transports and stores gas (Datamonitor, 2008d). The OMV has been active in Libya since 1985, and it has been engaging in several activities in the country. In 1994 the OMV expanded its Libyan presence by signing an agreement with the NOC to develop the enormous El-Shararah field in the Murzuq Basin. In 1997, exploration work was acquired in Block NC 186 of the Murzuq Basin followed by NC 197 in year 1999. In addition, the OMV along with Repsol, was given an exploration package 1 in 2003, about 6 blocks covering around 77, 00 kilometres. Moreover, in 2006, the OMV was involved in a total of 21 exploration and appraisal wells. Furthermore, in November 2006, the OMV signed an agreement with the NOC and Occidental Petroleum. The extension by 30 years of the agreement term aimed at the redevelopment of the Nafoora – Augila field, as well as the development of its present assets in the productive Sirte Basin (OMV Annual Report 2007).

Table 3.13 indicates the relevant oil and gas production joint ventures of the OMV in Libya; exploration and discovered resource joint ventures are not covered in the table:

Table: 3. 13 Relevant joint ventures of the production of the OMV in Libya

Field name	Licence/Block	Participation in %
El Shararah	NC 115	7.50
Nafoora Augila Unit	C 102	3.21
Intisar	C 103	12.25
A Field	NC 186	9.60
B Field	NC 186	9.60
D Field	NC 186	9.60
H Field	NC 186	9.60
EPSA Fields	NC 29, NC 74	4.75
Shatirah	NC 163	17.85

Source: Annual Report of OMV (2007, p. 136)

3.3.10.7 Royal Dutch/ Shell

The Royal Dutch/ Shell group of companies was very dynamic in the Libyan oil industry from the 1950s to 1974; it also operated exploration in Libya in the late 1980s (Rigzone News, 2004). Royal Dutch/ Shell are back now in Libya, and have been awarded a great deal in the country. This company agreed to assist in upgrading the liquefied natural gas plant at Marsa El-Brega on the coast of Libya, as well as to help with the exploration and development of five areas in the country's key oil and gas activities at Sirte Basin (Professional Engineering, 2005). The NOC has concluded an agreement with Royal Dutch/ Shell, whereby the latter invests around US$ 637 million in exploration and the development of Libya's liquefied natural gas (Middle East Economic Digest, 2005d).

3.3.10.8 American Oil companies in Libya

The United States of America has lifted almost all restrictions on investment and trade, as well as lifting sanctions against Libya which punished American companies investing in the country's oil industry. Lifting these sanctions has allowed the American oil companies to return to Libya, after being forced to leave in 1986, and these companies are now eager

to participate in investing, along with the other foreign companies already in the country. Consequently, many US oil giants have come back to the country and won contracts, such as Occidental, ConocoPhillips, Exxon, Marathon, and Amerada Hess.

The Oasis group of US oil companies, which is made up of ConocoPhillips, Amerada Hess, and Marathon, announced in December 2005 a return to its Waha oil and gas concessions after reaching an agreement with the NOC. This group re-entered Libya after a 19-year absence (Middle East Economic Digest, 2006c). The NOC has the largest share of the Waha concession (59.17 per cent), and the additional partners include ConocoPhillips (16.33 per cent), Marathon (16.33 per cent), and Amerada Hess (8.17 per cent) (Energy Information Administration, 2007).

Furthermore, the American company Occidental Petroleum Corporation has signed with the NOC nine exploration and production sharing agreements (EPSAs) under EPSA-4. This company has a 90% interest in onshore Block 59 in the Cyrenaica Basin, Blocks 131 and 163 in the Murzuq Basin, and Blocks 106 and 124 in the Sirte Basin (Middle East Economic Digest, 2005f).

3.4 Summary

This chapter has dealt with the activities of technology and knowledge transfer in Libya. It started by showing some of the transfers undertaken in different industries, such as telecommunications, electricity, cement, iron and steel, and the Great Man-Made River Project. It went on to cover technology and knowledge transfer in the oil and gas industry, giving a general overview regarding this important industry and indicating the leading firms involved in it.

Libya is regarded as a highly attractive oil region owing to its low oil recovery (as low as US$ 1 per barrel in some fields), the excellent quality of its oil, and its closeness to European markets (Energy Information Administration, 2007). Libya is very keen on bringing in state of the art technology and knowledge from foreign countries, via foreign companies and through different methods, such as the joint ventures mode. The interest in attracting technology and knowledge to the country began with intensity in 2003 after the lifting of almost all restrictions on investment and trade, as well as the lifting of sanctions

against Libya which had been imposed by the United Nations from 1992 to 2003. This has allowed many foreign companies to enter the country, bringing technology and knowledge; in particular, American oil companies who had been forced to leave in 1986. Therefore, the joint venture has become a very popular method in most industries in Libya, especially in the oil and gas industry, owing to the substantial benefits it offers, such as the transferring of modern technology, which is required for the modernisation of the infrastructure in most sectors, and also owing to the latest knowledge it brings and shares with the national workforce.

Chapter Four

Research Methodology

4.1 Introduction

This chapter investigates in greater detail the research methodology adopted by the study. It introduces some perspectives that assist in understanding the aim and practices of the essential research methods. It commences by defining the term "research" and goes on to give an overview of the two methods of research, qualitative and quantitative, indicating their main differences. This chapter also presents the methods of data collection used, (secondary and primary data) indicating their types, sources and advantages for the data gathering.

This chapter also comments upon the use of questionnaires and interviews as techniques for data gathering, determining their types and significance for collecting the required data. Finally, pilot testing is examined and the main reasons for carrying out this type of testing are indicated, particularly with reference to questionnaires.

4.2 Research

Research is essentially a method for examining or gathering information to solve certain problem (Coombes, 2001; Booth *et al.*, 2003; Zikmund, 2003; Locke *et al.*, 2004; Maylor and Blackmon, 2005; Cooper and Schindler, 2006). The word "research" is mainly used to demonstrate a large number of activities and actions, such as collecting a substantial amount of information, delving into esoteric theories, and collecting outstanding new insights (Walliman, 2005). Carrying out research is more than basically adopting and conducting certain techniques and methods. It is about thinking all the way through the process (O'Leary, 2004). In addition, research is a systematic process by which to expand

one's own understanding and that of others, by the finding of nontrivial facts and insights (Sharp *et al.*, 2002).

Research has been defined by several authors. For example, Ghauri and Gronhaug (2002, p. 3) define it as "the process of planning, executing and investigating in order to find answers to our specific questions. In order to get reliable answers to our questions, we need to do this investigation in a systematic manner, so that it is easier for others to understand and believe in our report." It is also defined by Sekaran (2003, p. 3) as "the process of finding solutions to a problem after a thorough study and analysis of the situational factors."

4.2.1 Research design

There are large number of research designs and methods from which a researcher can choose. However, the selection of a proper research design depends mainly on the nature of the aim and objectives, as well as the questions that the study seeks to answer (Hakim, 1987; De Vaus, 2001). Research design is indicated by Yin (2003, p. 20) as "the logical sequence that connects the empirical data to the study's initial research questions and, ultimately, to its conclusions". In addition, its key function, as revealed by De Vaus (2001, p. 9), is "to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible."

Choosing an appropriate research design is very important as it is considered to be the main element in conducting the study, because it essentially works to organize its aim and objectives, rationale and conditions, as well as the nature of the information and the data required for carrying out the study. Hedrick *et al.* (1993, p. 38) confirm this view by stating that "selecting a research design is a key decision for research planning, for the design serves as the architectural blueprint of a research project. It ensures that the data collection and analysis activities used to conduct the study are tied adequately to the research questions and that the complete agenda will be addressed."

4.3 Quantitative and qualitative research

Hammersley (1993, p. 39) has stated that "the term 'quantitative method' refers in large part to the adoption of natural science experiment as the model for scientific research, its key features being quantitative measurement of the phenomena studied and systematic control of the theoretical variables influencing those phenomena".

Quantitative methods and analysis are about using information completely to examine the data obtained and also to reach reasonable decisions (Kane and O'Reilly-De Brun, 2001; Ritchie and Lewis, 2003; Swift and Piff, 2005; Walliman, 2005). Quantitative methods usually involve the numerical analysis of data (Hussey and Hussey, 1997; Partington, 2002). Moreover, Denscombe (1998) argues that quantitative research tends to be associated with large-scale studies, with numbers as the unit of analysis, with a specific focus, with researcher detachment, and with a predetermined research design.

On the other hand, "Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry" (Denzin and Lincoln, 2000, p. 8). In addition, Kane and O'Reilly-De Brun (2001) believe that qualitative research can be used for several reasons such as understanding the meaning of material which has been gathered via quantitative techniques, demonstrating and fleshing out results from quantitative research, obtaining an initial image so that the researcher has sufficient information to improve his or her plans and, finally, questions, and ruling out hypotheses. Furthermore, Silverman (2005, p. 9) states that:

> "Qualitative researchers are prepared to sacrifice scope for detail. Moreover, even what counts as 'detail' tends to vary between qualitative and quantitative researches. The latter typically seek detail in certain aspects of correlations between variables. By contrast, for qualitative researchers, 'detail' is found in precise particulars of such matters as people's understandings and interactions. This is because qualitative researchers tend to use a non-positivist model of reality."

Qualitative research tends to be associated with small-scale studies, with words as the unit of analysis, with description, with a holistic perspective, with researcher involvement, and with an emergent research design (Denscombe, 1998).

The differences between quantitative and qualitative research have been indicated by numerous authors (e.g. Gillham, 2000; Blaikie, 2000; Coombes, 2001; Stebbins, 2001; Cavana *et al.*, 2001; Miller and Salkind, 2002; Ghauri and Gronhaug, 2002; Flick, 2002; Mason, 2002; Baker, 2003; Cramer, 2003; Thomas, 2003; Miller and Brewer, 2003; Creswell, 2003; Berg, 2004; Maxwell, 2005; Henn *et al.*, 2006; Berg, 2007). It is considered that the fundamental difference between quantitative and qualitative research methods is in the procedure. The difference between both types is mainly the distinction between numerical and non-numerical data (Babbi, 2004). Qualitative data are linked with qualities and non-numerical features, whereas quantitative data are all data that are gathered in numerical shape (King *et al.*, 1994; Collis and Hussey, 2003). In other words, in quantitative research, findings are accomplished by using statistical methods or other procedures or types of quantification, whereas in using qualitative methods, outcomes are not achieved by using statistical techniques or other procedures of quantification, rather, these methods generally involve the studied use and collecting of a variety of empirical materials: case study; interview; and personal experience. Moreover, the difference between these types of research is not merely a matter of quantification, but also of the consideration of various opinions and perspectives of knowledge and research objectives. Therefore, the difference between both methods resides mostly in the general form but also in the aim and objectives of the research (Ghauri and Gronhaug, 2002). In addition, quantitative research mainly operates with less detail than does qualitative, but with a wider range and more comprehensive level of explanation (Payne and Payne, 2004).

Furthermore, both quantitative and qualitative research may be distinguished by their respective methods of data collection, the procedures implemented for data processing and examination, and their manner of communicating the findings (Kumar, 2005; Alvesson and Deetz, 2000). In addition, Denzin and Lincoln (2000, p. 10) argue that:

> "Both qualitative and quantitative researchers are concerned with the individual's point of view. However, qualitative investigators think they can get closer to the actor's perspective through detailed interviewing and observation. They argue that quantitative researchers are seldom able to capture their subjects' perspectives because they have to rely on more remote, inferential empirical methods and materials."

Table 4.1 illustrates some essential differences between qualitative and quantitative data:

Table: 4. 1 Quantitative and qualitative data

Quantitative Data	Qualitative Data
Based on meanings derived	Based on meanings expressed
Collection results in numerical and standardized data	Collection results in non-standardized data requiring classification into categories
Analysis conducted through the use of diagrams and statistics	Analysis conducted through the use of conceptualization

Source: Ghauri and Gronhaug (2002, p. 137)

4.3.1 Combining quantitative and qualitative data

Qualitative data can be gathered through many methods, such as open-ended, semi-structured interviews and observation. These modes are often significant in investigating and describing individual behaviour, feeling and experience precisely, via in-depth examination within limited case studies. In addition, data acquired via qualitative methods are seen as rich in detail since they involve interaction with individuals in their own language and context (Tashakkori and Teddlie, 2003). Quantitative data, on the other hand, are usually collected through questionnaires, structured interviews, and numerical checklists, which can be statistically analysed and presented. Therefore, gathering quantitative data is regarded as an appropriate technique if the research deals with large numbers of respondents and involves the application of measurement or a numerical approach (Hammersley, 1992, Black, 1999).

Several authors have considered the combination of quantitative and qualitative data and its effectiveness when collecting information (e.g. Bryman, 1988; Brannen, 1992; Silverman, 2001; Tashakkori and Teddlie, 2003; Bryman, 2004; Seale, 2004; Punch, 2005). Indeed, Tashakkori and Teddlie (2003, p. 518) state that "a combination of both qualitative and quantitative research strategies enables researchers to have greater faith in their findings and make greater contributions to the field".

The use of combined methods of both qualitative and quantitative data collection and analysis would, thus, enhance the reliability and credibility, as well as supporting the

findings, of a study. In the current study, both methods were used in order to accomplish its aim and objectives as well as to obtain an answer to the research questions. Quantitative data, mainly questionnaires, were used to emphasize and display the practices, assessments and significance of technology and knowledge transfer to Libya, while qualitative data were essentially integrated with quantitative data in order to provide more information via unstructured interviews, to support, explain, and clarify these approaches and assessments. Such a technique would provide practical results and strengthen the reliability and credibility of the study's findings.

Furthermore, this study followed sequential procedures, by which the researcher first employed the quantitative technique, represented in the questionnaires, followed by qualitative research, represented in the unstructured interviews, after ascertaining that further clarification and information were needed. As stated by Creswell (2003, p. 16), in this type of combining of methods (sequential procedures):

> "The researcher seeks to elaborate on or expand the findings of one method with another method. This may involve beginning with a qualitative method for exploratory purposes and following up with a quantitative method with a large sample so that the researcher can generalize results to a population. Alternatively, the study may begin with a quantitative method in which theories or concepts are tested, to be followed by a qualitative method involving detailed exploration with a few cases or individuals."

The combination of both quantitative and qualitative methods of data collection could enhance and improve current knowledge by filling the gaps related to technology and knowledge transfer in Libya, whereas the adoption and implementation of only a single approach would have been unable to do so in an effective manner. Tashakkori and Teddlie (2003, p. 524) confirm this view and assert that "a combination of research approaches will maximize knowledge yield and widen the scope of research contributions".

4.4 Data collection

"Data collection is not just a process of collection; it is also a process of creation - of using information in unique ways related to the purpose of the study" (Birley and Moreland, 1998, p. 40). There are two major sources of data: original data, which are recognized as primary data, which are data gathered at source; and secondary data, which is information

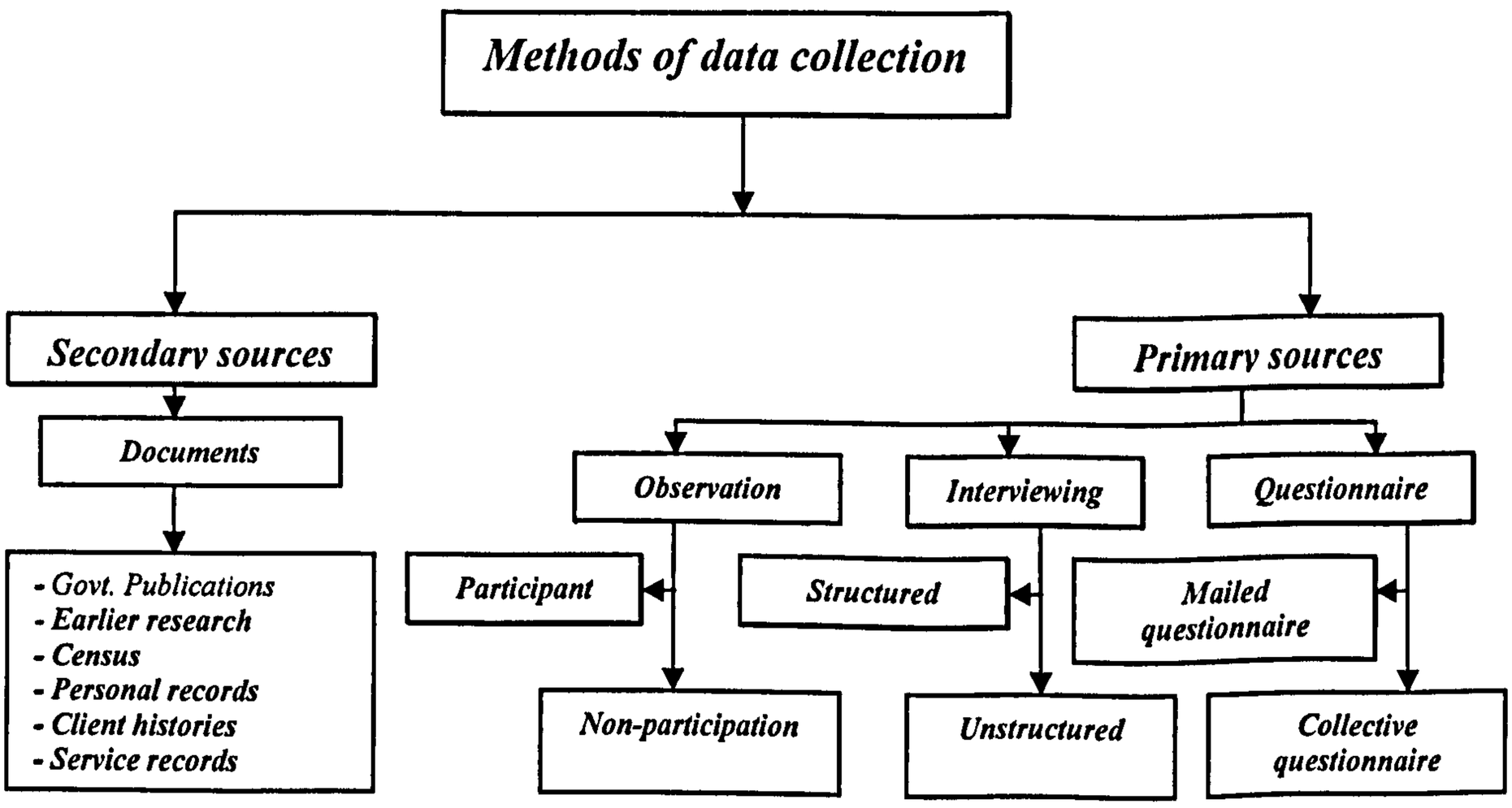
collected from sources already existing and available, such as journals, books, documents and the like (Hussey and Hussey, 1997; Blaikie, 2000; Sekaran, 2003; Collis and Hussey, 2003).

All research involves gathering and analysis of data. This can be carried out via several methods, such as, reading, measurement, observation, interviewing (asking questions) or other techniques and strategies. However, the methods of collecting data differ significantly in their kinds. For instance, data may involve words or might be numerical, or a combination of both. Data may also involve answers to interviews or questionnaires, or materials or documents, or taking notes through observations or experiments. Furthermore, in some cases, data can be original, where the researcher gathers materials never before gathered, or can be secondary, already invented by someone else but used again in a variety of methods (Blaxter *et al.*, 2001). However, "the choice of data collection techniques is in large part shaped by the nature of the research questions. All these techniques can yield enormous amounts of evidence" (Ragin, 1994, p. 26).

4.4.1 Methods of data collection

There are two major approaches to collecting information: collecting secondary data or primary data:

Figure: 4. 1 Methods of data collection



Source: Kumar (2005, p. 118)

4.4.1.1 Secondary data

Secondary data are information that have been previously gathered for some reason other than the problem at hand (Malhotra *et al.*, 2002; Zikmund, 2003, Hakim, 2000). In addition, secondary data are obligatory for most organisational research. This includes information collected by somebody other than the researcher carrying out the present research (Remenyi *et al.*, 1998; Sharp *et al.*, 2002; Sekaran, 2003).

It is absolutely essential that secondary data be gathered first, as these can provide helpful background information that can be used to define the research, develop goals, and determine the right methodology (Polonsky and Waller, 2005). Blumberg *et al.* (2005) confirm that data from secondary sources give outstanding background information about the research area as well as many excellent leads. They assist the researcher to decide what should be done and can be a valuable source of hypotheses. Furthermore, Hart (2001, p. 2) reveals that:

> "Analysing the literature can have as much intellectual and practical value as collecting first-hand data. A thorough critical evaluation of existing research often leads to new insights by synthesizing previously unconnected ideas, and can provide methods for the collection of data and suggest solutions tried in similar situations. An analytical reading of the literature is an essential prerequisite for all research."

4.4.1.1.1 Sources of secondary data

Secondary data can be collected through several methods. Jankowicz (2000) and Ghauri and Gronhaug (2002) indicate several sources that can be essential for carrying out a piece of research. These sources include regional and national government reports and studies; Internet sites and websites of different organisations and firms; reports and studies of organisations and institutions, for instance, universities, and other public or private institutions; publications of various organisations and institutions regarding their own industry; historical studies concerning the development of certain disciplines or problem areas; commercial research firms selling data; technical manuals; textbooks and other published material; academic journals and magazines related to the area; and international trade websites. The sources of secondary data collection fall into two main categories as can be seen in Table 4.2.

Table: 4. 2 Sources of secondary data

	Internal	External
Written	■ Memos ■ Contracts ■ Invoices	**Publishers of books and periodicals:** ■ Indexes ■ Yearbooks **Government and supranational institutions:** ■ White books ■ Reports **Professional and trade associations:** ■ (Annual) reports Media sources: ■ Newspapers and magazines ■ Special reports(supplements) **Commercial sources:** ■ (Annual) reports
Electronic	■ Management information systems ■ Accounting records	Publishers of books and periodicals: ■ Bibliographic databases **Government and supranational institutions:** ■ Websites (of statistical offices) ■ CD-ROMs **Professional and trade associations:** ■ Websites **Media sources:** ■ Websites ■ CD-ROMs of complete volumes **Commercial sources:** ■ Websites ■ Datasets of previous studies

Source: Blumberg *et al.* (2005, p. 347)

In this study, the researcher found the use of literature available at the Library of Durham University, in conjunction with the library's on-line system giving access to the Internet, particularly useful when conducting the secondary research. Furthermore, the researcher consulted several regional libraries, including the libraries of Newcastle Upon Tyne University and Northumbria University, in order to search for what had been published regarding technology and knowledge transfer. Consequently, it became apparent that there had been much research conducted into this topic. Hence, there were a large number of textbooks, journals and articles covering the area of research which had to be reviewed.

Furthermore, as the study examines technology and knowledge transfer in the oil and gas industry in Libya, it was necessary to review some issues relating to this topic, such as regulations, conditions, and rules in the country itself. It is for this reason that the researcher visited the National Oil Corporation (NOC), which is responsible for the upstream and downstream of the Libyan petroleum industry, in order to acquire a clear understanding of the rules and regulations governing joint venture agreements and other issues related to technology and knowledge transfer to the oil and gas industry in Libya.

4.4.1.2 Primary data

Primary data are the data collected by the researcher that have specific relevance to the current research problem (Malhotra *et al.*, 2002). Primary data are made up of material that the researcher has collected, such as the results of questionnaires and interviews, organized observations, surveys, information from archives, and case studies. The data are collected for the purpose of carrying out the current research mission and with a certain purpose in mind (Diamantopoulos and Schliegelmilch, 1997; Jankowicz, 2000; Hair, Jr *et al.*, 2003).

Furthermore, primary data depend heavily on the skill of the researcher to ascertain the context in which the data are best collected (Henn *et al.*, 2006). Blaikie (2000, p. 184) believes that:

> "Primary data can come from many sources, they are characterized by the fact that they result from direct contact between the researcher and the source, and that they have been generated by the application of particular methods by the researcher. The researcher, therefore, has control of the production and analysis, and is in a position to judge their quality."

Primary data can take a long time to collect and can also be very costly to gather. This type of data can also be very hard to gain access to. Therefore, the unexpected may influence or even obstruct competent data collection (Ghauri and Gronhaug, 2002). Primary data can be gathered through several methods. The choice of the method depends on the reason for the research, the resources on hand and the abilities and skills of the researcher (Kumar, 2005). There were two main methods of primary data collection in this study:

1. Questionnaire;
2. Interviews (unstructured interviews)

4.4.1.2.1 Questionnaire

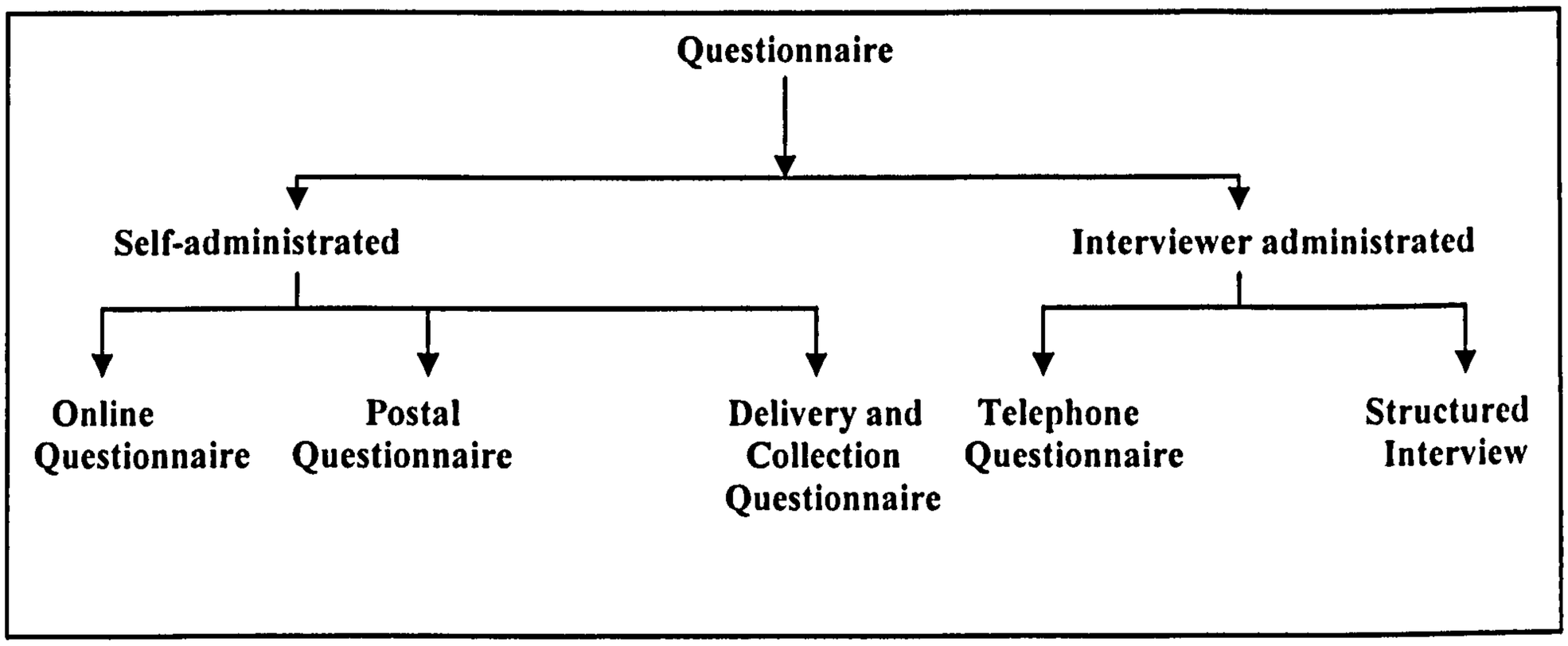
Collis and Hussey (2003, p. 173) define a questionnaire as "a list of carefully structured questions, chosen after considerable testing, with a view to eliciting reliable responses from a chosen sample. The aim is to find out what a selected group of participants do, think or feel". In addition, Sekaran (2003, p. 236) states that:

> "A questionnaire is a reformulated written set of questions to which respondents record their answers, usually within rather closely defined alternatives. Questionnaires are an efficient data collection mechanism when the researcher knows exactly what is required and how to measure the variables of interest. Questionnaires can be administrated personally, mailed to the respondents, or electronically distributed."

4.4.1.2.1.1 Types of questionnaire

Types of questionnaire can be categorized into two main groups. The first group is called self-administrated questionnaires; these are often completed by the respondents. This type of questionnaire is delivered and returned via three main methods: online questionnaire (where the e-mail or Internet can be used); postal questionnaire (questionnaires are posted and returned via post); and delivery and collection questionnaire (questionnaires are handed in and picked up personally). The second group is called interviewer-administrated questionnaires and is divided into two essential categories. The first category includes the telephone questionnaire, which involves contacting the respondents and administrating the questionnaire over the phone. The second category is termed the structured interview, which involves interviewing respondents face to face, employing questionnaires (Saunders *et al.*, 2003). Figure 4.2 shows the types of questionnaire.

Figure: 4. 2 Types of questionnaire



Source: Saunders *et al.* (2003, p. 282)

Two types of questionnaire were prepared for this study. The first type was specifically written to be handed to the Libyan national personnel in the oil and gas industry, while the second was specifically designed for the foreign individuals in the joint venture oil and gas companies in Libya. Each questionnaire was intended to seek information different from the other.

4.4.1.2.1.2 The structure of the questionnaire

A questionnaire is characteristically organised into sections that follow the reason for the sampling plan, the data gathering system and process, and question administration (Czaja and Blair, 2005). It collects information directly by requesting individuals to answer questions (Wisker, 2001). In a questionnaire, respondents look at the questions, understand what is expected and then put in writing their responses. It is normally designed to obtain large quantities of data, generally in numerical format (Kumar, 2005; Hair, Jr *et al.*, 2003).

In this study, each questionnaire was designed to include different parts. The first questionnaire, which was intended to obtain data from the national workforce, was divided into four main sections (see Appendix 1). As stated by Alreck and Settle (1995, p. 153) "the more effectively the items are grouped into sections, the more effective the questionnaire will be". The first section collected general background information about respondents. It consisted of five main questions seeking to obtain information about the respondent, such as employment position, age, experience, and qualifications. The second

section attempted to collect data regarding technology in the oil industry in Libya. It was made up of thirteen questions seeking to gather information such as technology types, sources, accessibility, and the benefits of their transfer to the Libyan oil industry. The third section was designed to acquire information about the knowledge that existed in the respondent's company. It consisted of twenty-two questions essentially designed to gather information relating to knowledge in the oil industry in Libya; such as, its significance, types, channels, protection, creation, sharing and transfer. Finally, the fourth section was added to discover about knowledge management and knowledge management system activities implemented in the oil sector in Libya. It was made up of seven questions aimed to collect materials regarding both concepts, such as, their significance, key activities, purpose, as well as their accessibility.

On the other hand, the second type of questionnaire, which was intended to obtain data from foreign oil companies in Libya, was divided into three main parts (see Appendix 2). The first part was designed to collect background information about the foreign companies involved in this survey. It comprised four main questions seeking to gather information about foreign companies working in the oil industry in Libya, such as, their type of investment, their research and development department (R&D) in Libya and their links to the local research centres in the country, and their joint venture agreement with the local partner. The second part attempted to find out more about technology. It consisted of eight questions intended to collect information regarding technology and its transfer from the foreign partner, while the third part aimed to gather information about knowledge, including knowledge management and knowledge management systems and their accessibility to these provided by the foreign partners in the oil industry in Libya.

4.4.1.2.1.3 Questionnaire design

The design of a questionnaire is not fixed and there is no universal design that would be acceptable for all circumstances. Therefore, designing any questionnaire depends on issues such as the kind of respondent (young people, old people, customers, business), the method of collecting data (face to face, postal or telephone), and also on the availability of the resources. Questionnaires can also differ, from being extremely unstructured to being highly structured (Remenyi *et al.*, 1998; Oakshott, 2001). Generally, the format of

questionnaires can differ significantly, using free-response questions, checklists, or rating scales (Black, 1999).

In this study, both questionnaires were carefully designed in order to achieve their objectives as well as to obtain high answer rates. Hair, Jr *et al.* (2003) believe that in order to accomplish a high answer rate and high quality answers, the researcher must give special consideration to the length of the questionnaire as well as the way in which the questions are prepared, structured, sequenced, and coded. In addition, attention should be paid to certain other factors when designing these questionnaires, such as, language and the general appearance of the questionnaires. As Sekaran (2003) points out, there are three main principles to designing a good questionnaire and to reducing the biases in research. The first principle relates to the phrasing and wording of the questions asked. The second relates to establishing how the variables will be coded, scaled and categorized after receiving the answers. The third principle relates to the general look and appearance of the questionnaire.

Furthermore, Oakshott (2001); Ghauri and Gronhaug (2002); Collis and Hussey (2003) have summarised the general rules for designing the questions on a questionnaire. These include such factors as: indicating the aim of the questionnaire to the respondents; keeping the questions as uncomplicated as possible and simple to answer; never using slang; asking only one question at a time and ensuring that each question deals with only one element or characteristic; including relevant questions only; starting the questionnaire with simple questions and not leaving the most important questions to last; putting the questions in a logical sequence; trying to avoid the inclusion of questions that need mathematical calculations; not including unpleasant or insensitive questions which could cause discomfiture and awkwardness; and keeping the questionnaire as short as possible, but including all the questions necessary to cover the research aim and objectives.

4.4.1.2.1.4 The order of questions on the questionnaire

Questions should be clearly set in order to allow the respondents to understand them. According to Robson (2001, p. 242) "respondents must be able to understand the questions in the way that the researcher intends, have accessible the information needed to answer

them, be willing to answer them, and actually answer in the form called for by the questions".

It has been argued by Thomas (2004) that several of the problems in securing suitable and important answers to survey questions stem from the design of the questions themselves. Problems usually arise from a number of elements: such as, language (terms might be ambiguous, vague or incomprehensible to respondents), question phrasing, question length, response formats and question order.

In this study, both questionnaires started with general questions, in order to obtain the background of the sample, then moved to questions relating to another issue (technology), followed by questions relating to yet another area (knowledge). Furthermore, the researcher sequenced questions, beginning from general questions and progressing towards the specific, also moving from easy to difficult. In addition, the open-ended questions were placed at the end of each questionnaire, where the respondents could add other relevant information and final comments. This order was seen as a means of avoiding confusion among respondents and of helping each respondent to feel more comfortable so each could link and organise his/her ideas to give clear, sensible, and linked answers and comments.

4.4.1.2.1.5 Type of questions

Two types of questions were used in the questionnaires: close-ended and open-ended format:

4.4.1.2.1.5.1 Close-ended questions

These questions ask respondents to select from a variety of pre-arranged responses and are very suitable for collecting factual data and are usually easy to code and analyse statistically (Oppenheim, 1992; Hussey and Hussey, 1997; Remenyi *et al.*, 1998; Babbie, 1998; Moore, 2000; Sekaran, 2003; Collis and Hussey, 2003; O'Leary, 2004).

In this study, most of the questions on the questionnaire were written in a closed format where the researcher asked the respondents to make a choice among a set of alternatives. The respondents had to answer several questions by choosing from various alternatives, such as, filling in numbers from 1 to 5, or answering with Yes or No. Respondents were

also asked to provide information about degree of agreement (strongly agree, agree, disagree, or strongly disagree), or to determine the significance of an element (most important, quite important, important or not important), or to state the value of an option (very high, high or low). Closed questions helped the researcher to analyse the findings quickly and easily. As stated by Bryman and Bell (2003), close-ended questions have several advantages: they can improve the comparability of answers, making it easier to display the connection between variables and to make contrasts between respondents or kinds of respondents; the answers are also easy to process; the questions are, furthermore, easy to complete as gaps are provided; and finally, the close-ended questions might clarify the meaning of a question for respondents because, occasionally it might not be obvious to respondents what, precisely, a question is about and the availability of answers might thus assist in elucidation.

4.4.1.2.1.5.2 Open-ended questions

These questions ask respondents to answer using their own expressions. Respondents can put forward any information and any view they desire, even though the size of gap provided for an answer will usually limit that answer. Such questions also permit the respondents to answer in any way they prefer (Oppenheim, 1992; Hussey and Hussey, 1997; Cavana *et al.*, 2001; O'Leary, 2004). Open-ended questions also give respondents greater freedom to answer the question because they answer in a manner that suits their understanding (Denscombe, 1998; Kelley, 1999; May, 2001; Miller and Brewer, 2003).

On the other hand, the open-ended format is not always beneficial. Such questions may be of limited value to the researcher for certain reasons, such as, lack of responses, owing to unclear questions or lack of a prompt; certain respondents being more eloquent than others; responses being hard to quantify, some respondents perhaps needing to give more than one response; and it not being easy to obtain a wide range of views. Open-ended questions require more effort on the part of the respondents; thus, although they can produce rich and open data, it may be data that is difficult to code and analyse (Black, 1999; Denscombe, 1998; Collis and Hussey, 2003; O'Leary, 2004).

In this study, the open-ended question was used in both questionnaires. As stated by Sekaran (2000, p. 237) "open-ended questions allow respondents to answer in any way

they choose". Therefore, the last question of each questionnaire was written in an open-ended form in order to allow the respondent to comment and to add anything on the topic that might not have been covered or might have been inadequately recorded in the questionnaire.

4.4.1.2.1.6 Translation of the Questionnaire

Before distributing the first questionnaire to the local personnel, it was necessary to translate it into Arabic, as it was intended to be answered by Libyans and the level of their English was not such as to allow them to understand and answer the questions, the main version of the questionnaire having been prepared in English. Therefore, the researcher took great pains in order to produce the most accurate translation and one that was completely understandable, taking into consideration such matters as lexical meaning (the exact meaning of individual words), grammar and syntax (the correct use of language), and experiential meaning. This translation was checked by specialized staff members from Al-Tahadi University in Libya (the researcher's sponsor for his PhD programme) in order to ensure that all the terminology, vocabulary and language used in the English edition were translated in a way easily comprehensible to the Libyan respondents.

4.4.1.2.1.7 The sample and distribution of questionnaires

The sample for this research was drawn from the oil sector in Libya, particularly the foreign oil companies that have joint venture agreements with the NOC, the local partner in Libya, which is responsible for signing this type of agreement with foreign companies.

There are several foreign oil and gas companies investing in Libya. However, seven international companies were selected to be a sample for this study, these are:

- Eni Oil company
- Eni Gas company
- Veba Oil operations
- Total
- Wintershall
- OMV
- Repsol

These companies were chosen because they were the key, largest oil and gas producers in Libya, and also because they had long investment experience in the Libyan market. In addition, the companies selected employed a large number of local personnel.

Different levels (Head of Dept., managers, supervisors, technicians, etcetera), and various departments and administrations (such as, information technology systems, maintenance, drilling, materials, engineering, and financial management) in each company were targeted, in order to include in the survey the entire workforce and to guarantee that any findings were based on data coming from as wide a range as possible of parties concerned.

Some of the questionnaires were personally distributed and collected, while large numbers of the questionnaires were delivered via the assistance of some friends working for the NOC who had a good relationship with the aforementioned foreign oil and gas companies. They were given certain instructions before they started the distribution processes in order to make sure that the all the questionnaires were distributed to various levels and departments in the companies targeted.

4.4.1.2.1.8 The response rate to questionnaires

4.4.1.2.1.8.1 The first questionnaires

245 copies of the first questionnaire were distributed to Libyan nationals in the joint venture companies surveyed. These questionnaires were given to seven companies, thirty five copies to each company. Out of this total, 175 copies were returned fully answered and were chosen for the analysis (71.4 per cent of the total number distributed), this return rate being reasonable and useful for the purpose of analysis. 24 copies were not completed properly and were, thus, excluded from the analysis, while 46 copies were not returned at all. Table 4.3 below shows a summary of response rates for local respondents.

Table: 4. 3 Summary of response rates for local respondents

Questionnaires Numbers	Name of company							Total Number
	Eni Oil	Eni Gas	Repsol	Total	Wintershall	Veba	OMV	
Distributed	35	35	35	35	35	35	35	245
Returned and used	25	25	25	25	25	25	25	175
Not returned	6	5	8	6	8	6	7	46
Excluded	4	5	2	4	2	4	3	24

4.4.1.2.1.8.2 The second questionnaires

In addition, 49 copies of the second questionnaire were distributed to foreign personnel in the same companies as those in which the first questionnaire had been given to the Libyan nationals. 7 copies were distributed to each company. Out of this total, 35 copies were returned fully answered and were chosen for the analysis, while 4 copies were not appropriately completed and were, thus, excluded from the analysis, and 10 copies were not returned at all. Table 4.4 shows a summary of response rates for foreign respondents.

Table: 4. 4 Summary of response rates for foreign respondents

Questionnaires Numbers	Name of company							Total Number
	Eni Oil	Eni Gas	Repsol	Total	Wintershall	Veba	OMV	
Distributed	7	7	7	7	7	7	7	49
Returned and used	5	5	5	5	5	5	5	35
Not returned	1	1	2	1	2	1	2	10
Excluded	1	1	-	1	-	1	-	4

4.4.1.2.2 Interviews

Miller and Salkind (2002, p. 309) state, an "interview is a personal contact between an interviewer and a respondent, usually in the home or office of the respondent. The interview can range from highly structured situation with a planned series of questions to a very informal talk with no structure except for some areas of discussion desired by the interviewer."

Interviewing is a method of data collection which usually involves questioning and collecting information from people (Kelley, 1999; Blaxter *et al.*, 2001; Wisker, 2001; Hair, Jr *et al.*, 2003; Thomas, 2003; Punch, 2005; Kumar, 2005). It is the most widely applied method for gathering information and collecting large amounts of data very rapidly (Kvale, 1996; Marshall and Rossman, 1999; Kane and O'Reilly-De Brun, 2001; Robson, 2001; Ghauri and Gronhaug, 2002; Miller and Brewer, 2003; Blumberg *et al.*, 2005).

Furthermore, "interviews are associated with both positivist and phenomenological methodologies. They are a method of collecting data in which selected participants are asked questions in order to find out what they do, think or feel. Interviews make it easy to compare answers and may be face-to-face, voice-to-voice or screen-to-screen; conducted with individuals or a group of individuals" (Collis and Hussey, 2003, p. 167). Interviews represent a valuable means of gathering large numbers of facts and amounts of evidence in one, or across many, research positions (Remenyi *et al.*, 1998)

4.4.1.2.2.1 Types of interview

There are several types of interview as an essential method for the data collection. However, this study looks at two main types, which are: structured interviews and unstructured interviews.

4.4.1.2.2.1.1 Structured interviews

Denscombe (1998, p. 112) states that "structured interviews involve tight control over the format of the questions and answers. In essence, the structured interview is like a questionnaire which is administered face to face with a respondent. The researcher has a predetermined list of questions, to which the respondent is invited to offer limited option responses."

Structured interviews are performed when it is known at the beginning what information is required. They are verbally obtainable, with the benefit that there is the chance for the interviewer to interpret questions, clear up misunderstandings, or even collect information from those not completely educated in the designer's language (Black, 1999; Hakim, 2000; Robson, 2001; Sekaran, 2003).

Punch (2005, p. 170) clarifies that "in structured interviews the respondent is asked a series of pre-established questions, with preset response categories. There is a little room for variation in the response, though open-ended questions may sometimes be used. All respondents receive the same questions in the same order, delivered in a standardized manner." Coombes (2001) argues that interviews are a useful research means where direct and uncomplicated data are required and, once the questions are created, they have the added benefit that more than one individual can ask the pre-arranged questions

4.4.1.2.2.1.2 Unstructured interviews

The unstructured interviews are informal and are used to find out a comprehensive area of concern in more detail (Welman *et al.*, 2005). In this type of interview "no questionnaire or checklist is used, but a framework is established by selecting topics on which the interview is guided" (Bell, 2005, p. 161). The interviewer in the unstructured interview usually has only a list of subjects or matters, often named an interview guide, that are normally covered. The method of questioning is generally informal. The manner of speaking and sequencing of questions will differ from interview to interview (Bryman and Bell, 2003). One feature of unstructured interviews is that the matters examined, the questions raised and the issues discovered change from one interview to the next as dissimilar characteristics of the subject are shown (Collis and Hussey, 2003).

It has been argued by Hair, Jr *et al.* (2003, p. 138) that "unstructured interviews are used when research is directed toward an area that is relatively unexplored, by obtaining deeper understanding of critical issues involved, the researcher is in a better position to not only better define the research problem, but to develop a conceptual framework for the research." There are a number of kinds of unstructured interviewing, for instance: in-depth interviewing, focus group interviewing, narratives and oral histories (Kumar, 2005).

Table: 4. 5 Differences between structured and unstructured interviews

	Structured	Unstructured
Purpose	Providing valid and reliable measurements of theoretical concepts	Learning the respondent's viewpoint regarding situations relevant to the broader research problem
Instrument	Questionnaire, i.e. specified set of predefined questions	Memory list Interview guide
Format	Fixed to the initial questionnaire	Flexible, depending on the course of the conversation, follow-up and new questions raised

Source: Blumberg *et al.* (2005, p. 294)

4.4.1.2.2.1.2.1 Rationale for conducting unstructured interviews

After analysing the questionnaire, it was discovered that answers to certain questions were unclear. Therefore, it was decided to carry out unstructured interviews, where more exact information could be obtained. In addition, conducting unstructured interviews would result in a higher response rate since this would ensure that all questions needing to be clarified could subsequently be answered by respondents. Added to this, more communication and interaction between the interviewee and interviewer would allow questions to be explained and answers to be fully understood by the interviewer. This type of interview helped the researcher to obtain very valuable information, as the interviewees could speak freely about their experience and attitudes towards issues related to technology and knowledge transfer to Libya within the oil and gas industry.

Individuals at different levels of the companies surveyed were targeted. Originally, this was to guarantee that any findings were based on data coming from various parties concerned. As indicated by Sekaran (2003); Hair, Jr *et al*. (2003) and Aldridge and Levine (2001), the main objective of unstructured interviews is to enable some initial matters to surface so that the researcher can then decide which variables require additional in-depth examination. Such interviews also allow individuals to express themselves in their own words, focusing their own opinions, preferences and main concerns, rather than those of the researcher. Moreover, unstructured interviews allow the researcher to examine in greater depth issues and problems which arise during such interviews.

In-depth interviews were carried out with several individuals at different levels and positions in the companies. All respondents were guaranteed anonymity and confidentiality both for themselves and for their organizations. To this end, the researcher informed the interviewees that personal information revealed to him would be treated as confidential, and it was explained how such confidentiality would be protected and that no information would be publicly reported that would identify them by name as participants in the study.

The researcher has interviewed nineteen individuals from different departments in the oil and gas companies to achieve in-depth information about technology and knowledge transfer in Libya.

Table 4.6 provides detailed information about the sampling.

Table: 4. 6 Number of interviewees

Name of company	Eni Oil	Eni Gas	Repsol	Total	Wintershall	Veba	OMV	Total Number
Interviewees	3	4	3	3	2	2	2	19

4.4.1.2.2.1.2.2 Time and place of interviews

Before choosing the date and time of the interview, the interviewees were asked about the place in which to be interviewed, as the decision about interview location belongs to the person being interviewed: respondents may feel more comfortable at their own place of work, home or a particular place they like. Respondents were also given the choice of being interviewed individually or together.

Some of the interviews were conducted in an interviewee's workplace, while most of these interviews were held outside the interviewees' workplace, as they preferred to be interviewed outside working hours. Most of the interviews were arranged beforehand so that the interviewee was forewarned and not otherwise engaged. The interviews lasted for between thirty to sixty minutes.

4.4.1.2.2.1.2.3 During the interviews

Before starting the interviews, the main objectives of carrying out the study were outlined and openly explained in a way understandable to the interviewees. Thus, the nature and

purpose of the study, as well as its potential benefits and significance to the company, oil industry, and the country in general, were clearly indicated in brief.

During the interviews, the interviewees were encouraged to answer, having the freedom to express their opinion in any way they liked and without interruptions, as some interviewees were shy and found it difficult to state their ideas, judgment or opinions to individuals from outside their company or persons whom they did not know. However, they were kept to the point on issues of interest to the researcher. In addition, simple language was used and a full and clear explanation of unfamiliar terms was provided when needed.

During the interviews, the researcher spent most of the time in taking notes and recording the interviewee's answers; however, while writing the researcher nodded occasionally to let the interviewees know that the researcher was carefully listening and paying attention. Moreover, in order to comprehend the interview fully, the researcher was engaged intensively not only in what was mentioned, as well as how it was mentioned, but also in what was not said.

During the interview, the questionnaire was used as a guideline to highlight the questions to be asked in more detail. The interviews were dominated by informal discussion, during which the questions were asked by the interviewer in different ways. At the same time, the interviewees were allowed sufficient time to answer the questions asked. Subsequently, the main points of the discussion were written up in order to be included in the project analysis. In each interview, the last question asked was to allow interviewees the opportunity to provide any other information they wished to add to their previous statements, and, before closing the interview, the interviewees were asked if there was anything they regretted saying, any answer they would like to change, as well as their impressions of the interview. Finally, the interviewees were thanked for their time, patience and willingness to take part.

4.4.1.2.2.1.2.4 Transcribing the unstructured interviews

Kvale (2007, p. 92) states that "the interview is an evolving face-to-face conversation between two persons, by transcription the direct face-to-face conversation becomes abstracted and fixed into a written form. Once the interview transcriptions have been made, they tend to be regarded as the solid rock-bottom empirical data of an interview project."

As soon as possible after the interviews, all the interview notes and materials were gathered and written in clear handwriting and eventually translated into the English language otherwise the researcher would not have been confident about what, precisely, had been said in the interview. All of the recorded interviews were transcribed verbatim and the transcriptions were used as the basis for the project analysis.

4.5 Pilot testing

Before finishing any questionnaire completely, it should be sent for pre-testing, whereby feedbacks on a variety of aspects may be obtained. As stated by Robson (2001, p. 254):

> "The draft questionnaire is best pre-tested informally, initially concentrating on individual questions. Colleagues, friends and family can usually be cajoled into reading them through providing constructive comments on wording. Are the questions clear, simple, unambiguous."

The rationale of the pilot test is to purify the questionnaire in order to allow the respondents to answer its questions without any difficulty, as well as to test validity and reliability. Saunders *et al.* (2003) state that pilot testing allows the researcher to gain some evaluation of the validity of the questions and probable reliability of the data that will be gathered. In addition, an initial analysis using the pilot test data can be carried out to make sure that the data gathered will facilitate the answering of the exploratory questions.

A pilot test is carried out to identify limitations in design and instrumentation and to provide alternative data for selection of a probability sample (Cooper and Schindler, 2006). Thus, Punch (2003) identifies three common goals in conducting the pilot testing. Firstly, recently written items and questions need to be tested for understanding and clarity, as well as for respondent uncertainty and difficulty in response. Therefore, questions have to be set in such a way that respondents can easily, quickly and confidently answer them. Secondly, the entire questionnaire needs to be tested for time, length and difficulty in completion. Thirdly, the planned data gathering process itself, of which the questionnaire is the essential element, needs testing. This takes into consideration issues of access and approach, ethical issues, covering letter and any other related aspects.

Both questionnaires were sent for pilot testing in order to acquire some constructive guidance to cope with the shortcomings the questionnaires might have, as well as to check their structure, organisation and question order, and also to make sure that the respondents would have no difficulties in understanding and filling in the questions asked. Bell (1999) confirms that the main reasons for sending questionnaires for pilot testing include: the simplicity of orders; which, if any, questions are ambiguous or uncertain; whether there are any important topic omissions; whether the design is understandable and logical; which, if any, questions the respondent felt uncomfortable about answering; how long the questionnaire took to fill in, and any other related comments.

The questionnaires for this research were designed nearly three months before carrying out the key fieldwork, and were also checked and discussed with the researcher's academic supervisor at Durham University. Subsequently, twenty copies of the questionnaires were distributed to the researcher's friends and also to academics in Durham, Newcastle upon Tyne and other UK cities, in order for the researcher to obtain comments on the representativeness and suitability of the questions, and also to gain some ideas and suggestions regarding the organization and structure of the questionnaires. In the covering letter sent with the questionnaires for pilot testing, the researcher outlined the main objectives in carrying out the study and kindly asked the respondents to make any remarks they wished. Generally, they were asked to check some particular areas, such as, the clarity of instructions, the layout of questions (was the questionnaire clear and attractive; easy to answer?), the time taken to finish answering the questionnaires, and any other remarks and comments they felt were essential to add or remove.

Three weeks were allowed for the return of the tested questionnaires. Fourteen copies out of the twenty which were received included constructive remarks and comments, which allowed the researcher to modify and make improvements to the questionnaires in several areas, such as, design, structure, and the clarity of questions, as the results revealed that some questions were ambiguous or too hard for the respondents to understand, thus, to answer. After collecting the tested questionnaires, the researcher wrote to the respondents a letter of appreciation in order to thank them for the support and assistance they had offered and informing them that their comments and remarks would be taken into consideration.

4.6 Data analysis

After data are acquired via questionnaires, interviews, or via secondary sources, they require to be edited. The empty answers, if any, have to be dealt with in a certain way, the data coded, and a classification plan has to be drawn up. The data will then have to be entered, and a software program should be used to analyze them (Sekaran, 2003).

Analysis means the arranging, ordering, organising and structuring of data to create knowledge (Sharp *et al.*, 2002). Therefore, data analysis normally requires cutting accumulated data to a controllable and manageable amount, developing summaries, trying to find patterns and using statistical techniques (Cavana *et al.*, 2001; Cooper and Schindler, 2003; Blumberg *et al.*, 2005).

- The procedure of analysing data collected from the questionnaires was carried out using the statistical computer software called the Statistical Package of Social Sciences (SPSS). This package is very important and widely used for analysing collected data. This view is supported by Brace *et al.* (2006, p. 2) who state that "SPSS is a widely used computer program designed to aid the statistical analysis of data, particularly data collected in the course of research".

As the researcher had no experience of using the SPSS package before, it was necessary to study several sources related to the package, as well as to look for training courses in order to use this programme effectively. Therefore, the researcher joined a training course (an introduction to SPSS for Windows) organised by the Information Technology Service at Durham University. This course lasted for three days (30, 31 January, and 1 February 2007), and covered numerous topics, such as, defining, entering and editing data, saving and printing data, selecting and running commands from the menus, examining, saving and printing results, creating new variables, and selecting cases.

The researcher entered the data collected from the completed questionnaires into the computer after coding them, as the coding process helped the researcher to sort and organize data. Black (1999) confirms that the coding strategy assists the researcher to sort and store for analysis. Coded data was analysed using SPSS as a simple analytic measure

in the form of descriptive statistics, such as percentages and frequencies. Crosstabulation was also used to display the common distribution and relation of two variables

4.7 Summary

This chapter has sought to raise a number of important issues that surround the research methods used. It began by defining the term "research", indicating that research is the process of discovering and analysing information in order to answer a question about a certain problem. This chapter further discussed quantitative and qualitative research and has shown that quantitative research uses statistical technique programmes and other methods of quantification as tools for obtaining findings and results, while qualitative research depends mainly on the collection of a variety of empirical materials, such as, case study, interviews and personal experience, for its findings and results.

Data are collected from two main sources, secondary and primary. Secondary data are typically historical and their collection does not need the researcher's contact to respondents. Such data can commonly be gathered quickly and might offer information not otherwise obtainable and accessible to the researcher. However, researching secondary sources is multifaceted and demands much effort. Furthermore, secondary data are not intended specifically to meet the researcher's requirements. The researcher must analyse these data for understanding, accuracy, and prejudice. On the other hand, primary data are collected by the researcher as a result of direct contact between the researcher and supplier, via several methods, such as, interviews or questionnaires.

This chapter has looked at the questionnaire and the interview as methods of data collection. It has shown that they are basically means that allow the researcher to bring together data in a consistent, easily analysed, structure. Interviews, in general, enable individuals to express comprehensively and in depth their thoughts and opinions. This chapter has also commented on the use of interviews as a technique for data gathering. It has examined a broad variety of matters involved in the gathering of data via different types of interview. The application, and certain attendant advantages and disadvantages, of a variety of related concepts have been presented in some detail.

The questionnaire is an essential method for data gathering. Excellent questionnaire design is considered as a vital procedure for obtaining excellent research outcomes or results. This chapter has considered some of the most important matters involved in designing a questionnaire. It has been pointed out that the value of the data collected relies greatly on the creation and structure of understandable, logical, explicit and unambiguous questions, those expressing the same meaning to all the respondents targeted. Questions on the questionnaire can be divided into two main forms, open and closed question format. Closed questions ask the respondents to choose from several predetermined options; while open questions ask the respondents to comment on a topic in the space provided, using their own words. Factual questions may be closed questions, whereas questions which look for views may be open-ended.

This chapter has also discussed pilot testing. It has concluded that pilot testing is primarily conducted to discover any shortcomings in the design of the questions. Therefore, in order to assess the validity and the likely reliability of the questions and to make sure that they are written in understandable and clear format, questionnaires should be pilot tested prior to collecting data so that the respondents can answer the questions without facing any difficulty.

Chapter Five

Survey Results on Technology Transfer in the Oil and Gas Industry in Libya

5.1 Introduction

As the study investigated both the provision and its limits when transferring technology and knowledge to the oil and gas industry in Libya, questions were formulated and asked which would facilitate a better understanding of the topic and after acquiring the relevant data, the interview notes were edited and the results of the questionnaires analysed. This chapter examines and puts together all the materials collected regarding technology; it begins with a clear profile of the participant sample and then introduces the term "technology", including its types, benefits, methods of selection, as well as the actual technological provision that was transferred by the foreign partners involved in the oil sector in Libya. Eventually, a summary of the chapter is drawn.

5.2 Profile of respondents

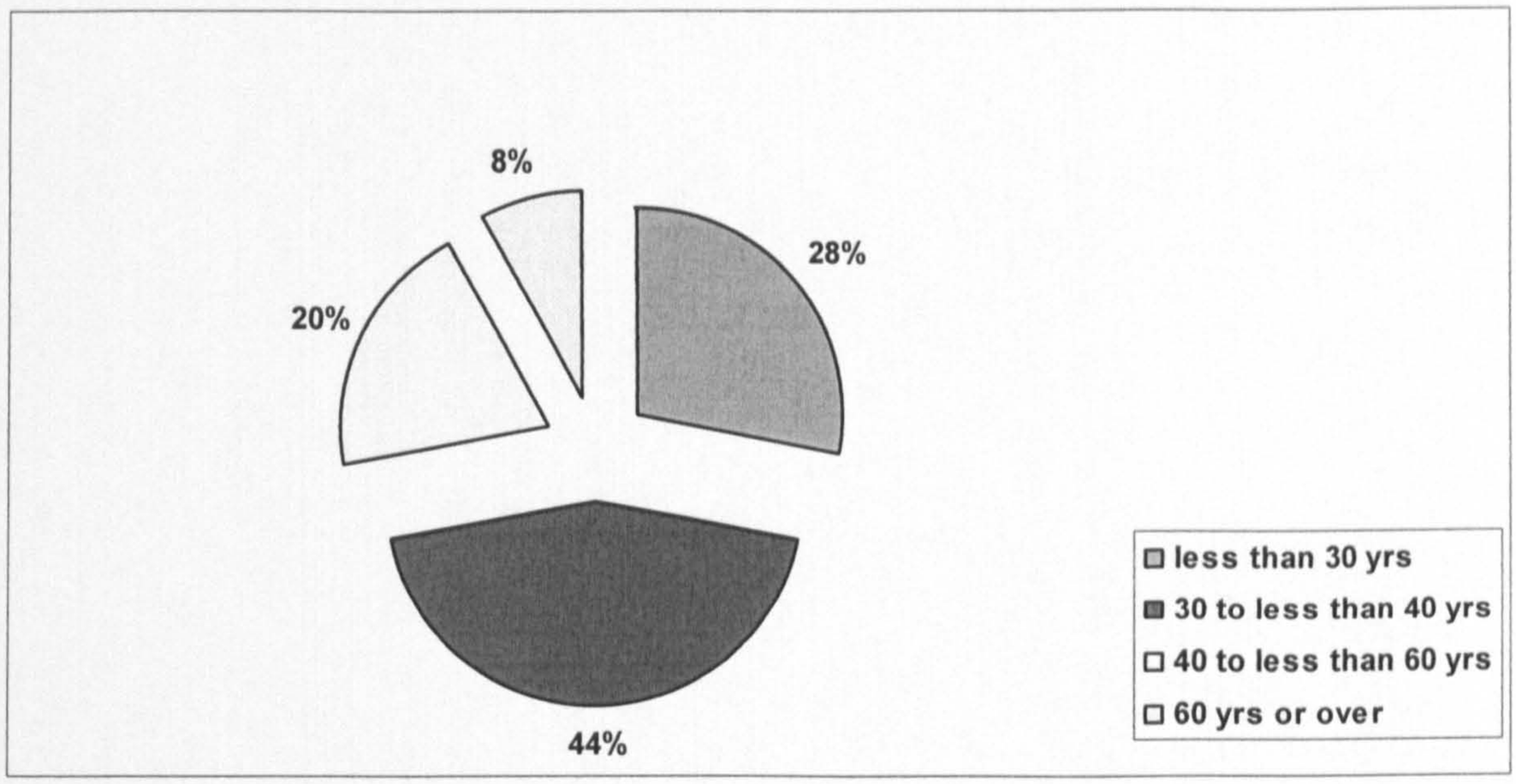
In order to provide a clear idea of the sample surveyed, this section supplies basic information about the Libyan individuals working alongside the foreign partners: their ages, qualifications, sex, and employment positions.

5.2.1 Age and Sex

The age of the respondents involved in this survey ranged from less than 30 years of age to over 60. As can be seen from Figure 5.1, the largest group of participants were from 30 to

less than 40 years old; they constituted about 44 per cent of the total sample. In addition, nearly 28 per cent were less than 30 years old, and 20 per cent were from 40 to less than 60 years old, whereas only 8 per cent of the respondents were over 60.

Figure: 5. 1 Age of respondents

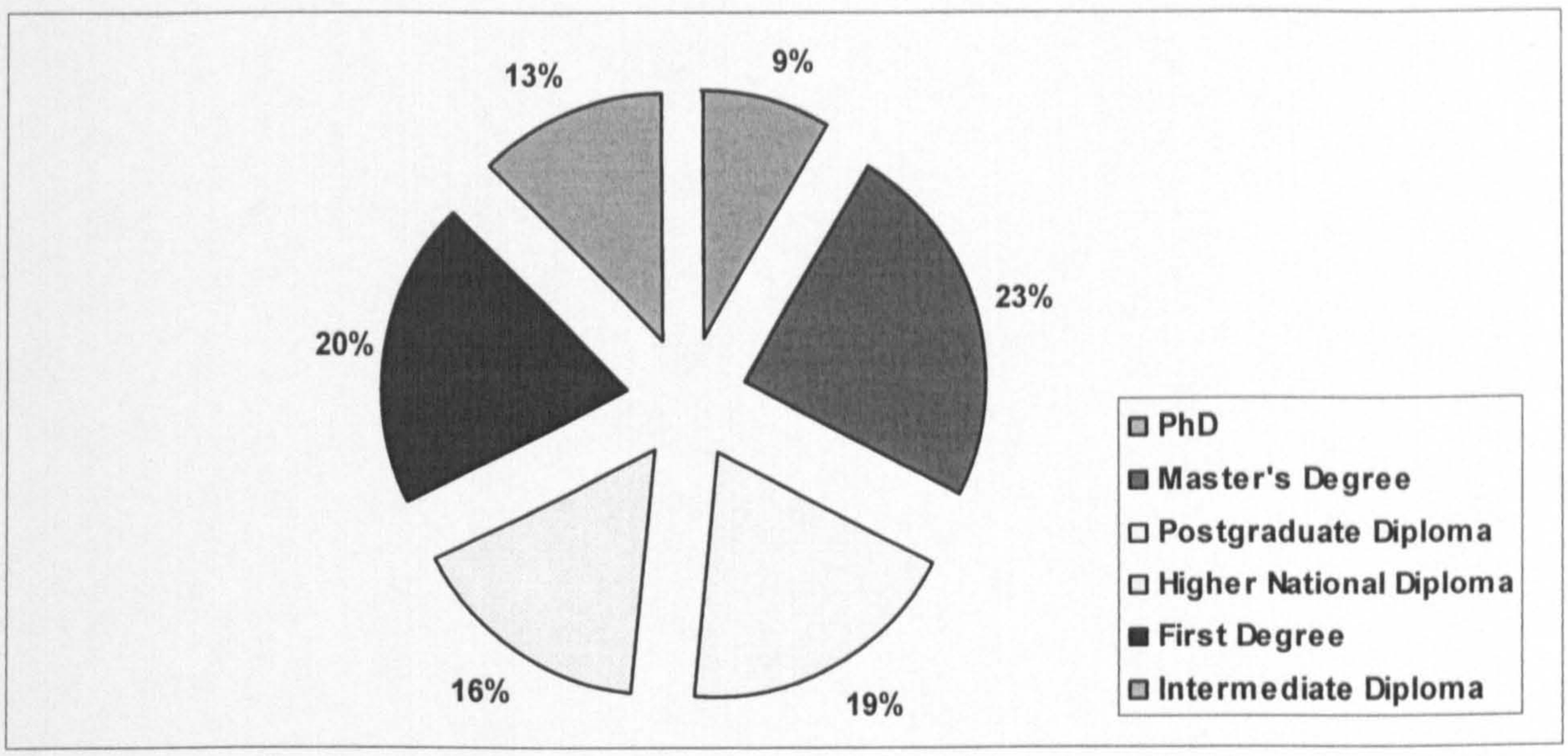


Regarding the sex of the participants, it was unsurprising to discover that the majority of the participants surveyed were male (90 per cent); this was owing to the nature of the oil industry and its requirements, which require individuals to work in the oilfields in addition to other jobs that mostly require males. Only 10 per cent of the participants were female and these were mostly involved in administrative duties.

5.2.2 Qualifications

The respondents to the questionnaires held various qualifications. The majority of those who responded were highly qualified. Master's degree holders came first, at 23 per cent, followed by those with a first degree, either a BSc or BA, at 20 per cent of the total sample. Then came, respectively, postgraduate diploma at 19 per cent, higher national diploma at 16 per cent, intermediate diploma at 13 per cent, and at, only 9 per cent, PhD holders. Figure 5.2 presents the qualifications held by the respondents.

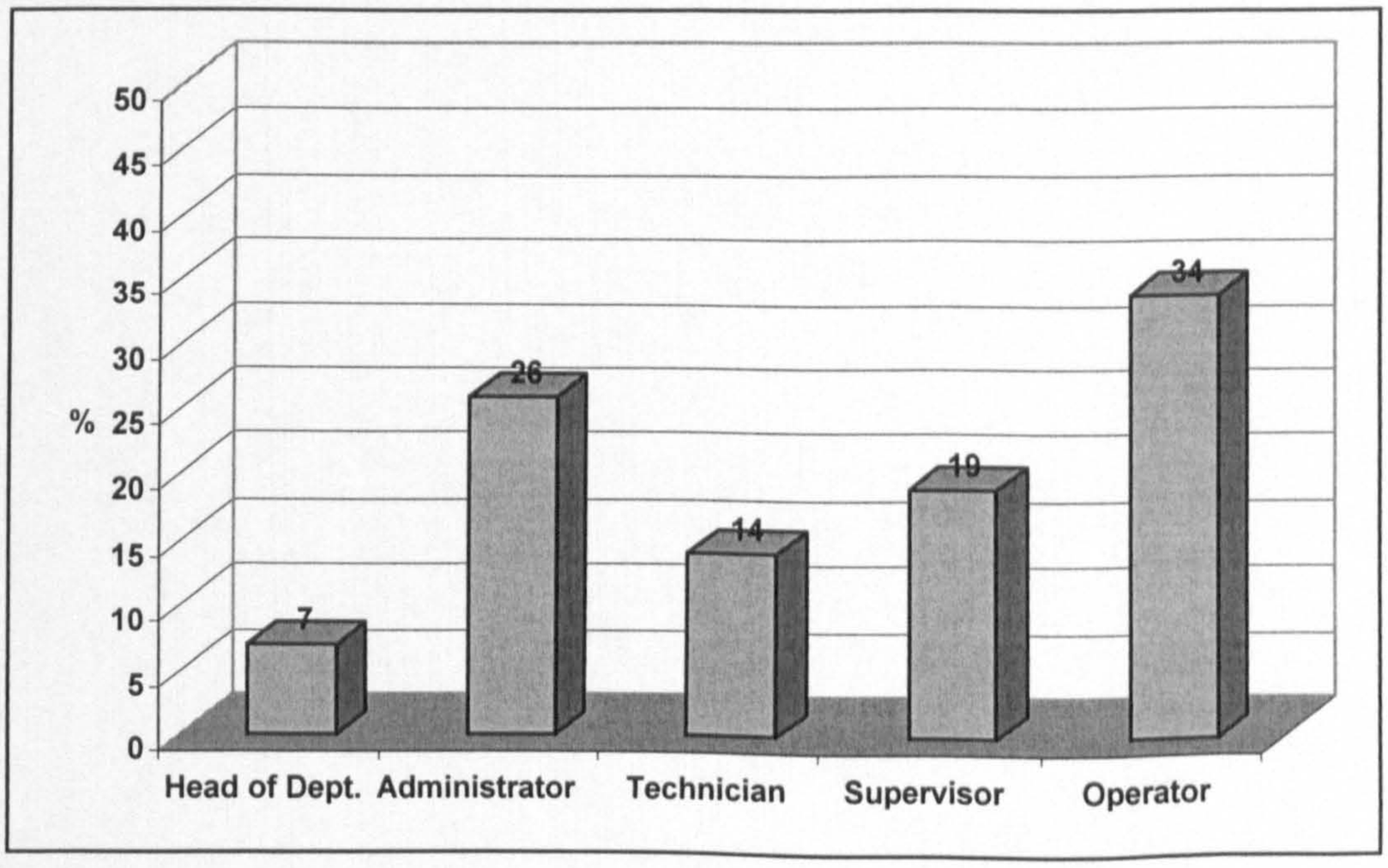
Figure: 5. 2 Qualifications of respondents



5.2.3 Employment positions

The questionnaires were targeted at a variety of individuals and levels. Nearly 34 per cent of the sample surveyed were operators, while 26 per cent were administrators, 14 per cent were technicians, 7 per cent were working in the post of Head of Department, and 19 per cent of the total participants were supervisors. Figure 5.3 shows the employment positions of respondents.

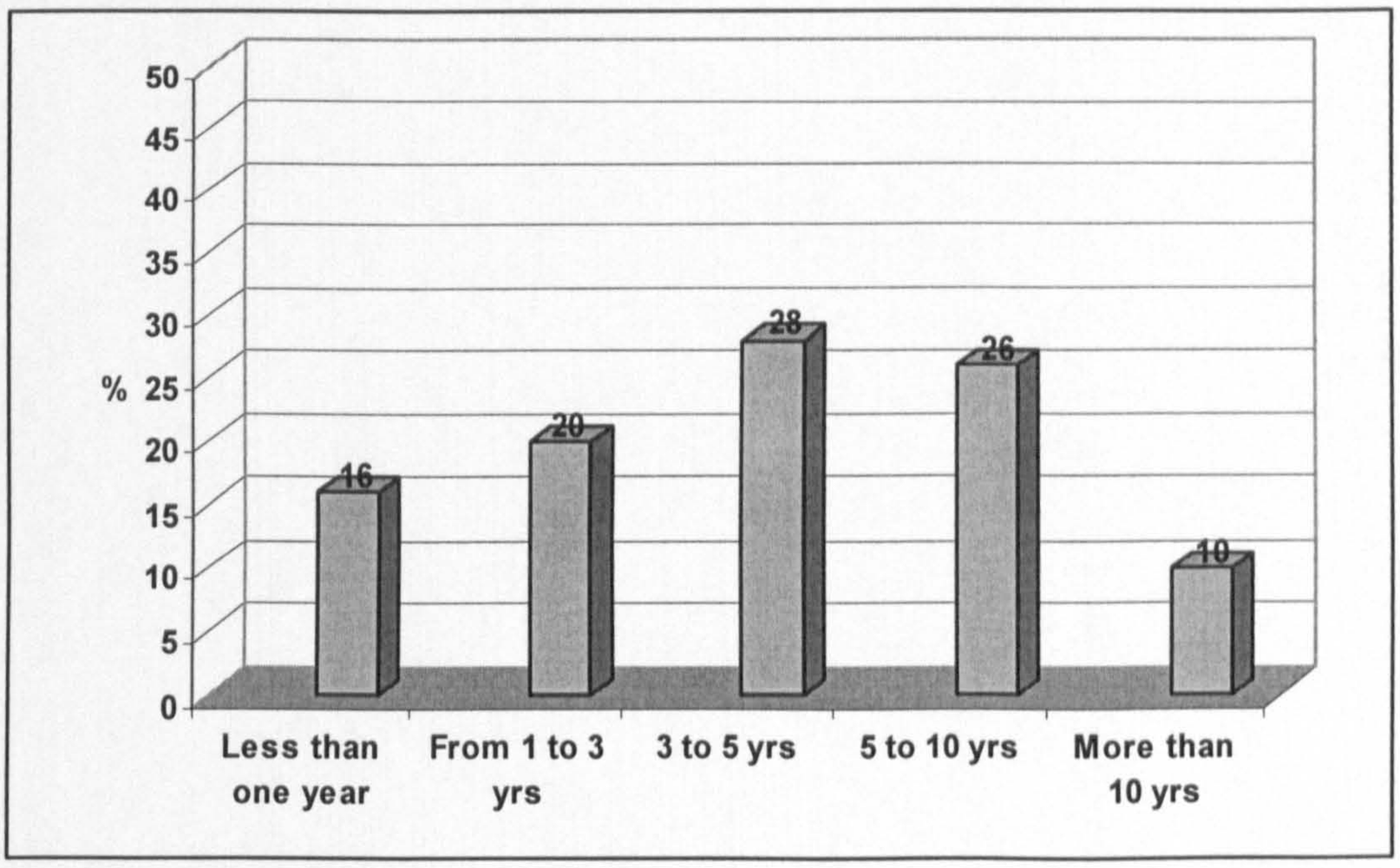
Figure: 5. 3 Employment positions of respondents



5.2.4 Work experience

With respect to how long respondents had worked for companies, this varied from less than one year to more than ten years. Respondents with three to five years of work experience predominated in this survey, being almost 28 per cent of the total number, whereas about 26 per cent had worked for their companies from five to ten years, respondents having from one to three years work experience coming third, at 20 per cent of the total surveyed. Then came, respectively, 16 per cent who had less than one year of experience, and 10 per cent who had more than ten years of work experience with their companies. Figure 5.4 below indicates the work experience of respondents.

Figure: 5. 4 Years of experience

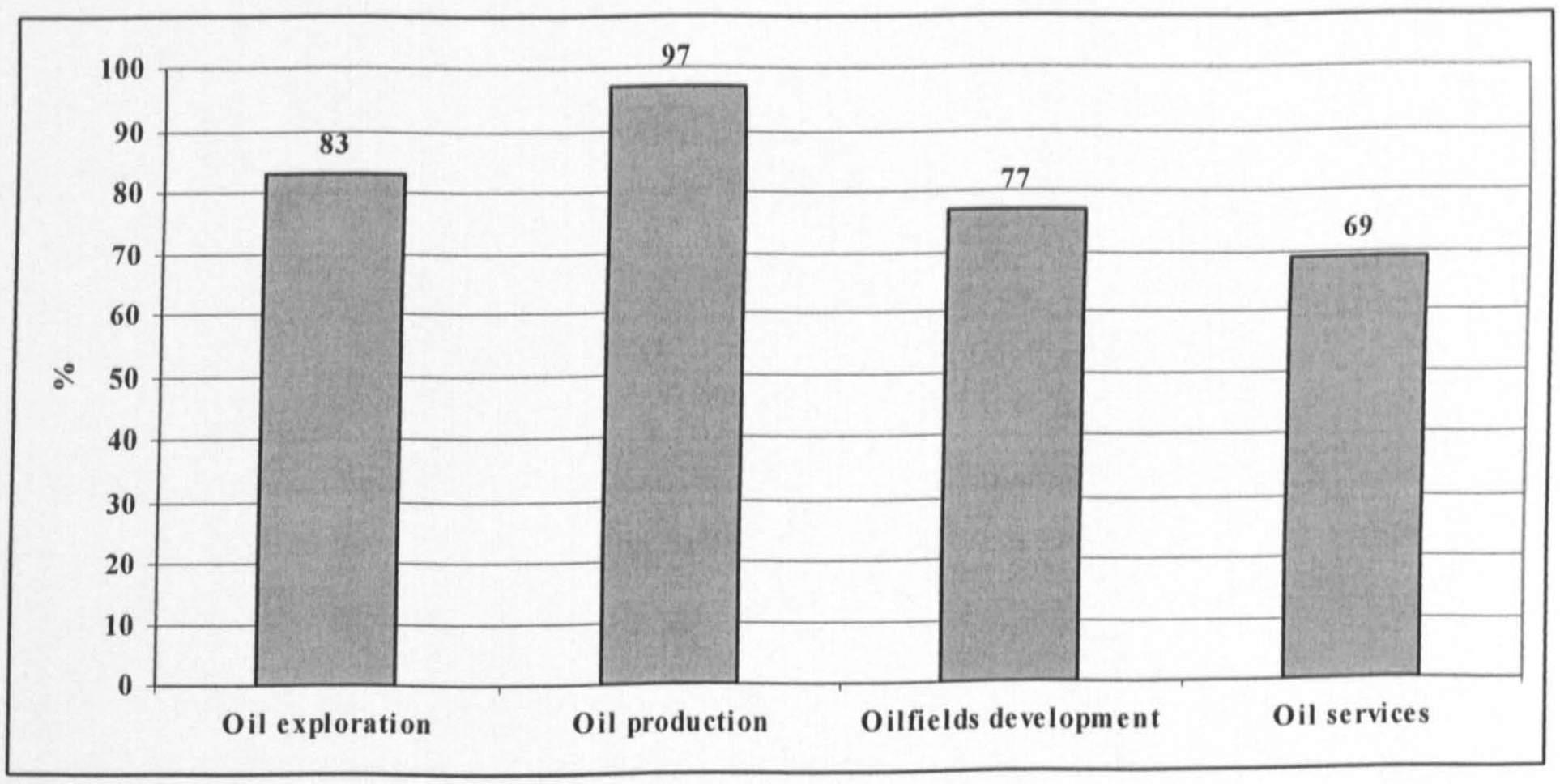


5.3 Type of investment

There are many foreign companies working for the oil industry in Libya in various capacities. Their activities include oil exploration and production, oilfields development and oil services. In this survey, foreign participants were asked to determine the main activities in which their companies were involved with their local Libyan partner. Four options were given, and respondents were asked to choose more than one option if applicable. The findings showed that the vast majority of the respondents (97 per cent) indicated that their companies were mainly involved in oil production, whereas around 83 per cent declared their companies' involvement in oil exploration. Oilfields development

came third with almost 77 per cent, and, finally, 69 per cent of the respondents revealed that their companies were engaged in oil services.

Figure: 5. 5 Type of investment



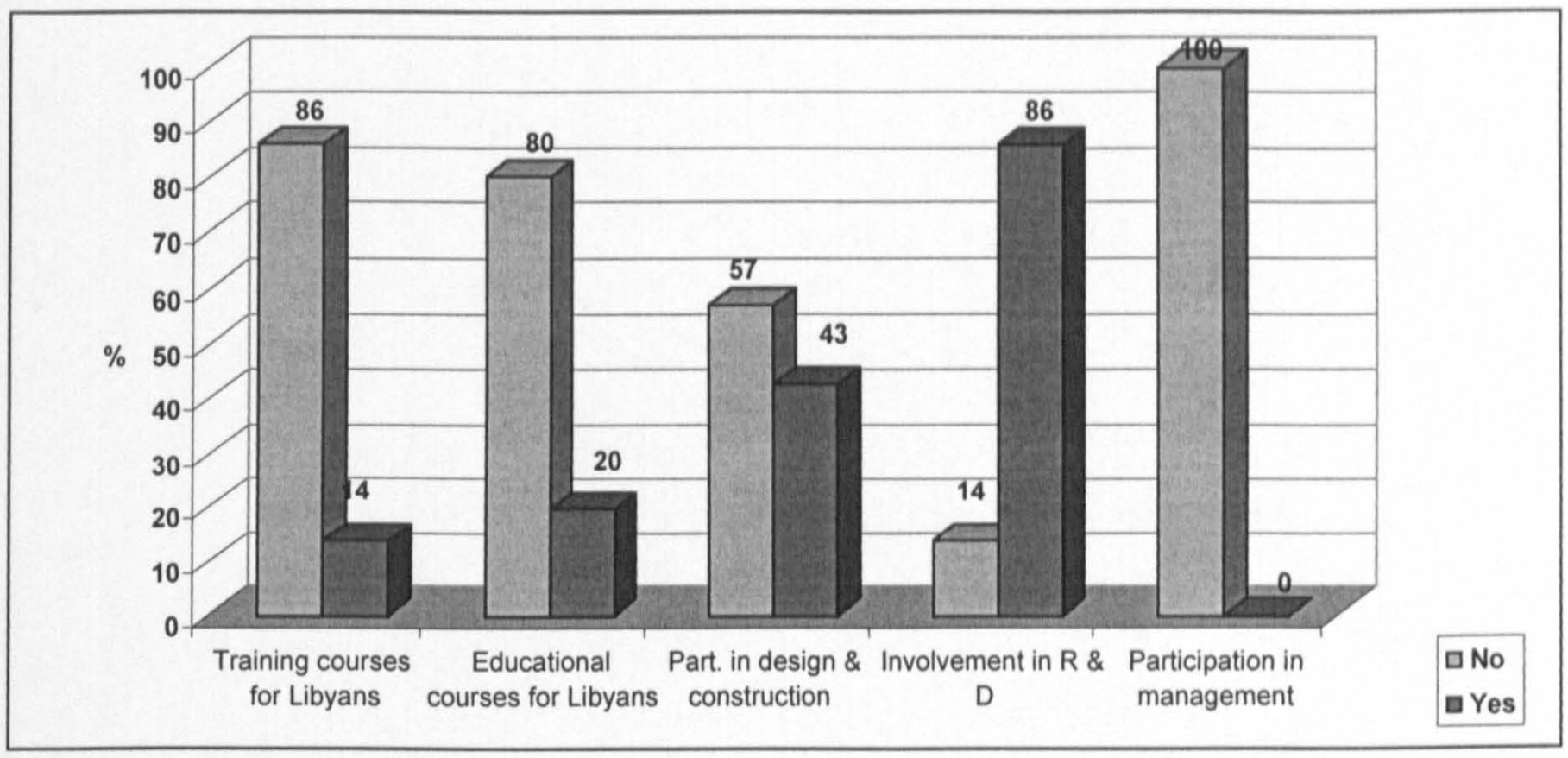
It can be seen from the above results that most of the companies surveyed were usually involved in more than one activity in Libya, oil production being the main activity, with one or two other activities besides.

5.4 Joint venture agreements

A joint venture agreement is an arrangement by which two or more companies join forces to develop one particular project or product. It could be thought of as a "partnership" that exists only for this one project. All parties involved preserve their separate sphere of activity and financial identity. Joint ventures are often co-operations between a local and foreign partner and, hence, they are common in the oil and gas industry in Libya owing to the benefits and advantages the country gains from following this mode.

This survey asked the foreign participants to state if there was any article in the joint venture agreement with the local partner which obligated their companies to provide certain services to the Libyan partner. Respondents had to answer with either Yes or No on each element questioned.

Figure: 5. 6 Joint venture agreement obligations



The first question concerned training courses for Libyan personnel. The result showed that nearly 86 per cent of the respondents revealed that there was no article in the joint venture agreement with the Libyan partner which obligated their companies to provide training courses for the local personnel. However, only 14 per cent of the respondents indicated that there were such articles.

The second question was asked to find out about the educational courses provided for the Libyan personnel (usually for a long period). Approximately 80 per cent of the respondents stated that there was no article in the joint ventures agreement with the local partner which obligated their companies to provide educational courses for the Libyan personnel, compared with about 20 per cent who revealed that there was such an article.

The third question was posed in order to discover any obligation in the agreement regarding local participation in design and construction. Almost 57 per cent of the respondents reported that there was no such article in the joint venture agreement with the local partner, while 43 per cent indicated that there was such an article in their joint venture agreement.

The fourth question was to ascertain whether there was any obligation in the agreement regarding local involvement in research and development. As a result, nearly 86 per cent of the participants revealed that there was a clear article in the joint venture agreement with

the local partner which obligated their companies to allow the local personnel to participate in research and development. Thus, a mere 14 per cent indicated that there was no such article concerning the involvement of locals in research and development.

The final question was asked to discover any obligation in the joint venture agreements regarding local participation in management. The findings showed that all the respondents (100 per cent) indicated that there was no clear article obligating local participation in management.

5.5 Research and Development (R & D)

Research and development plays a crucial role in any technology transfer. R & D is defined by the Frascati Manual, OECD as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including the knowledge of man, culture and society, and the use of this stock knowledge to devise new applications" (Persaud *et al*, 2003, p. 1002).

Foreign respondents were asked whether their companies had their own research and development department and, if they had so, whether they had any relations with the Libyan research institutions. The findings revealed that about 86 per cent of the participants indicated that their companies had their own research and development department, whereas 14 per cent of the respondents believed that their companies did not have their own research and development department in Libya. When the researcher asked the interviewees whether their companies had any relations with any research centres in the country, most of the informants mentioned that their companies had relations with the Petroleum Research Centre (PRC), which is the technical and social development arm of the National Oil Corporation of Libya (NOC). On the technical side, this centre offers research and development in both upstream and downstream activities within the oil sector. It also concentrates heavily on the development of human resources. The PRC also has good facilities with regard to laboratory technology and equipment.

5.6 Technology

Technology can be viewed by Miles (1995, p.3) as:

> "The means by which we apply our understanding of the natural world to the solution of practical problems. It is a combination of "hardware" (buildings, plant and equipment) and "software" (skills, knowledge and experience together with suitable organizational and institutional arrangements). Technology must be applied and maintained, which implies a demand for a further input of a suitable range of human resources and skills. It is this latter input that is at the root of the difficulty in transferring technologies between different environments."

This section aims to collect data regarding technology. It attempts to find out more about its benefits; types; sources; selection; accessibility; and areas of transfer into the Libyan oil industry.

5.6.1 Benefits of technology transfer

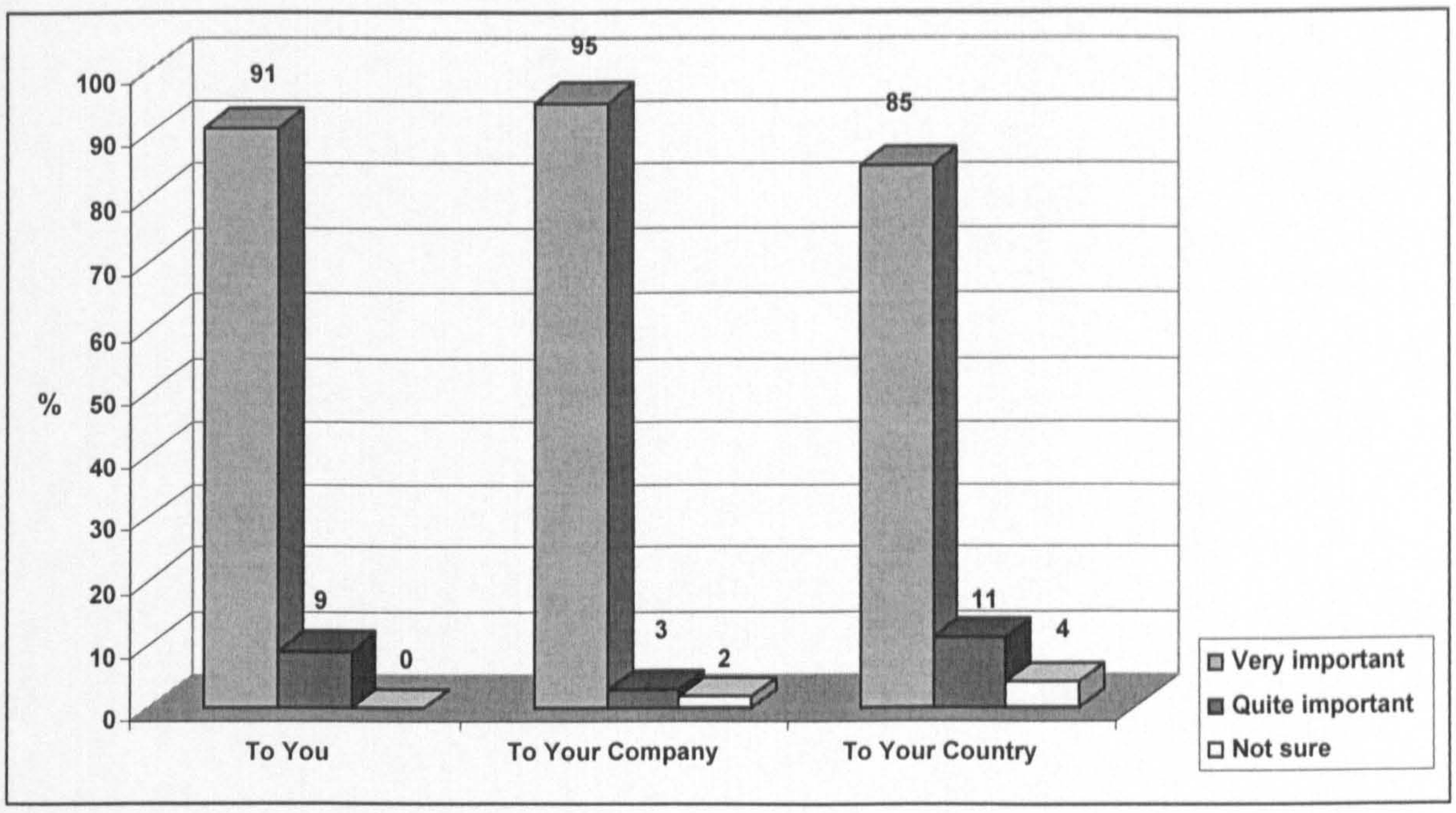
Technology has numerous benefits. Libyan respondents were asked to comment on the benefits of technology transfer, firstly, to them personally; secondly, to the company they worked for; and, finally, to their country. They were given five options (very important, quite important, not too important, not at all important, and not sure).

The findings of this study revealed that the vast majority of the participants (95 per cent) considered that the benefits of technology transfer were very important to the company, whereas about 3 per cent stated that they were quite important and only 2 per cent of the respondents were not sure about such benefits.

Regarding the benefits of technology transfer to the country, the results showed that around 85 per cent of the respondents believed that such benefits were very important, while almost 11 per cent claimed they were quite important, and only 4 per cent of the participants were not sure about the benefits of technology transfer to their companies.

With respect to the benefits of technology transfer to the individual working for the company, it was discovered that close to 91 per cent of the respondents considered these were very important, compared with almost 9 per cent who indicated they were quite important to the individual. Figure 5.7 summarises these benefits of technology transfer.

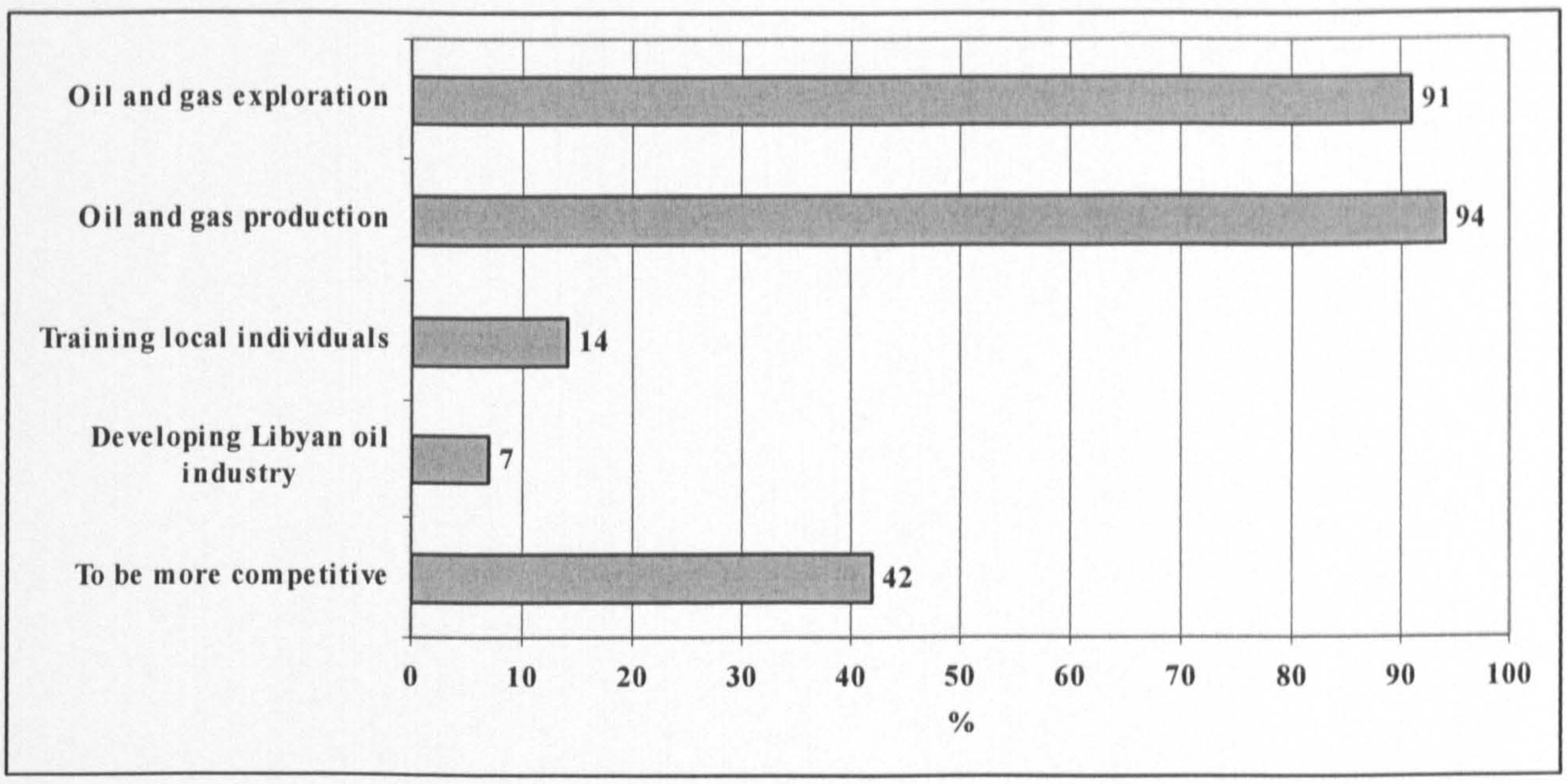
Figure: 5. 7 Benefits of technology transfer



5.6.2 Reasons for bringing technology

Technology increases the efforts of individuals to create knowledge, which, in turn, can help in achieving innovation; it is also useful because it makes faster and easier the recovery of knowledge. In this survey, Libyan participants were asked to indicate the reasons they thought their foreign partners had for bringing in technology. The survey gave five reasons for bringing foreign technology to the oil sector in Libya. These were: to be used for oil and gas exploration, to be used for oil and gas production, to be used for the training of Libyan personnel, to help in developing the infrastructure of the Libyan oil sector, and to be more competitive. The respondents were asked to tick more than one choice if applicable.

Figure: 5. 8 Reasons for bringing technology



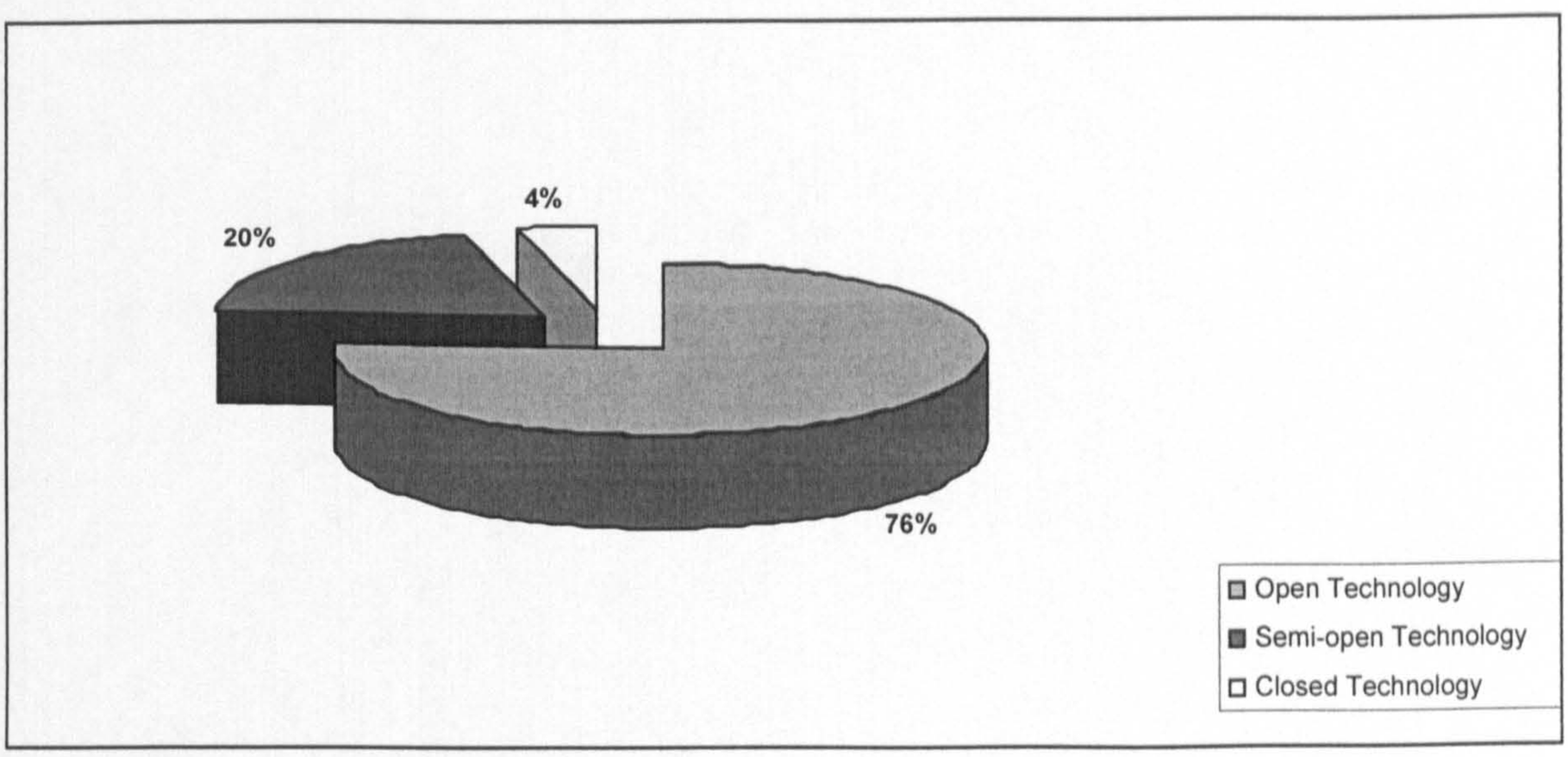
The above figure (5.8) shows that the majority of the respondents (94 per cent) believed that the main reason for bringing technology was to use it for oil and gas production, while about 91 per cent believed that it was to be used for oil and gas exploration. However, nearly 42 per cent of the respondents reported that their foreign partner brought technology in order to be more competitive. On the other hand, only approximately 14 per cent indicated that it was to be used for the training of Libyan personnel, and a mere 7 per cent of respondents thought that their foreign partner had brought technology so that it could help in developing the infrastructure of the Libyan oil sector.

5.6.3 Type of technology

As has been indicated in Chapter Two, technology can be divided into three main types: open technology; semi-open technology, and closed or secret technology. Open technology refers to published technological theories, such as scientific articles, as well as conferences, technical training courses, and the like. Semi-open technology refers to patented technology where permission is needed for the inventions to be seen, after some essential parts have been kept secret, while closed technology means the technologies which are unpublished and highly protected by security rules and measures.

Libyan respondents were asked to state the type of technology which they thought was usually brought by their foreign partners. They had to choose only one type from those above-mentioned types. The findings showed that nearly three quarters of the respondents (76 per cent) indicated that their foreign partner transferred open technology, while 20 per cent believed that semi-open technology was usually brought by their foreign partner. However, only 4 per cent of the participants stated that their foreign partner brought closed technology. Figure 5.9 presents the main types of technology brought.

Figure: 5. 9 Types of technology brought



When the researcher discussed this question with the interviewees, most of them agreed that their foreign partners usually transferred open technology, and they confirmed that their partners often brought the technology that could be shared and that was available to everybody in the company, not that type of technology which had certain elements that their partners had the right to keep secret. Moreover, most of the interviewees indicated that their foreign companies usually provided and equipped specialised libraries, which contained most of the technical material needed for maintenance and for solving certain problems, such as, manuals, books and other types of material.

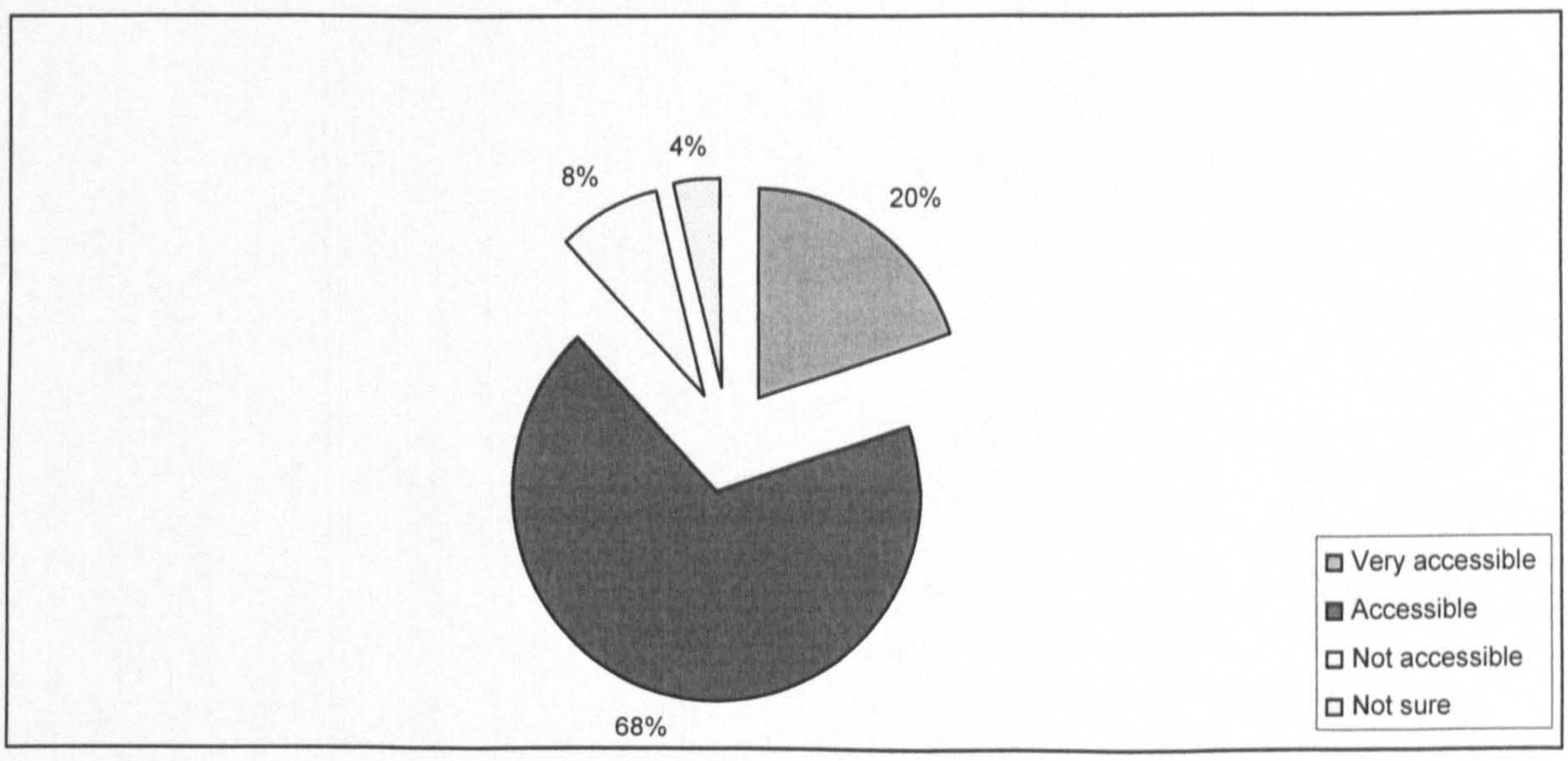
5.6.4 Technology accessibility

Accessibility to technology leads to ease in acquiring what is transferred. Libyan respondents were asked to describe the accessibility to technology. Was the technology

brought accessible? Four options were given (very accessible, accessible, not accessible, and not sure). They were allowed to tick only one choice.

The results showed that over two thirds of the respondents, 68 per cent, felt that technology was accessible, whereas 20 per cent stated that it was very accessible. As indicated by the informants, most of the foreign companies usually prepared reports on certain technical topics and these topics were then inserted into the companies' data bases where they were available and accessible to everybody in the company. These were in addition to the available internal networks and documentation of the workflow process that allowed accessibility to all individuals in the company. On the other hand, about 8 per cent of the participants indicated that technology was not accessible and only 4 per cent were not sure about its accessibility. The following figure (5.10) presents the accessibility of technology.

Figure: 5. 10 Accessibility of technology

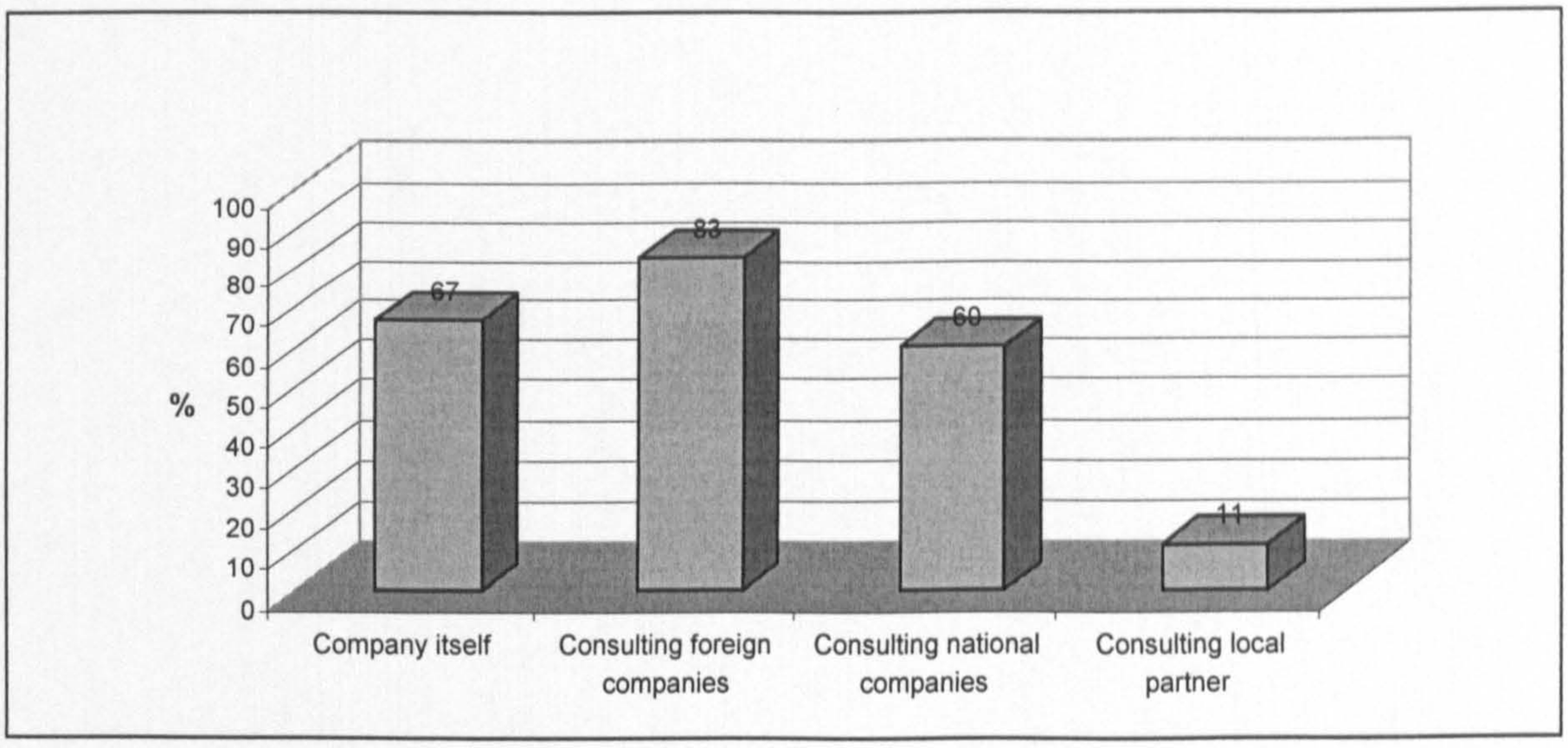


On the other hand, Libyan participants were also asked to state if their foreign partner distinguished between the technology that should be centrally controlled and the technology that anyone should be free to use. An analysis of these replies revealed that almost 59 per cent of the respondents confirmed that there was a distinction between these technologies. Only 8 per cent of the participants did not notice any difference at all, while 33 per cent were not sure whether their foreign partner distinguished between the technology that should be centrally controlled and the technology that anyone should be free to use.

5.6.5 Technology selection

The selection of technology brought can be a difficult issue. Foreign respondents were asked to comment on how technology was selected. In this survey, they were given four options regarding methods of technology selection (by the company itself, by consulting foreign companies, by consulting national companies, or by consulting local partner). They were asked to tick more than one choice if applicable.

Figure: 5. 11 Selection of technology



As can be seen from Figure 5.11 above, about 83 per cent of the respondents reported that their companies consulted foreign companies when they needed to select and bring in technology, whereas 67 per cent believed that they asked their own companies when they needed to select and bring in technology, and almost 60 per cent did so by consulting national companies, as there were several national oil companies working in the same industry, thus, foreign partners sometimes asked the companies to provide them with the required technology as it was an easier and cheaper mode of supply. However, only 11 per cent of the respondents indicated that their companies consulted local partners when they needed to select and bring in technology.

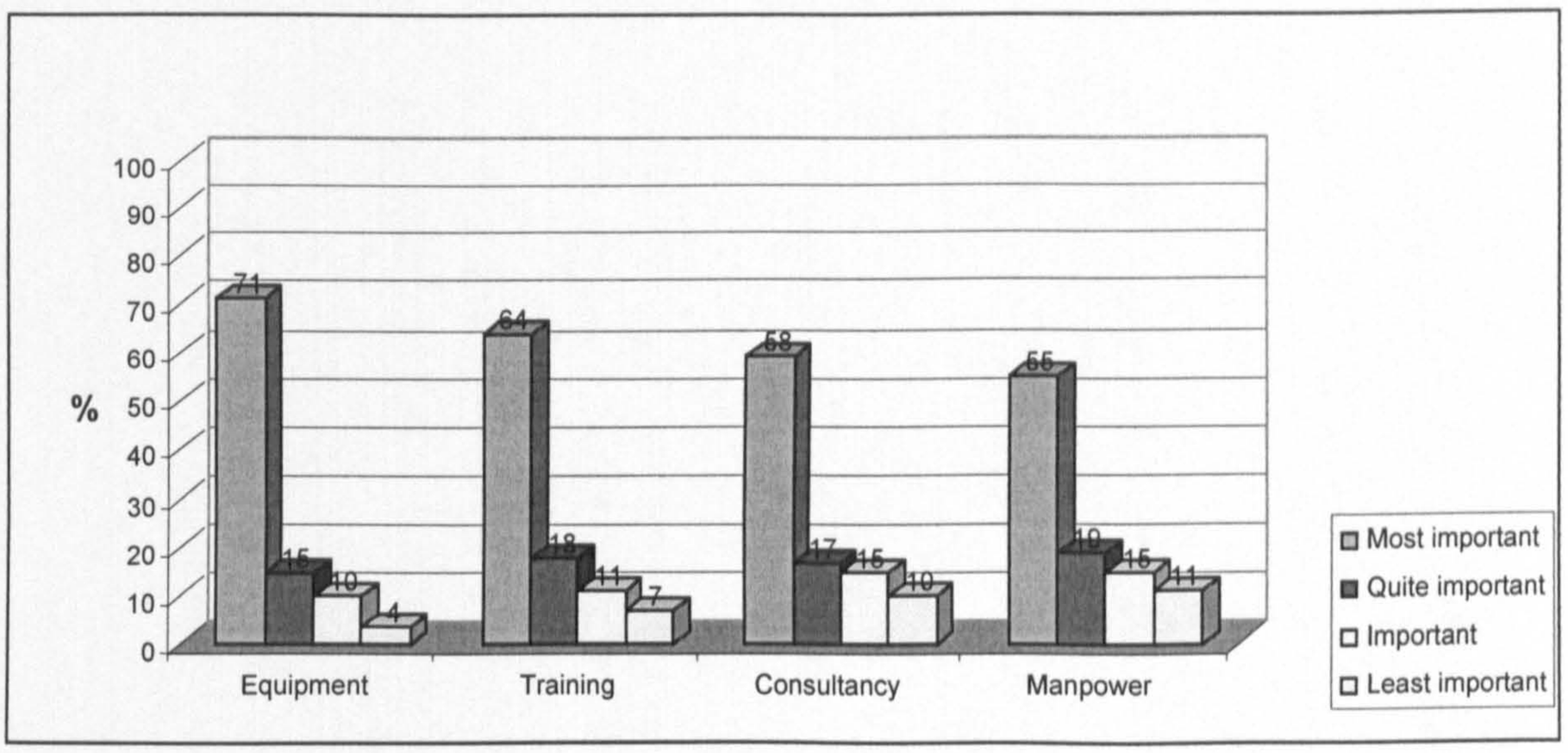
Furthermore, the results from the interviews revealed that most of the foreign companies did not consult their local partner, which was mainly the National Oil Corporation (NOC), when they needed to bring in technology; they directly contacted their headquarters when

they needed it, because they knew exactly what they wanted and, consequently, worked on providing what was required and transferred it to their branches in Libya.

5.6.6 Sources of technology

There are several sources of technology. In this survey, four sources of technology were given (equipment, training, consultancy, and manpower). National respondents were asked to rate each source from 1 – 4, where 1= most important, 2= quite important, 3= important, and 4= least important).

Figure: 5. 12 Sources of technology



The findings revealed that equipment, which, in general, means all the machines, materials, tools, etcetera needed for a purpose or to carry out a particular task or activity, was considered as the essential source of technology. Close to 71 per cent of the respondents indicated equipment as being the most important source of technology, while 15 per cent considered it as quite important, and 10 per cent as an important source. However, only 4 per cent of the respondents acknowledged equipment as the least important source of technology in their companies. Individuals interviewed reported that before bringing new equipment, the companies had sent individuals, either externally or internally, to be trained on the forthcoming equipment so that when it arrived the individuals concerned could use it easily and also carry out any necessary maintenance and repair operations.

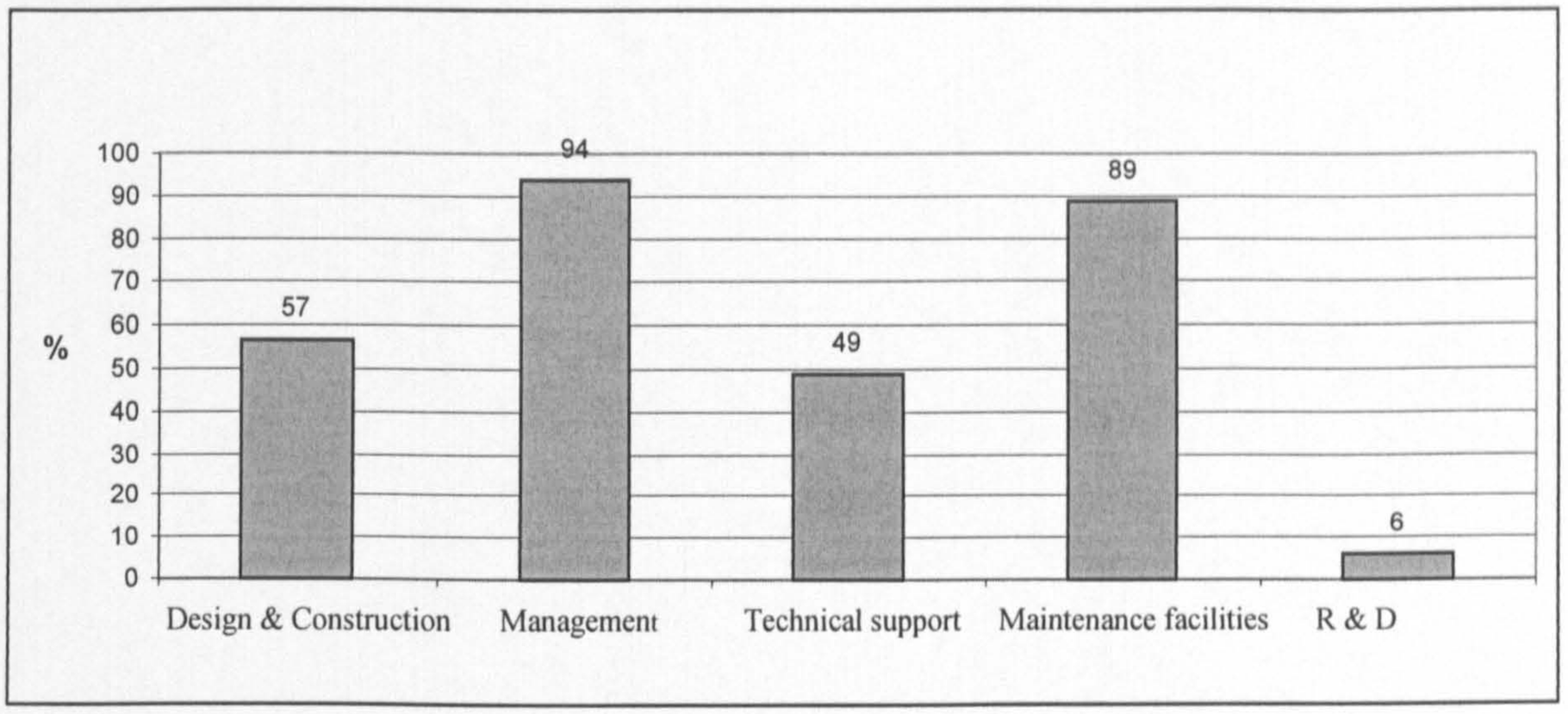
As can be seen from Figure 5.12, training came in the second place as a vital source of technology, with about 64 per cent of the respondents considering it as the most important source of technology in their companies. Nearly 18 per cent of the participants confirmed that it was quite important, while 11 per cent indicated that it was important. On the other hand, around 7 per cent revealed that training was the least important source of technology in their company.

Consultancy came next, with almost 58 per cent of the total respondents noting that it was the most important source of technology, while 17 per cent believed it was quite important, and 15 per cent indicated that it was important. However, 10 per cent of the participants revealed that they considered consultancy was the least important source of technology in their companies. Finally came manpower, with approximately 55 per cent of the respondents indicating that it was the most important source of technology, whereas 19 per cent believed it was quite important, while 15 per cent indicated that it was important. However, 11 per cent of the participants confirmed that manpower was the least important source of technology in their companies.

5.6.7 Areas of technology transferred

It is believed that foreign companies rarely transfer all the technology owned unless it is absolutely necessary and in certain areas. Therefore, in the survey, the foreign respondents were given five areas of transferred technology. These were: design and construction techniques, provision of management techniques, technical support, maintenance facilities, and research and development. The participants were asked to select more than one of the areas if applicable.

Figure: 5. 13 Areas of technology transferred



As Figure 5.13 shows, the vast majority of the sample surveyed (94 per cent) indicated that the provision of management techniques was frequently transferred, as the joint venture agreements entitled the local partner's personnel to participate in management as its success meant company success. Provision of maintenance facilities came in the second place, with 89 per cent of the total sample surveyed. In addition, more than half of the respondents, 57 per cent, pointed out that their companies were involved in transferring the techniques of design and construction to their local partner. Moreover, nearly half of the respondents, 49 per cent, confirmed that their companies transferred necessary technical support. Unsurprisingly, only 6 per cent revealed that their companies transferred research and development to their local partner. This is because most of the foreign companies want to keep the essential parts of their work secret; hence, they are often reluctant to provide research and development.

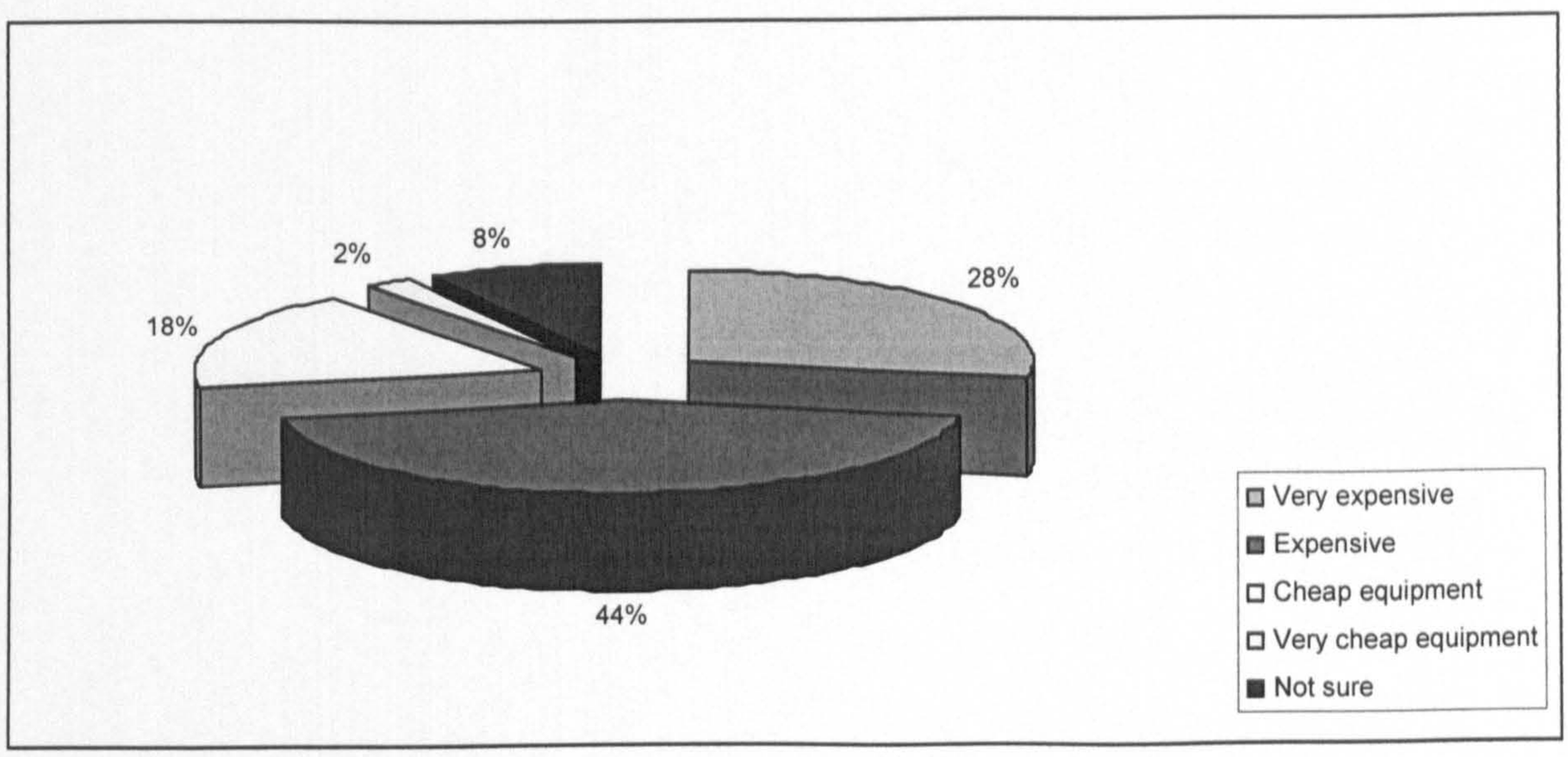
5.7 Equipment

Equipment is a very important source of technology, as was confirmed by 71 per cent of the respondents. In general, it includes all the machines, materials, tools, etcetera needed for a purpose or to carry out a particular task or activity. This section attempts to find out more about equipment, such as its cost; reliability; complexity; modification if needed; as well as its acquisition and usage.

5.7.1 Cost of equipment

Technology can be expensive or cheap depending on its features and specifications. Libyan respondents were asked about the cost of the equipment brought by their foreign partner. They were given five options, and allowed to tick only one option. The findings showed that about 44 per cent of the respondents indicated that the equipment brought was expensive, while 28 per cent confirmed that it was very expensive equipment. Compared with this, almost 18 per cent of the participants stated that it was cheap equipment, whereas, 8 per cent were not sure about the cost of transferred technology. Figure 5.14 below shows the cost of technology brought.

Figure: 5. 14 Cost of equipment



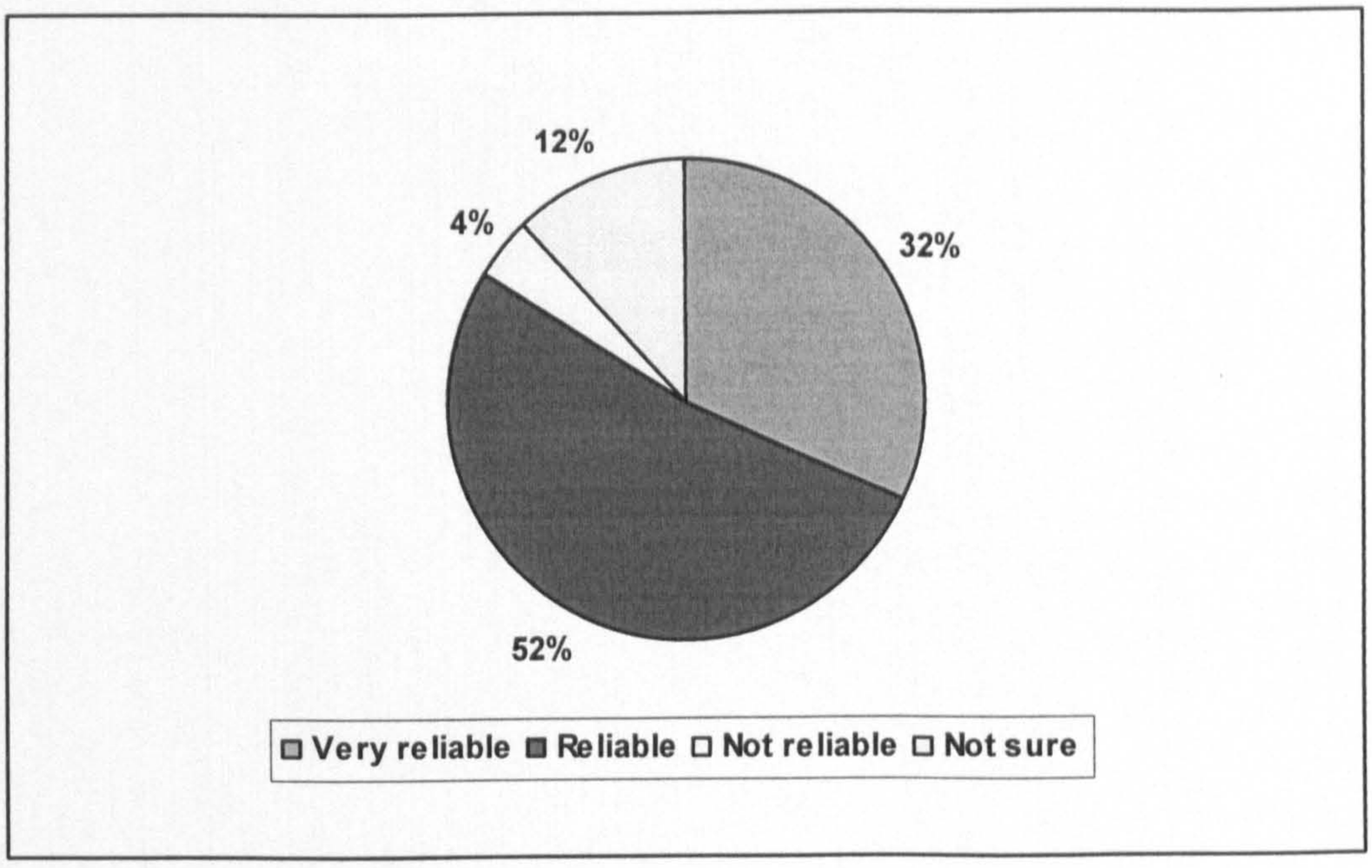
An interesting finding which arose from the interviews was that most of the interviewees indicated that their foreign partners often transfer either expensive or very expensive equipment because they believe that if they transferred cheap equipment, it might easily break down and this could lead to delay and the postponing of work. Accordingly, foreign partners are keen to transfer expensive and reliable equipment and, in most cases, they transfer them with spare parts in order to prevent any delay which might occur in the operations and production processes.

5.7.2 Reliability of equipment

Local respondents were asked about the reliability of the equipment brought. They were given four options, and allowed to tick only one option. The findings indicated that about

52 per cent of the respondents confirmed that the equipment was reliable, while 32 per cent acknowledged that it was very reliable. On the other hand, nearly 4 per cent revealed that the equipment brought was not reliable, whereas 12 per cent of the respondents were not sure about its reliability. Figure 5.15 below presents the reliability of technology.

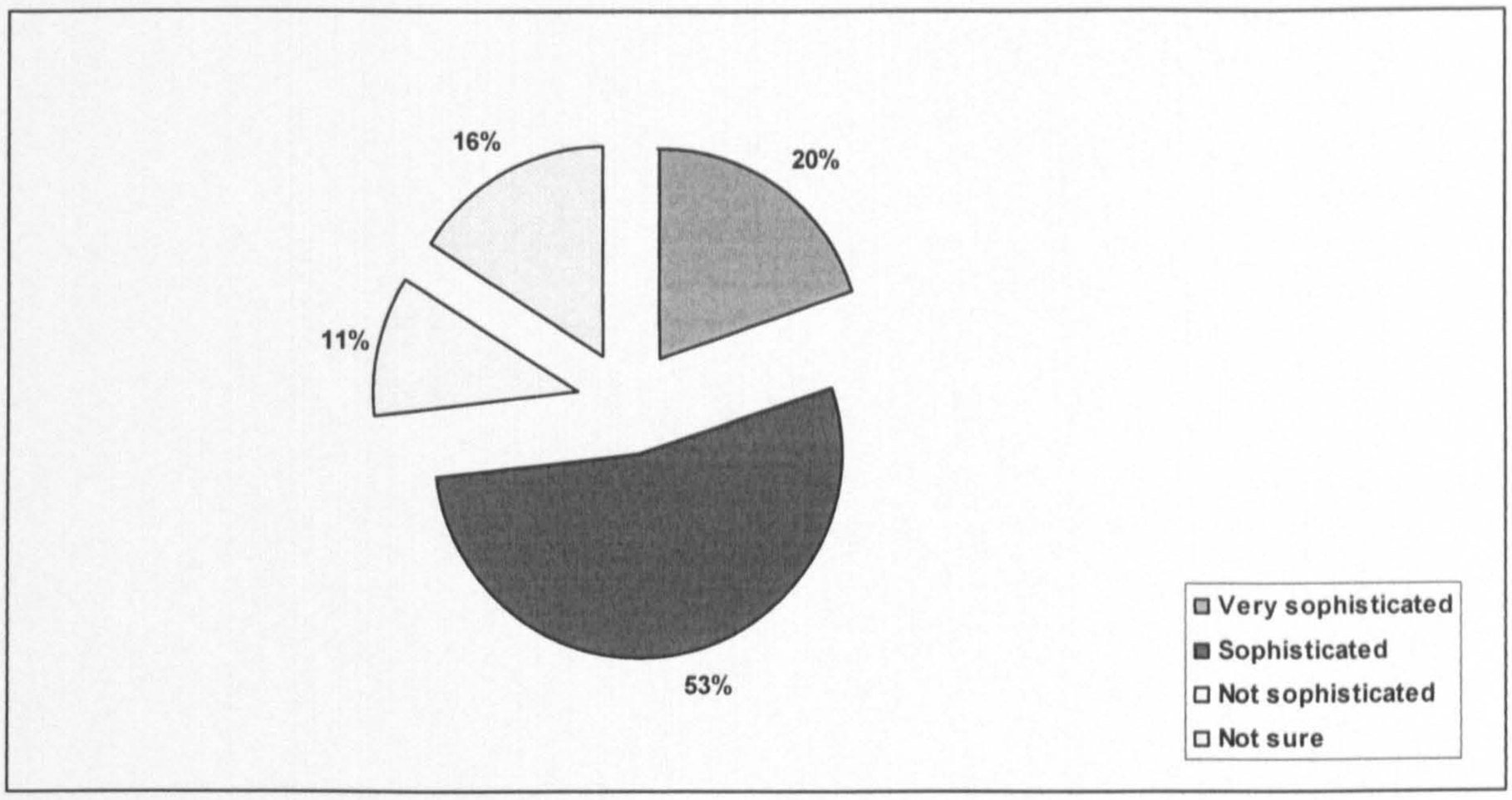
Figure: 5. 15 Reliability of technology



5.7.3 Sophistication of equipment

Regarding the sophistication of transferred equipment, in this survey, national respondents were asked to provide information regarding the use of equipment, and the level of sophistication of equipment brought by their foreign partner. They were given four options, and allowed to tick only one option. Findings revealed that almost 53 per cent of the respondents considered the equipment to be sophisticated, while 20 per cent believed that it was very sophisticated. However, about 11 per cent stated that the equipment was not sophisticated, whereas 16 per cent of the respondents stated that they were not sure about the level of sophistication. Figure 5.16 indicates the complexity of the transferred equipment.

Figure: 5. 16 Complexity of equipment

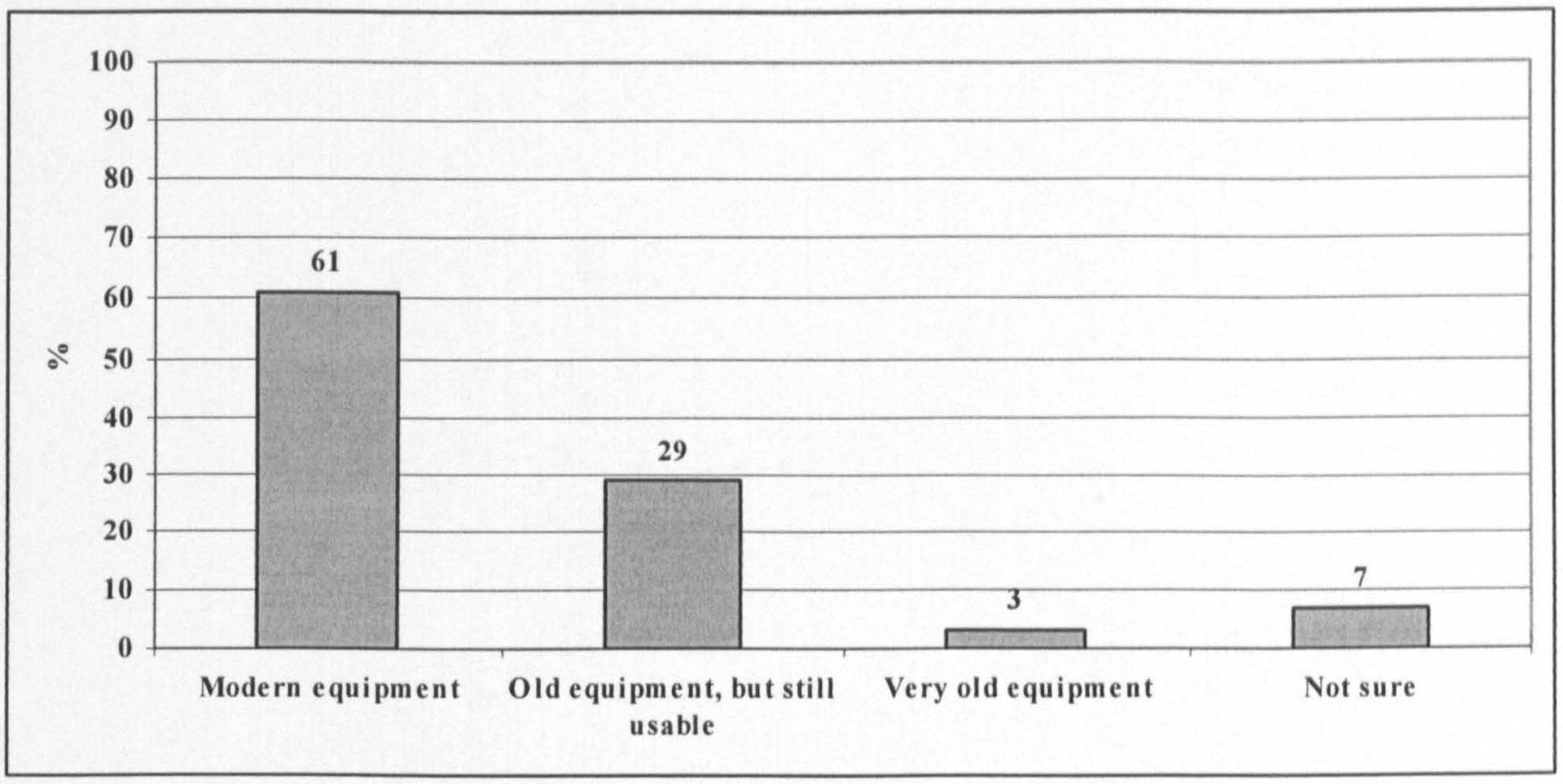


An important point identified from the interviews was that the nature of equipment in general was complex; in other words, how this equipment was manufactured, as well as its maintenance, was sophisticated and required certain techniques to be learnt; its use, however, was not so complex, operation being mainly a matter of pressing certain keys.

5.7.4 Condition of equipment

Libyan respondents were asked to provide information regarding the appearance of equipment. Was it modern or old equipment? They were given four options, and allowed to tick only one. Findings indicated that nearly 61 per cent of the respondents stated that it was modern equipment, while 29 per cent believed that it was old equipment, but still usable. Moreover, only 3 per cent confirmed that it was very old equipment, whereas 7 per cent of the respondents were not sure about its condition.

Figure: 5. 17 Condition of equipment

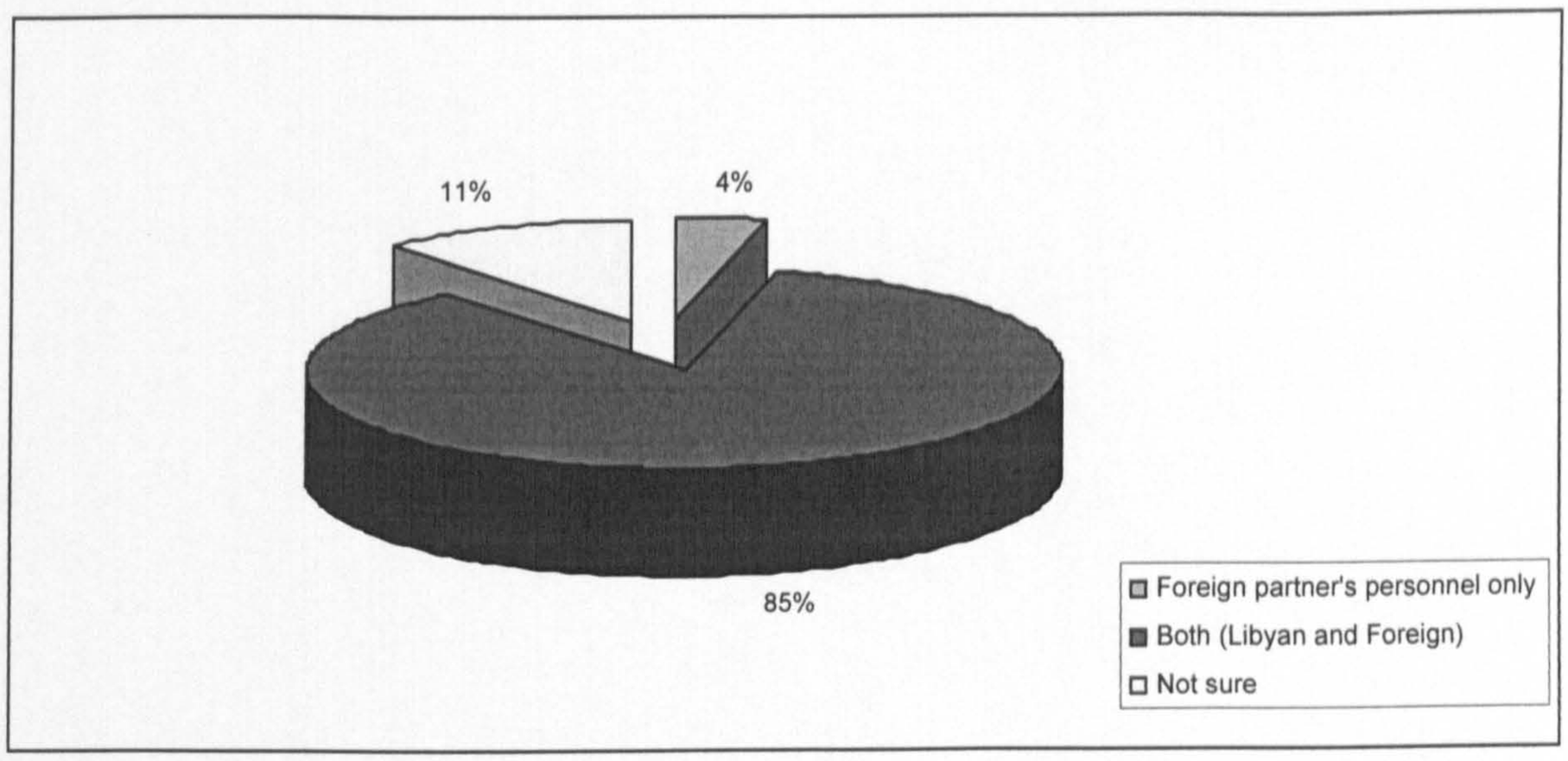


After the researcher had discussed this question with the interviewees, the findings revealed that most of the transferred equipment was modern equipment. However, foreign companies sometimes transferred old, but still usable equipment. For example, one employee (from Eni Gas company) reported that this company had established a new department (well testing); this department was equipped totally with old equipment, but still usable. These items of equipment were obtained from other companies and, eventually, local individuals along with foreigners were well trained to use them effectively.

5.7.5 Usage of equipment

Local respondents were asked about the usage of equipment brought: whether it was used most by Libyan or by foreign personnel. They were given three options, and allowed to tick only one option. The findings revealed that around 85 per cent of the respondents stated that the equipment brought was used by both Libyan and foreign personnel, owing to the company's interest in the benefits from the use of the transferred equipment by both groups. However, only 4 per cent confirmed that it was used by foreign partner's personnel only, whereas almost 11 per cent of the participants were not sure about the usage of equipment. Figure 5.18 presents the usage of equipment.

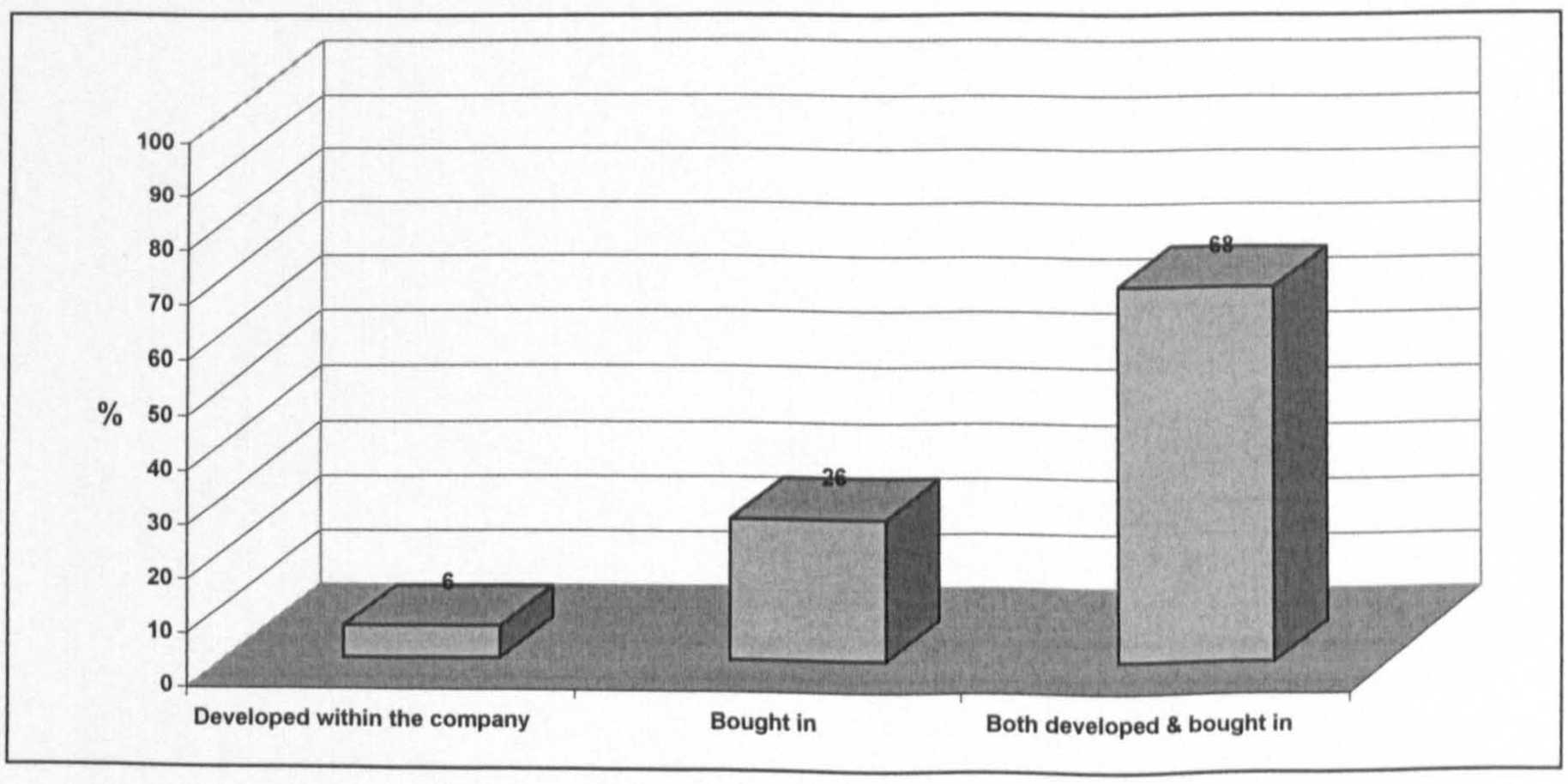
Figure: 5. 18 Usage of equipment



5.7.6 Acquisition of equipment

Equipment can be obtained via various methods. Foreign participants were asked to provide information about the methods employed by their companies to obtain equipment. They were given three options (developed within the company, bought in, and both – developed and bought in), and allowed to tick only one option.

Figure: 5. 19 Acquisition of equipment



As can be seen from the above figure (5.19), around 68 per cent of the respondents indicated that the equipment was both developed within the company and was bought in

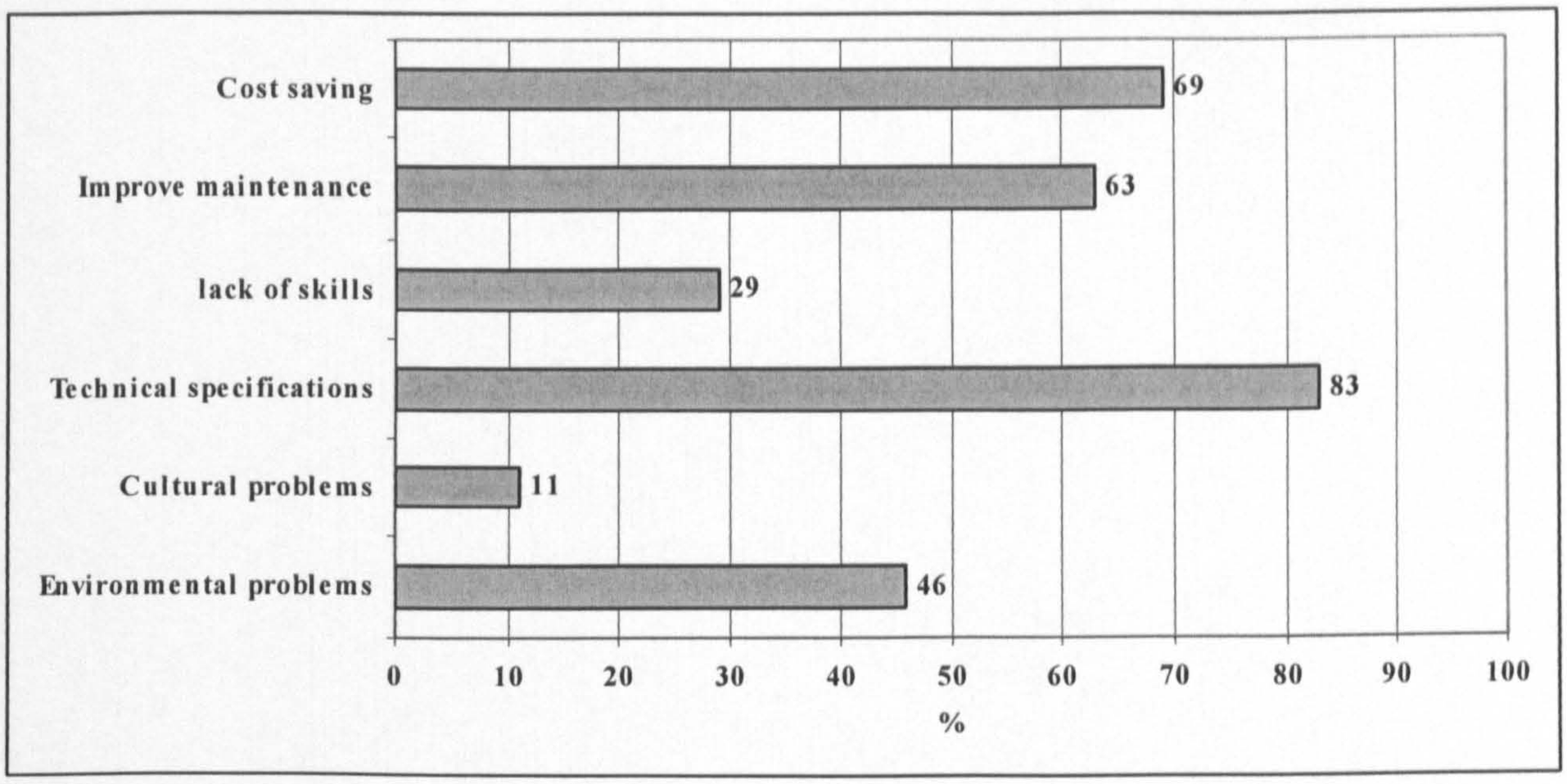
from other parties and producers, while 26 per cent believed that it was only bought in. However, only 6 per cent confirmed that equipment was developed entirely within their company.

5.7.7 Modification of equipment

Equipment may need some modifications before being transferred to Libya. Foreign respondents were asked to state whether their companies made any modifications to equipment bought from other producers before they transferred that equipment to Libya, and, if such modifications had been made, whether they were minor, modest, or significant. Furthermore, they were asked their opinions about the main reasons for the modification of the equipment.

The analysis of replies revealed that nearly 71 per cent of the foreign respondents believed that their companies made modifications when they bought equipment from other producers before this equipment was subsequently transferred to Libya. However, only 6 per cent of the participants confirmed that their companies did not make any modifications at all, and almost 23 per cent were not sure if there were modifications or not. These modifications were usually minor; this was confirmed by about 71 per cent of the respondents, and that some were modest was indicated by 23 per cent. However, none of the participants mentioned any significant modifications. The main reasons behind the modifications were varied. Nearly 83 per cent of the respondents believed that the essential reason was to meet different technical specifications, while 63 per cent indicated that it was just to improve maintenance, and about 69 per cent for cost saving. In addition, close to 46 per cent of the respondents named environmental problems as a main reason for the modifications, whereas only 11 per cent gave social and cultural reasons, and almost 29 per cent of the respondents believed that the main reason for the modifications was a lack of available skills. The following figure (5.20) illustrates the main reasons for modifications.

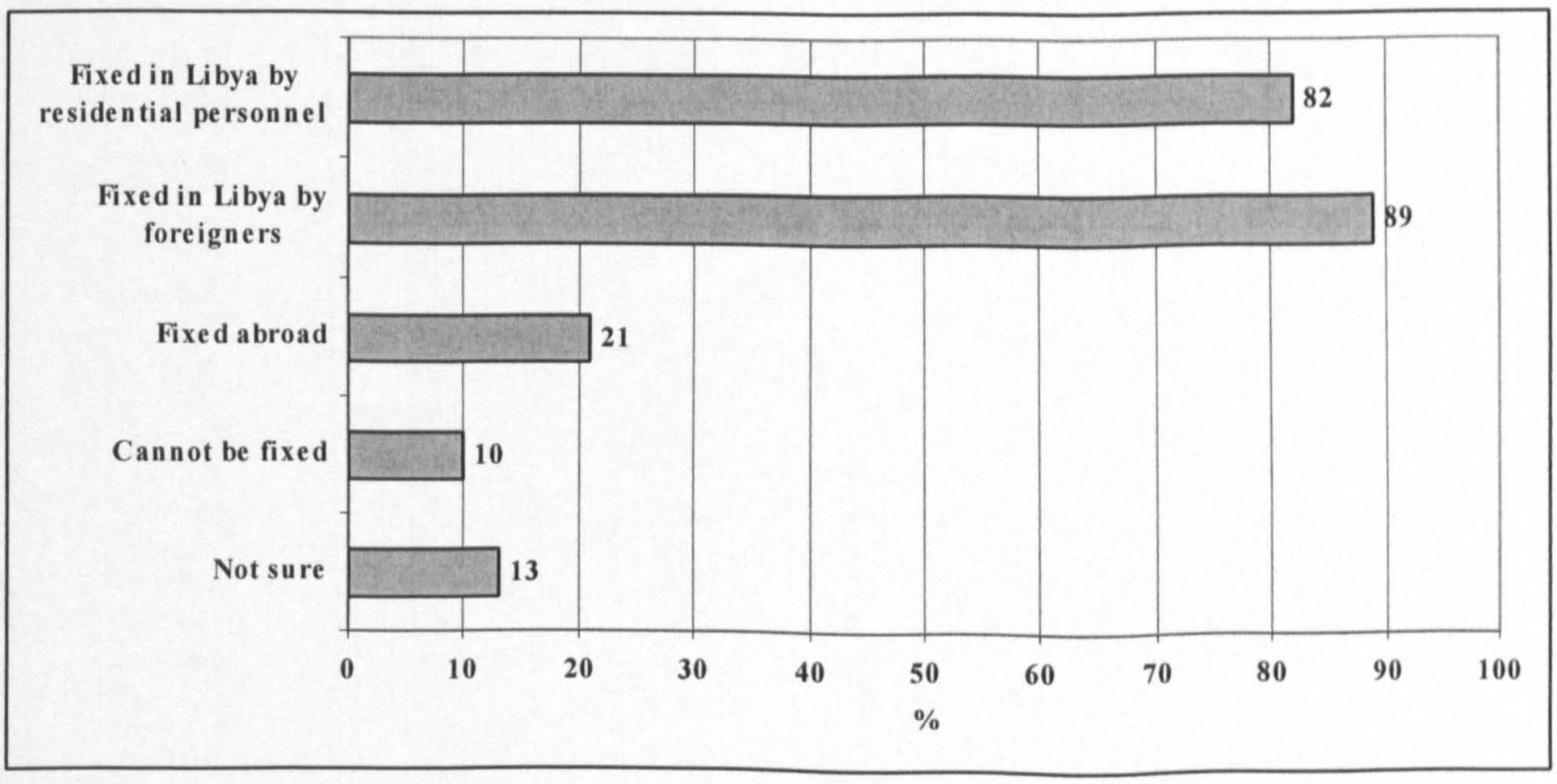
Figure: 5. 20 Reasons for modification



5.7.8 Maintenance of equipment

Repairing broken down equipment was another issue for local and foreign partners. Libyan respondents were asked to give information regarding the repair of equipment. They were given five options (can easily be fixed in Libya with residential personnel, can be fixed in Libya by bringing in foreign personnel, can be fixed abroad, cannot be fixed, and not sure). The respondents were allowed to choose more than one option if applicable.

Figure: 5. 21 Maintenance of equipment



The findings indicated that about 89 per cent of the respondents reported that the equipment could be fixed in Libya but by bringing in foreign personnel, while 82 per cent believed that it could be fixed in Libya by residential personnel. On such occasions, normally the foreign companies ask other companies in Libya to hire their personnel to fix certain problems as most of the equipment used is found in other oil companies. However, almost 21 per cent believed that this equipment could be fixed abroad. Nearly 10 per cent thought that it could not be fixed, and 13 per cent of the participants mentioned that they were not sure about the repairs.

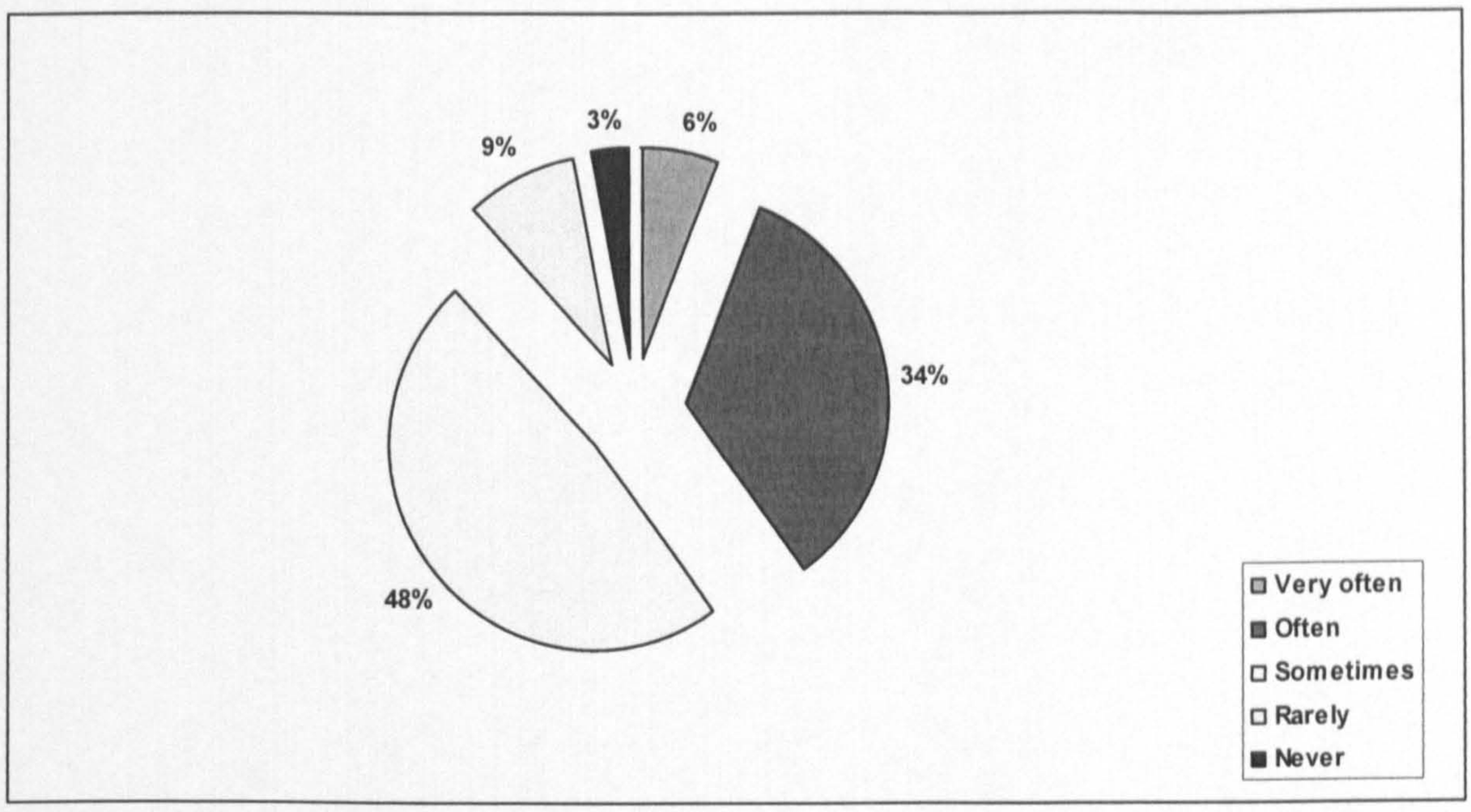
Furthermore, foreign participants were asked about hiring personnel; in other words, when a new opportunity arose, did the foreign partners first try to retool their existing skills base, including Libyan personnel, before hiring new individuals. The findings revealed that about 77 per cent of the foreign participants said yes, while 9 per cent disagreed with the statement. However, almost 14 per cent were not sure if their companies tried to retool their existing skills base, including Libyan personnel, before hiring new individuals.

5.8 Solving technical problems

Libyan respondents were asked about their involvement in solving technical problems. In other words, when a technical fault arose whether their partner company involved them in solving that problem along with the foreign experts. The findings indicated that almost 61 per cent of the respondents confirmed that they were allowed to participate in solving the problem. However, 39 per cent of the participants indicated that their partner did not involve them in solving problems along with the foreign experts when a technical fault occurred.

Conversely, the foreign respondents were asked to comment about issues after solving a problem. Put simply, when individuals finished solving problems, did they generally take the time to meet other individuals and analyse what went wrong and what could have been done better? They were given five options (very often, often, sometimes, rarely, and never).

Figure: 5. 22 Meeting after solving technical problems



As can be seen from the above figure (5.22), about 48 per cent of the participants indicated that they sometimes met other individuals for this matter, whereas 34 per cent believed that this often occurred. However, whereas 9 per cent chose rarely, and 6 per cent very often, only 3 per cent of the respondents reported that they never generally took the time to meet other individuals and analyse what went wrong and what could have been done better when they had finished solving problems.

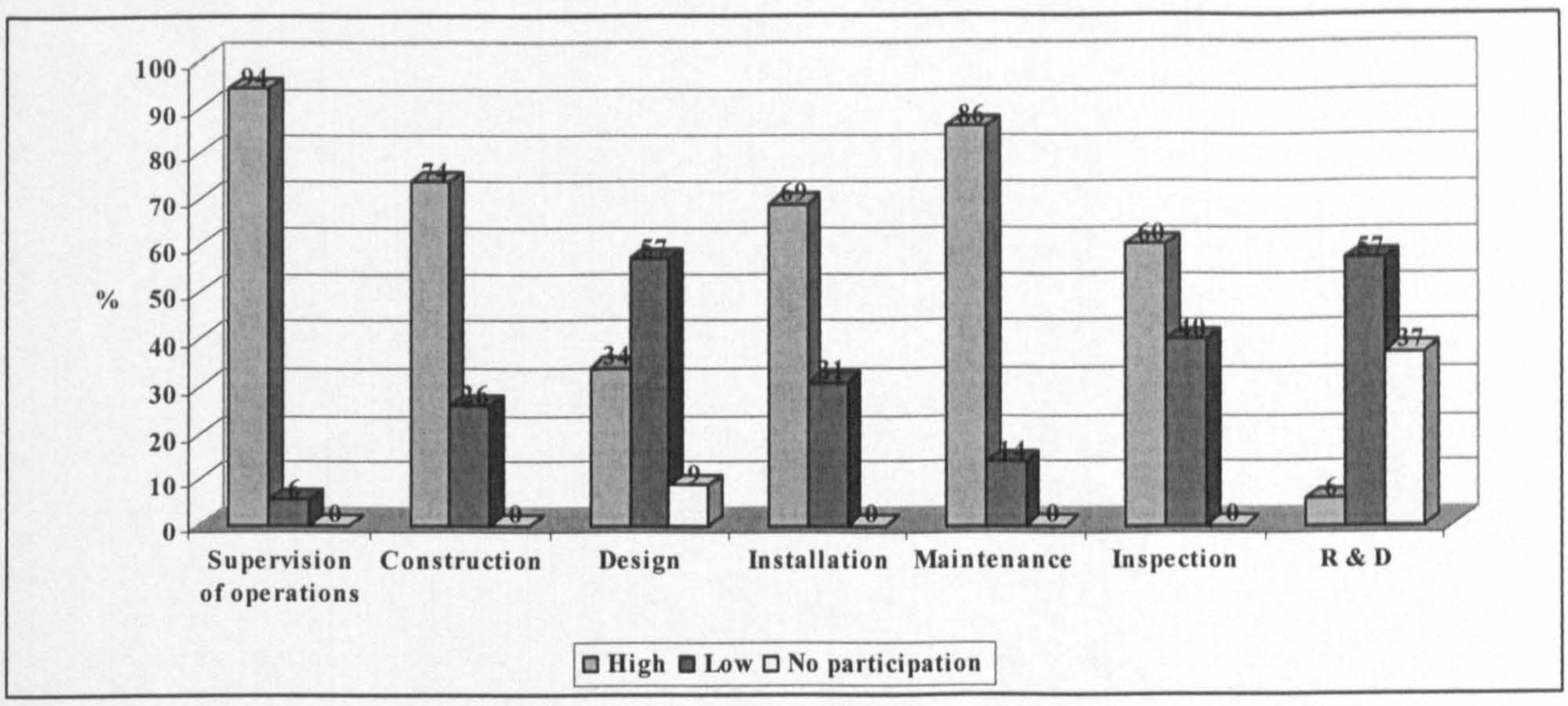
An interesting point identified from the interviews was that, according to some of the oil companies' rules, when a technical fault arises during repairs, three representatives from three related departments attend these repair operations. Firstly, the production department, in order to send the broken equipment in a safe condition to be fixed; secondly, the safety department, in order to apply all the safety procedures, such as, fire fighting, first aid and security; and, thirdly, the maintenance department, in order to carry out the repair and maintenance procedures.

5.9 Local participation

In order to achieve a positive technology transfer, local individuals should participate effectively in most of the activities in which their foreign partner are involved so that they can receive and absorb the transferred technology. Therefore, foreign respondents were

asked to indicate the rate of local participation in completing projects. As can be seen from Figure 5.23 below, seven criteria were given, and participants were allowed to tick an appropriate box.

Figure: 5. 23 Local participation



As the above figure shows, local individuals participated in all the activities mentioned, but they participated at various levels. They were very highly involved in the supervision of operations, at 94 per cent, whereas only 6 per cent were highly involved in research and development, 57 per cent had low involvement, and 37 per cent had no participation at all in research and development. In addition, local personnel participated greatly in maintenance activities, at 86 per cent, in construction at 74 per cent, installation at 69 per cent, and inspection at 60 per cent. However, their involvement in design ranged from a low 57 per cent to no participation at 9 per cent.

5.10 Local workforce

Virmani and Rao (1997, p. 33) state that "the extent of technology transfer is dependent upon the absorbing capacity of the human resources in the recipient country/organisation. This absorptive capacity, in turn, is dependent upon the availability of a workforce with the general educational background and technology-specific training." What follows attempts to ascertain the educational background of the national personnel as well as their abilities and willingness to learn and carry out the allocated tasks and duties.

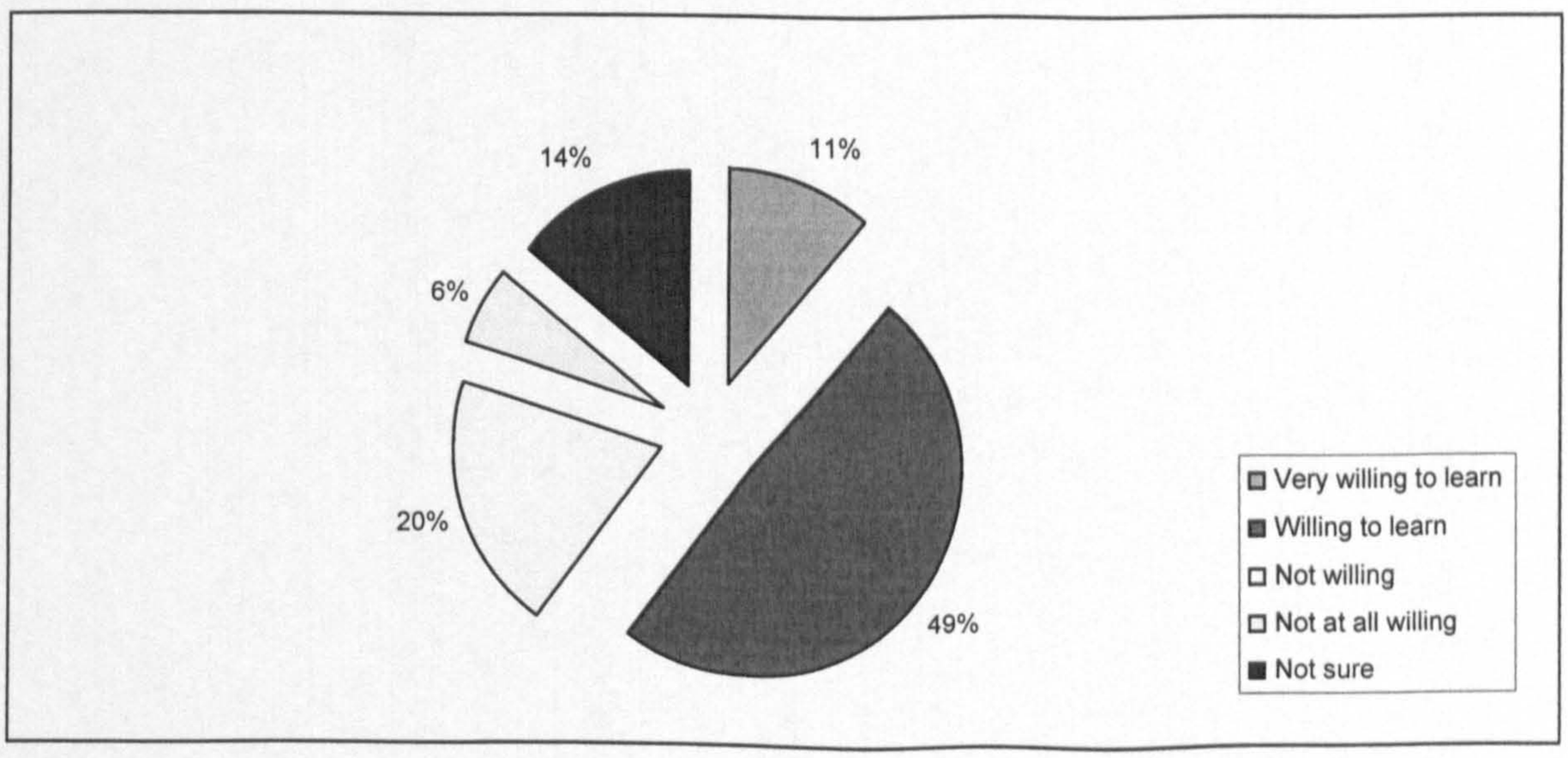
5.10.1 Local educational background

"The capacity to receive technology is dependent upon one's general education and training" (Virmani and Rao, 1997, p. 23). Foreign participants were asked about the educational background of the Libyan personnel receiving the technology. The result of this question revealed that around 52 per cent of the respondents indicated that the educational background of the Libyan personnel was satisfactory, whereas 26 per cent of the participants claimed that it was good. Although the percentage of respondents who believed that the educational background of the Libyan personnel was excellent was only 11 per cent, it was also only approximately 11 per cent of the total sample who expressed the idea that the educational background of the Libyan personnel acquiring knowledge was generally poor.

5.10.2 Willingness of Libyan personnel

Foreign participants were asked about the desire and willingness of local manpower to learn. The findings indicated that about 49 per cent of the respondents believed that the local personnel were willing to learn, and 11 per cent revealed that they were very willing to learn. On the other hand, 20 per cent of the total participants considered that the Libyan personnel were not willing, and 6 per cent stated that they were not at all willing to learn. Nearly 14 per cent of the respondents revealed that they were not sure about the desire and willingness of local personnel to learn.

Figure: 5. 24 Willingness to learn



5.11 Summary

This chapter has examined certain issues regarding technology transfer to the oil and gas industry in Libya. It was pointed out that technology was transferred for various reasons, confirming its use in oil and gas production as being the most important reason in the opinion of the majority of survey respondents. In addition, this research has identified that closed technology was not an easy matter to transfer, particularly as the vast majority of the companies preferred to keep their technology highly protected by security rules and measures. It can be concluded that what foreign companies transfer is only a margin of technology; that which can serve to accomplish their interests. However, open technology was transferred widely, where training courses and conferences were usually provided, in addition to other types of open technology, such as scientific articles and other related materials.

This chapter has also discovered that local individuals were involved and participated in various activities alongside their foreign partners' personnel. It has been found that they participate highly in supervision of operations and maintenance activities, and relatively highly in construction and installation processes. By contrast, their involvement is still low in the design activities to very low in the research and development operations.

Furthermore, it has been shown that technology is supplied through various sources, such as equipment; technical training programmes; consultancy; and manpower. This chapter has revealed that equipment is the most important source of technology transferred, followed by technical training courses, as the foreign partners more often than not bring the expensive and reliable, as well as less complex equipment.

Chapter Six

Survey Results on Knowledge Transfer in the Oil and Gas Industry in Libya

6.1 Introduction

This chapter examines and collates all the findings and materials collected regarding knowledge transfer in the oil industry via international joint ventures in Libya. It commences by introducing the term "knowledge" and showing its significance, requirement, sharing, transfer, and types, concentrating on the two main types (explicit and tacit) and indicating their main channels and their conversion processes. This chapter also considers terms relating to knowledge management (KM) and knowledge management systems (KMS), presenting their significance, functions and the accessibility of KMS, as well as the main activities of KM. Finally, a summary of the chapter is drawn

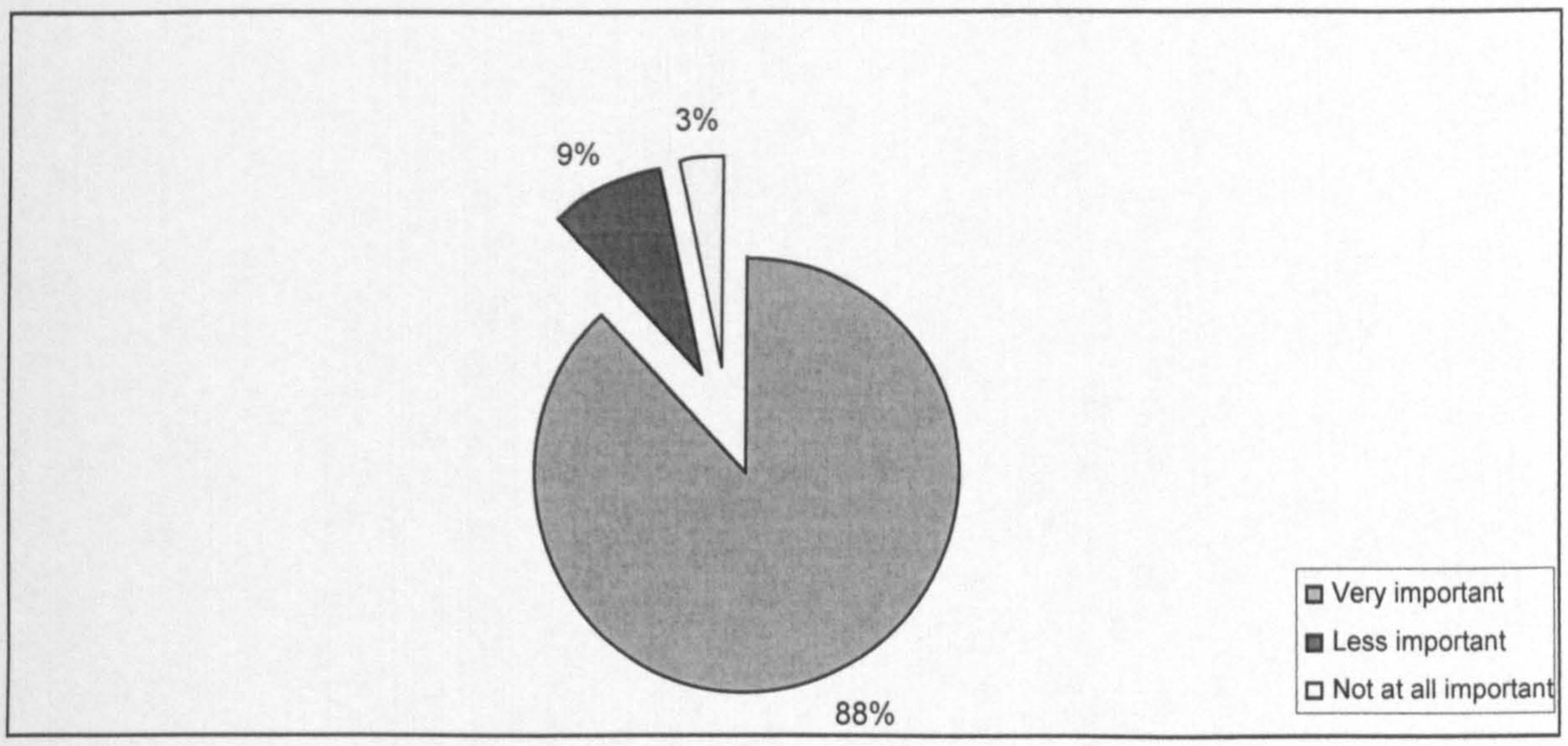
6.2 Knowledge

As has been stated by Davenport and Prusak (1998, p. 5), knowledge is "a fluid mix of framed experience, values, contextual information, expert insight, and intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates in individual minds but is often embedded in organizational routines, processes, practices, systems, software, and norms." This section attempts to acquire information about knowledge in the companies surveyed, indicating its significance, requirement, types, creation, sharing, and transfer.

6.2.1 The significance of knowledge

Knowledge is an element essential to the continuous development of companies. It is becoming increasingly beneficial and important and is now known as a resource that is priceless to the company's ability to advance and compete and, thus, a necessary source of competitive advantage. In this survey, the Libyan respondents were asked to rank the significance of knowledge in their companies. They were given three possible options (very important, less important, and not at all important).

Figure: 6. 1 Significance of knowledge



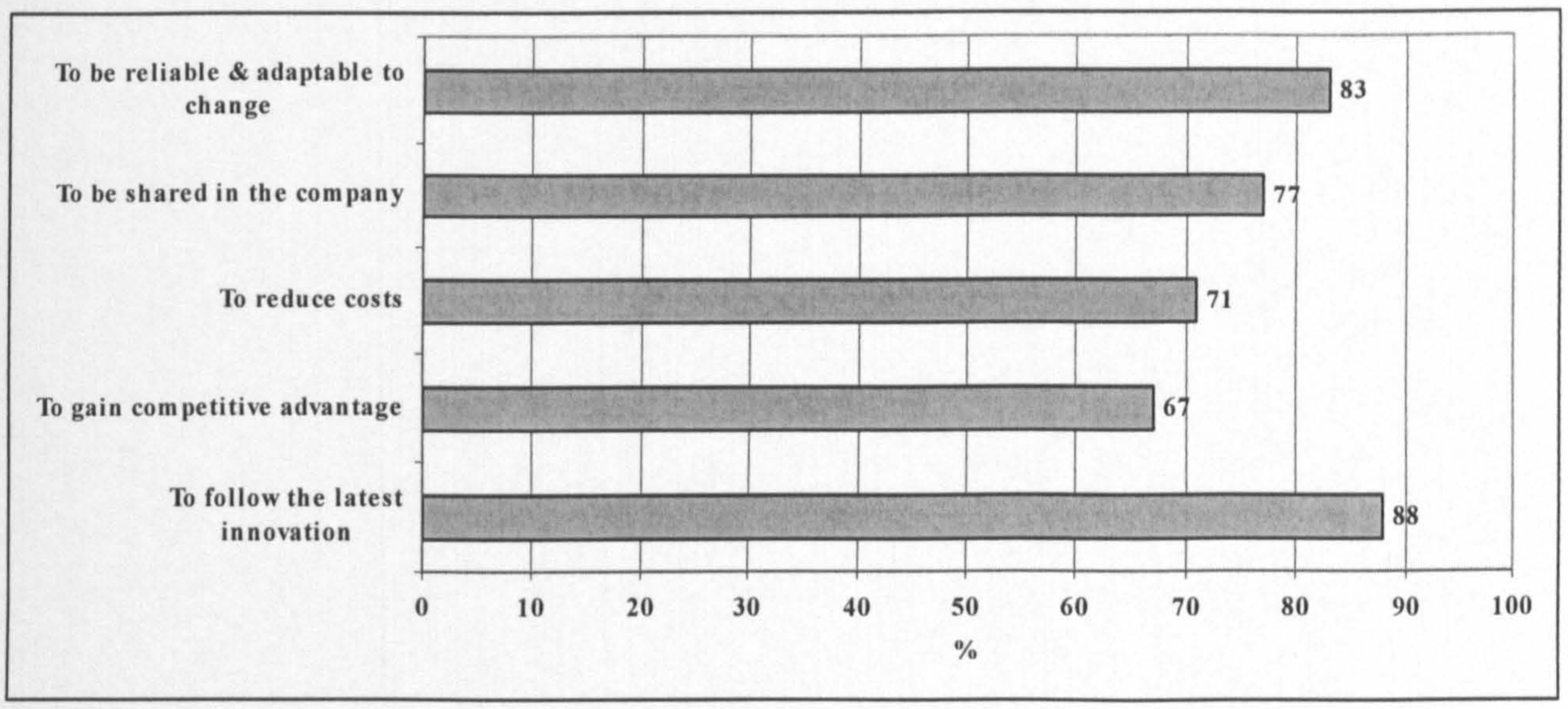
As can be seen from the above figure (6.1), the majority of local respondents (88 per cent) confirmed that knowledge was very important, compared with only 9 per cent who believed that it was less important. By contrast, only 3 per cent of the Libyan respondents believed that knowledge was not at all important in their companies.

On the other hand, this survey also gathered data on the extent to which foreign participants recognized knowledge as an essential part of their companies' resources. It was found that nearly 80 per cent of those respondents recognized knowledge as an essential part. On the other hand, only 6 per cent did not recognize it as an important part, while almost 14 per cent of the participants were not sure about the recognition of knowledge as an essential part of their companies' resources.

6.2.2 Knowledge requirement

Knowledge is always required in companies. There are several reasons behind this requirement. This study asked the Libyan respondents to determine the main reasons for requiring knowledge in their companies. They were given five reasons (to follow the latest innovation, to gain competitive advantage, to reduce costs, to be shared with others in the company, and to be more reliable and adaptable to change), and they were allowed to tick more than one choice, if applicable.

Figure: 6. 2 Knowledge requirement



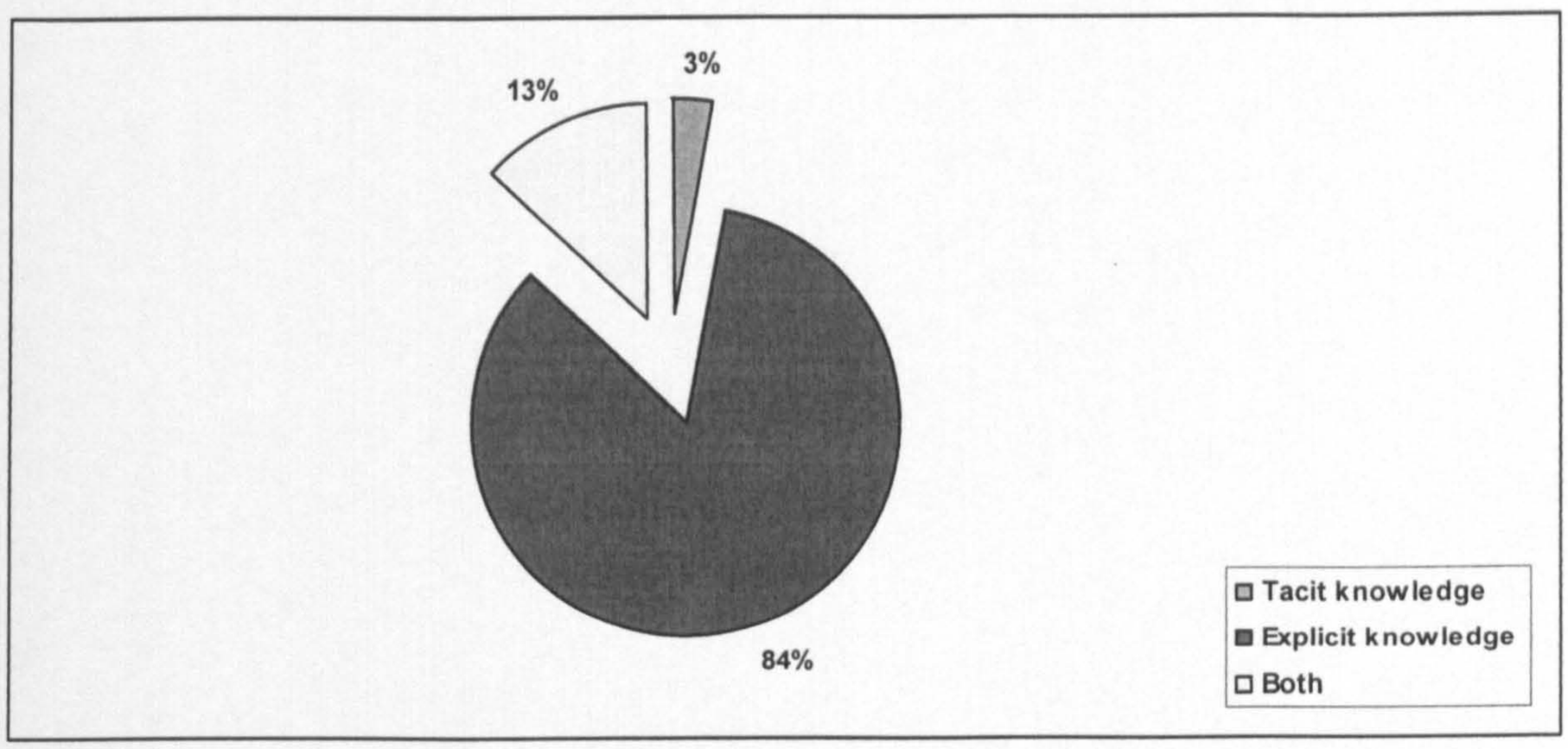
The analysis of replies revealed that almost 88 per cent of the respondents believed that they required knowledge just in order to follow state of the art innovation. Moreover, as can be seen from Figure 6.2, nearly 83 per cent of the participants confirmed that they needed knowledge just to be more reliable and adaptable to change. In addition, requiring knowledge in order for it to be shared with others in the company was regarded by nearly three quarters of the respondents (77 per cent) to be a vital reason. Approximately, 71 per cent of the respondents selected reducing costs, and almost 67 per cent indicated that knowledge was required just to gain competitive advantage.

6.2.3 Types of knowledge

As indicated in Chapter Two, there are several types of knowledge, but here special emphasis is on only two main types: tacit and explicit knowledge. In this survey, Libyan nationals were asked to state the type of knowledge transferred by their foreign partners.

They were given three main options (tacit knowledge, explicit knowledge, or both) and allowed to tick only one choice.

Figure: 6. 3 Types of knowledge



The results of the survey revealed that transferring explicit knowledge was a very common type of knowledge transfer provided, this was confirmed by about 84 per cent of the participants, who believed that their foreign partners transferred it to their companies, whereas about 13 per cent indicated that their foreign partners transferred both types of knowledge (tacit and explicit). However, it appears that tacit knowledge only was not commonly transferred, a mere 3 per cent of the local respondents stating that their foreign partners transferred such knowledge.

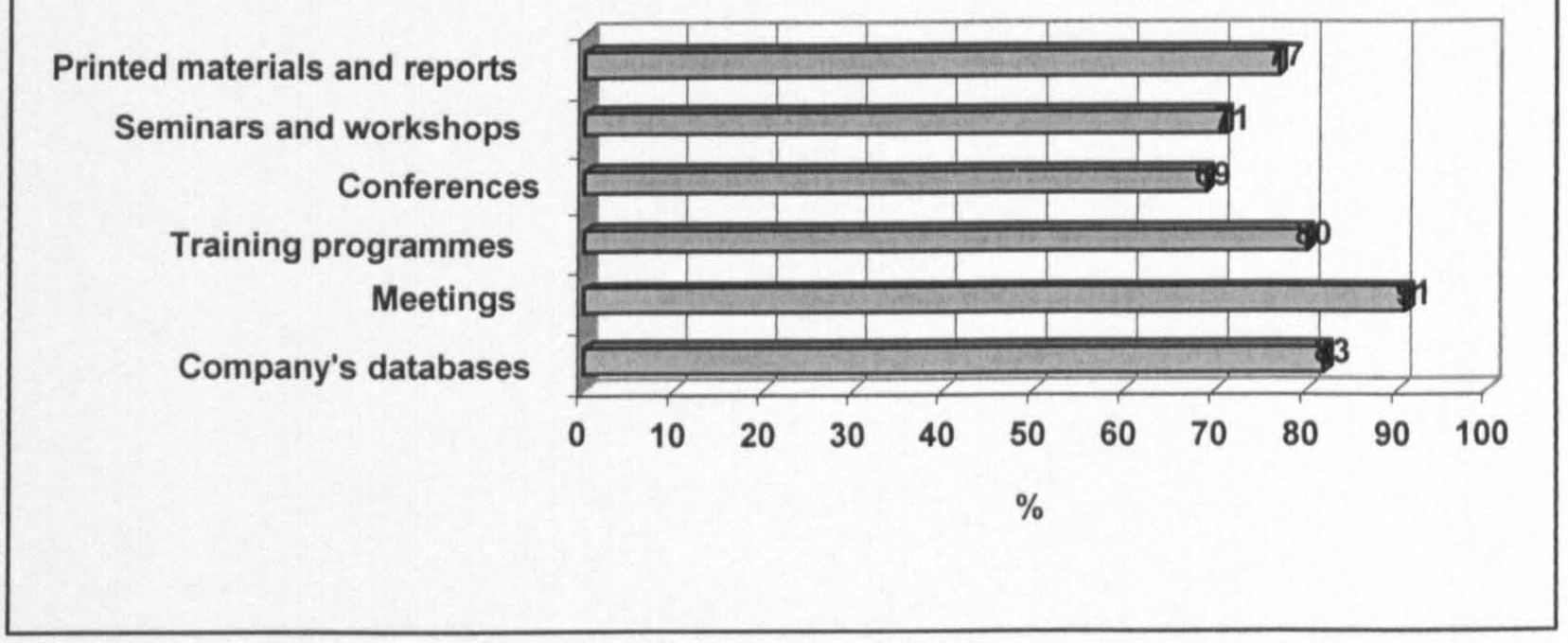
6.2.4 Channels of explicit knowledge transfer

Explicit knowledge is that type of knowledge which can be articulated in verbal and printed materials, and mainly shared without difficulty. In addition, explicit knowledge is transferred through a variety of means. In this study, the Libyan respondents were asked to indicate the main channels for transferring explicit knowledge. They were also given the freedom to choose more than one channel, if applicable. The channels given were as follows:

1. The company's databases and electronic forms
2. Meetings
3. Technical training programmes

4. Conferences
5. Seminars and workshops
6. Printed materials and reports

Figure: 6. 4 Explicit knowledge transfer channels



As can be seen from the above figure (6.4), the majority of the participants (91 per cent) considered meetings as the main channel for transferring explicit knowledge. Next came the company's databases and electronic forms, with the support of 83 per cent of the respondents; this transfer channel might involve actively putting a document into a shared database. Nearly 80 per cent confirmed that technical training programmes were the main channels for transferring explicit knowledge. There followed, respectively, printed materials and reports (77 per cent), seminars and workshops (71 per cent), and conferences (69 per cent).

As found in the interviews, the capturing of explicit knowledge came from the individual's workflow or daily activities or from other tools by which to gain explicit knowledge, including content management systems, and shared folders or drivers. In addition, knowledge might be transferred to other individuals through all kinds of sharing media and those individuals in groups might use the knowledge thus transferred in their routines.

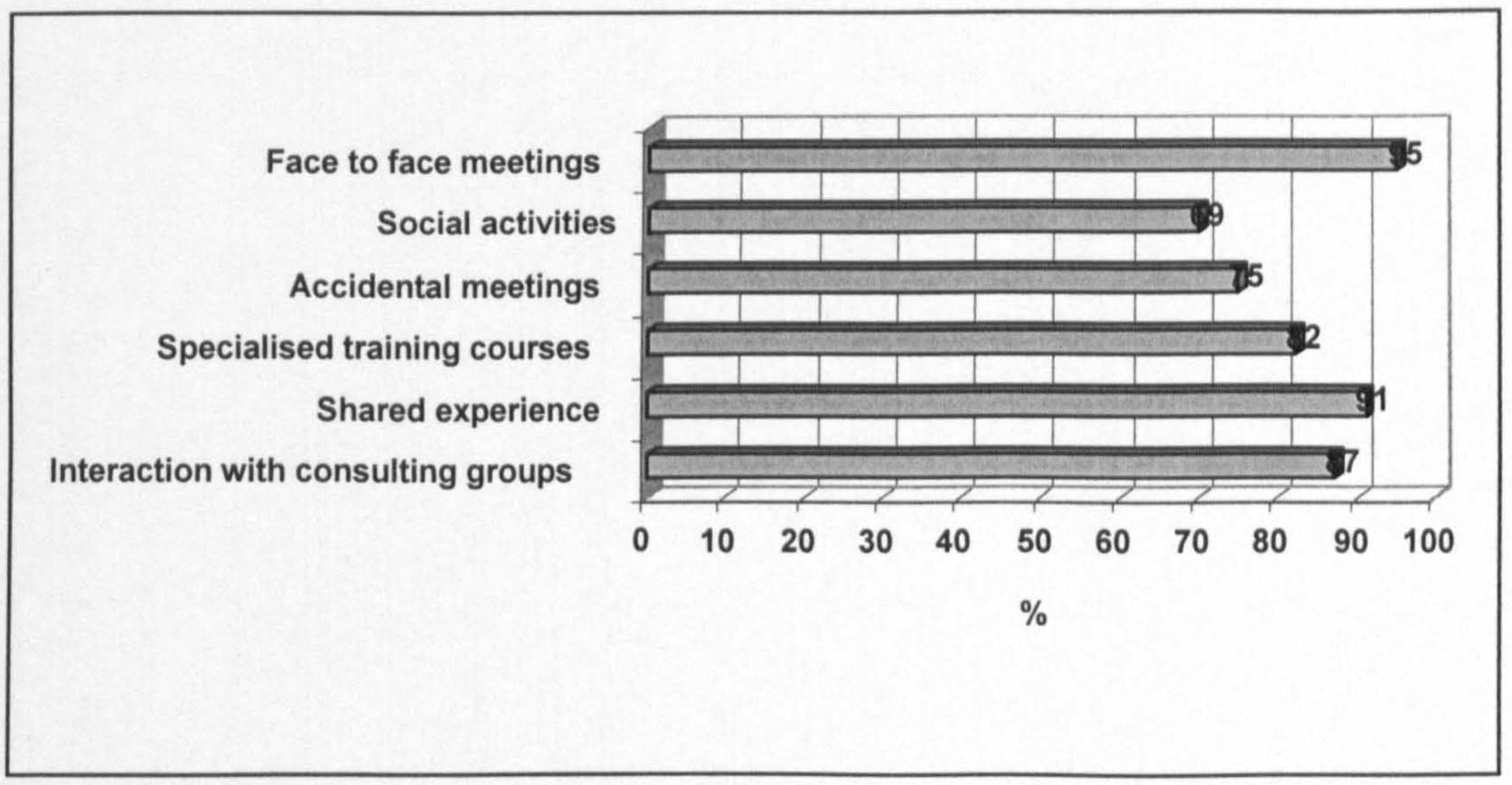
6.2.5 Channels of tacit knowledge transfer

Tacit knowledge is that type of knowledge which an individual has personally adopted while carrying out various tasks and functions in different work situations and

circumstances. Tacit knowledge is transferred through various means. In this survey, local respondents were asked to indicate the main channels of tacit knowledge transfer. They were also allowed to choose more than one channel, if applicable. The channels given were:

1. Face to face meetings
2. Social activities
3. Accidental meetings
4. Specialised training courses
5. Shared experience
6. Interaction with consulting groups

Figure: 6. 5 Tacit knowledge transfer channels



As can be seen from the above figure (6.5), the vast majority of the respondents (95 per cent) noted that face to face meetings were the main channel for gaining tacit knowledge, as meetings can often generate new ideas that can be shared and transferred among individuals. Nearly, 91 per cent of the participants selected shared experience, while almost 87 per cent opted for interaction with consulting groups. Specialised training courses came next, with approximately 82 per cent of participants choosing this mode, followed by accidental meetings (75 per cent). Finally, 69 per cent of the respondents believed that the transfer of tacit knowledge was accomplished through informal sharing or socialisation amongst individuals with common interests (social activities).

As can be summarised, all the channels offered for the respondents' selection were considered as very important methods of transferring tacit knowledge. This can be seen from the high percentage each channel gained. However, as was confirmed by the interviews, the main effective approaches by which tacit knowledge is transferred is by the communicating of practice and by internal networks, while the face to face interview remains a very active mode or channel of tacit knowledge transfer. In addition, tacit knowledge is actionable knowledge; hence, it is the most important, and it is the essential element for the production of new knowledge.

6.2.6 The conversion processes

The four conversion processes between the two types (tacit and explicit) knowledge are: explicit into explicit knowledge (combination mode); tacit into explicit knowledge (externalization mode); explicit into tacit knowledge (internalisation mode); and tacit into tacit knowledge (socialisation mode).

6.2.6.1 Explicit into explicit knowledge (combination mode)

By combination mode is meant the process of combining different systems of explicit knowledge to form new explicit knowledge. For example, gathering data to produce a report that examines these data. In this survey, local respondents were asked to comment on the methods of converting explicit into explicit knowledge in their companies. They were given five sources of explicit knowledge (meetings, documents, shared database, reports and e-mails, and company's newsletters). Participants were asked to rate these from 1-4, where 1= very high, 2= high, 3= low, and 4= not sure.

Table: 6. 1 Explicit into explicit knowledge

Channels	Rate			
	Very high	High	Low	Not sure
Meetings	92 %	4 %	3 %	1 %
Documents	78 %	11 %	8 %	3 %
Shared databases	84 %	9 %	3 %	4 %
Reports & e-mails	72 %	15 %	9 %	4 %
Company's newsletters	62 %	17 %	10 %	11 %

The survey results revealed that almost 92 per cent of the respondents rated meetings very highly as a method of converting explicit into explicit knowledge, while 4 per cent just rated this method as high. By contrast, around 3 per cent indicated that this was a low mode and only (1 per cent) of the participants revealed that they were not sure about meetings as a method of converting explicit into explicit knowledge in their companies.

The analysis of replies also indicated that slightly more than three quarters of the participants (78 per cent) believed that documents rated very high as a method of converting explicit into explicit knowledge, while 11 per cent believed this method was just high. However, nearly 8 per cent gave documents a low rating and 3 per cent of the respondents confirmed that they were not sure about documents as a source of converting explicit into explicit knowledge in their companies.

Furthermore, the results showed that approximately 84 per cent of the respondents considered putting documents into shared databases as a very effective mode of converting explicit into explicit knowledge, and, thus, rated it number one, while 9 per cent rated it at number two. On the other hand, around 3 per cent rated it as low and only 4 per cent of the respondents indicated that they were not sure about shared databases as a means of converting explicit into explicit knowledge in their companies.

Regarding reports and e-mails, the findings revealed that close to three quarters of the participants (72 per cent) rated the effectiveness of these methods as very high for converting explicit into explicit knowledge, whereas about 15 per cent chose high. However, about 9 per cent chose the low rating for these methods and a mere 4 per cent of the respondents confirmed that they were not sure about reports and e-mails as a means of converting explicit into explicit knowledge in their companies.

Finally, with respect to the company's newsletter, the results indicated that 62 per cent of the respondents rated this means very highly as a method of converting explicit into explicit knowledge, whereas 17 per cent selected high. By contrast, almost 10 per cent rated this method as low, compared with 11 per cent of the respondents who acknowledged that they were not sure about the company's newsletter as a means of converting explicit into explicit knowledge in their companies.

It has been mentioned that explicit knowledge includes skills and information that can be formally presented in data, printed materials, instruction manuals and other documents. It is also easily collected, stored, distributed, documented, communicated and transferred from individual to individual, team to team, and from group to group within the companies.

6.2.6.2 Tacit into explicit knowledge (externalization mode)

Externalization, as viewed by Nonaka, involves the formation of a shared intellectual model, which is then articulated through dialogue. Externalization mode refers to the knowledge creation processes whereby tacit knowledge may be encoded into some form of explicit knowledge. In this survey, the Libyan respondents were asked to comment on how their companies articulated tacit knowledge into explicit. They were given four sources of articulation (talks between individuals in the company, elicitation of ideas, application of methods and procedures, and the company's correspondence). Participants were asked to rank these from 1-4, where 1= very high, 2= high, 3= low, and 4= not sure).

Table: 6. 2 Tacit into explicit knowledge

Channels	Rate			
	Very high	High	Low	Not sure
Talks between individuals	82 %	11 %	4 %	3 %
Elicitation of ideas	87 %	10 %	2 %	1 %
Application of methods & procedures	69 %	16 %	7 %	8 %
Company's correspondence	21 %	17 %	22 %	40 %

The analysis of replies revealed that out of the total sample approximately 87 per cent of the respondents ranked as very high elicitation of ideas as a method of articulating tacit into knowledge explicit. Typical activities in which this conversion takes place are: conversation among team individuals, reacting to questions, and the elicitation of stories. In addition, about 10 per cent of the respondents ranked this means as high. However, nearly 2 per cent ranked this mode as low and only 1 per cent of the participants indicated that they were not sure about this method as a technique for articulating tacit into explicit knowledge in their companies.

The survey results also showed that about 82 per cent of the respondents put in the first rank talks between individuals in the company as a way of articulating tacit into explicit knowledge, while 11 per cent put it in the second rank: high. On the other hand, approximately 4 per cent ranked this mode as low and only 3 per cent of the participants noted that they were not sure about this method as a technique for articulating tacit into explicit knowledge in their companies.

Furthermore, the results illustrated that nearly two thirds of the respondents (69 per cent) believed that application of methods and procedures ranked very high as a mode of articulating tacit into explicit knowledge, while 16 per cent ranked this mode as high. However, around 7 per cent selected number three, low, and 8 per cent of the participants confirmed that they were not sure about this method as a strategy for articulating tacit into explicit knowledge in their companies.

Finally, with regard to the company's correspondence, the findings revealed that only 21 per cent of the participants believed that this method ranked very high as a mode of articulating tacit into explicit knowledge, compared with 22 per cent who indicated that this mode ranked low as a method of converting tacit into explicit knowledge. Nearly, 17 per cent of the total participants ranked it as high. On the other hand, about 40 per cent of the respondents confirmed that they were not sure about this method as a technique for articulating tacit into explicit knowledge in their companies.

It has been stated that tacit knowledge is by nature difficult to transfer into explicit; this is because this tacit knowledge resides in the individual's brain. Therefore, it is not at all easy to convert, especially the most important part of it, unless following certain methods and techniques. It has been confirmed that sharing and the elicitation of ideas, particularly in informal places, as well as sharing individual experiences, can help in one way or another in gaining this type of knowledge.

6.2.6.3 Explicit into tacit knowledge (internalisation mode)

Internalisation mode refers to the processes of gaining access to explicit knowledge, whereby it can be developed and become an essential part of an individual's tacit knowledge. In this study, national respondents were asked to comment on how their

companies converted explicit into tacit knowledge. Participants were asked to rank these channels from 1-4, where 1= very high, 2= high, 3= low, and 4= not sure). They were given three sources:

1. Involving the company's individuals in carrying out many tasks in order to use their experience in the company
2. Providing several training courses in order to build up the individual's knowledge for the benefit of the company
3. Shared experience

Table: 6. 3 Explicit into tacit knowledge

Channels	Rate			
	Very high	High	Low	Not sure
Shared experience	84 %	13 %	1 %	2 %
Providing training courses	79 %	13%	3 %	5 %
Using individual's experience	71 %	18 %	6 %	5 %

As can be seen from Table 6.3, almost 84 per cent of the respondents indicated that shared experience ranked very high as a method of converting explicit into tacit knowledge, while 13 per cent selected high. However, about 1 per cent ranked it low as a mode and only 2 per cent of the participants acknowledged that they were not sure about this method as a technique for converting explicit into tacit knowledge in their companies.

The analysis of replies also revealed that about 79 per cent of the participants rated as very high option two, providing several training courses in order to build up the individual's knowledge for the benefit of the company, as regards conversion of explicit into tacit knowledge, while 13 per cent rated this high as a method. By contrast, just about 3 per cent judged that it was low as a mode and only 5 per cent of the respondents confirmed that they were not sure about this means as a policy of converting explicit into tacit knowledge in their companies.

Furthermore, the results also showed that nearly 71 per cent of the participants believed that involving the company's individuals in carrying out many tasks in order to use their

experience in the company was a very effective method of converting explicit into tacit knowledge, ranking it number one, very high, whereas 18 per cent chose high. However, roughly 6 per cent ranked this mode low and only 5 per cent of the respondents indicated that they were not sure about this means as a technique for converting explicit into tacit knowledge in their companies.

It has been stated that converting explicit into tacit knowledge usually occurs through reading documents from various sources, as well as through improving the individual's skill. Therefore, individuals can play an essential role in this regard, where they can, to some extent, re-experience what others have learned previously, and also have the chance to create new knowledge by combining their existing tacit knowledge with the knowledge of others.

6.2.6.4 Tacit into tacit knowledge (socialisation mode)

Socialisation mode refers to the methods of sharing and transferring tacit knowledge to other individuals, who encode the new knowledge in the form of new tacit knowledge. In this survey, the Libyan respondents were asked to comment on how their companies transfer tacit into tacit knowledge. They were given four sources of transference (face to face meetings and sharing experiences, practice, observation, and imitation). Participants were asked to rate these from 1-4, where 1= very high, 2= high, 3= low, and 4= not sure).

Table: 6. 4 Tacit into tacit knowledge

Channels	Rate			
	Very high	High	Low	Not sure
Face to face meetings & sharing experiences	84 %	13 %	1 %	2 %
Practice	78 %	15 %	4 %	3 %
Observation	69 %	15 %	7 %	9%
Imitation	53 %	16 %	11 %	20 %

As can be seen from the table (6.5), almost 84 per cent of the respondents pointed out that face to face meetings and sharing experiences rated very high as methods of transferring tacit into tacit knowledge. A typical activity in which tacit knowledge sharing can take place is a team meeting, often informal, during which experiences are described and shared. Moreover, around 13 per cent ranked this means as high. However, only 1 per cent

selected the low rating and 2 per cent of the participants acknowledged that they were not sure about this method as a technique for transferring tacit into tacit knowledge in their companies.

The analysis of replies also found that around 78 per cent of the respondents indicated that practice ranked very high as a mode of transferring tacit into tacit knowledge, while 15 per cent ranked it high. On the other hand, about 4 per cent selected the low ranking and only 3 per cent of the participants indicated that they were not sure about this method as a strategy for transferring tacit into tacit knowledge in their companies.

Furthermore, the survey results showed that nearly 69 per cent of the participants believed that observation rated very high as a mode of transferring tacit into tacit knowledge, whereas 15 per cent selected high. By contrast, around 7 per cent classified it as low and only 9 per cent of the participants indicated that they were not sure about this method as a strategy for transferring tacit into tacit knowledge in their companies.

Finally, with regard to imitation, the analysis of replies revealed that approximately 53 per cent of the respondents rated it very high as a mode of transferring tacit into tacit knowledge, while 16 per cent chose the category high. However, 11 per cent ranked the mode as low and 20 per cent of the participants indicated that they were not sure about this method as a mode of transferring tacit into tacit knowledge in their companies.

It has been stated that transferring tacit into tacit knowledge usually involves conducting face to face meetings in order to share experiences available, and it quite often requires contacts or interactions between individuals via several means, such as observation, imitation, practice or apprenticeships.

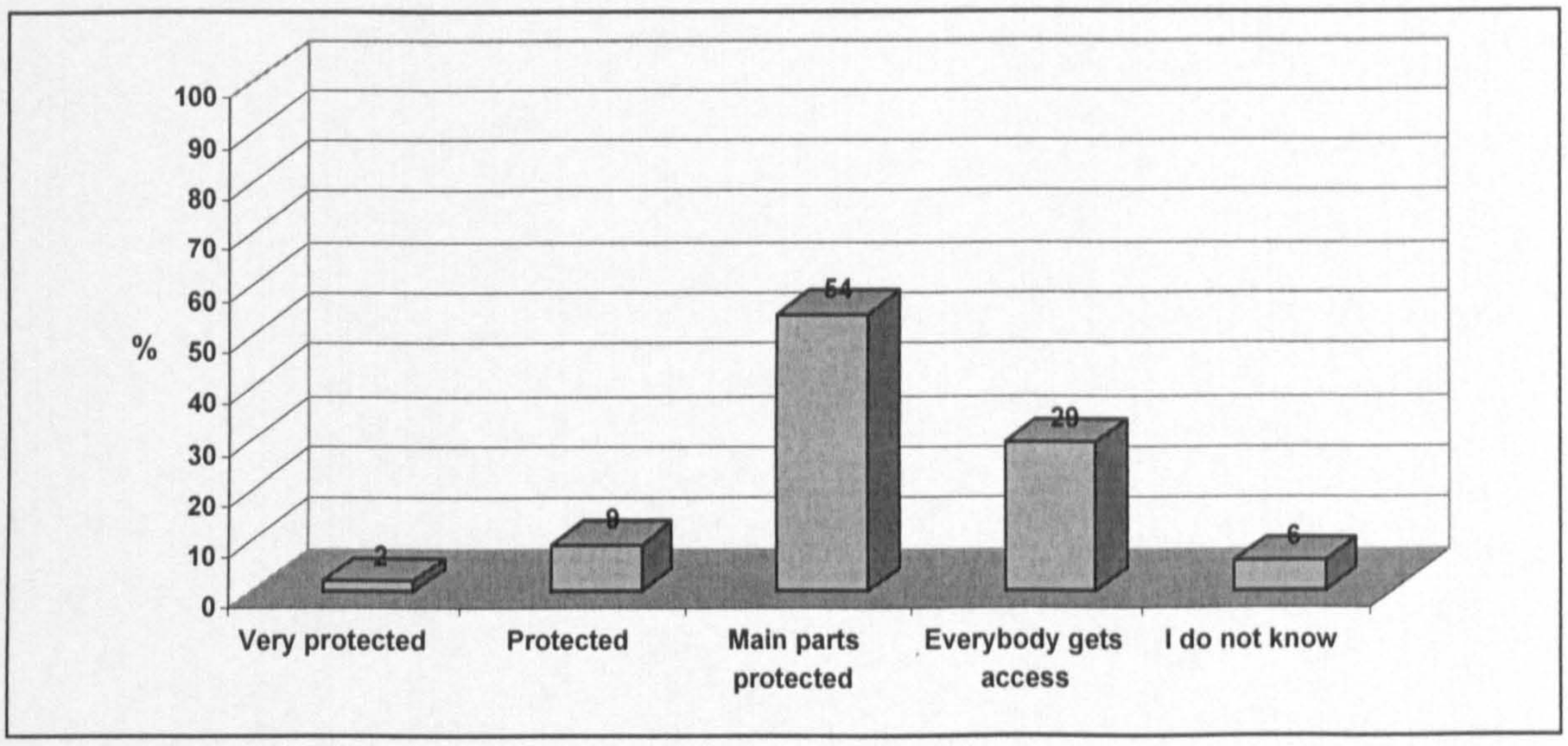
6.2.7 Knowledge protection

Companies may in one way or another try to protect their own knowledge and information or just to keep the essential parts of their work secret, while other companies may grant individuals easy access to their knowledge and information so that local individuals can be well-equipped and qualified, to the benefit and the interest of companies in general. In this study, foreign respondents were asked whether they had just the right level of security for

the sensitive information and knowledge they possessed. They were given five possible options and allowed to choose only one. The options given were:

1. Yes, our information and knowledge are very securely protected
2. Yes, our information and knowledge are securely protected
3. No, we only protect the essential part of our information and knowledge
4. No, everybody in the company can get access to our information and knowledge
5. I do not know

Figure: 6. 6 Security of knowledge and information



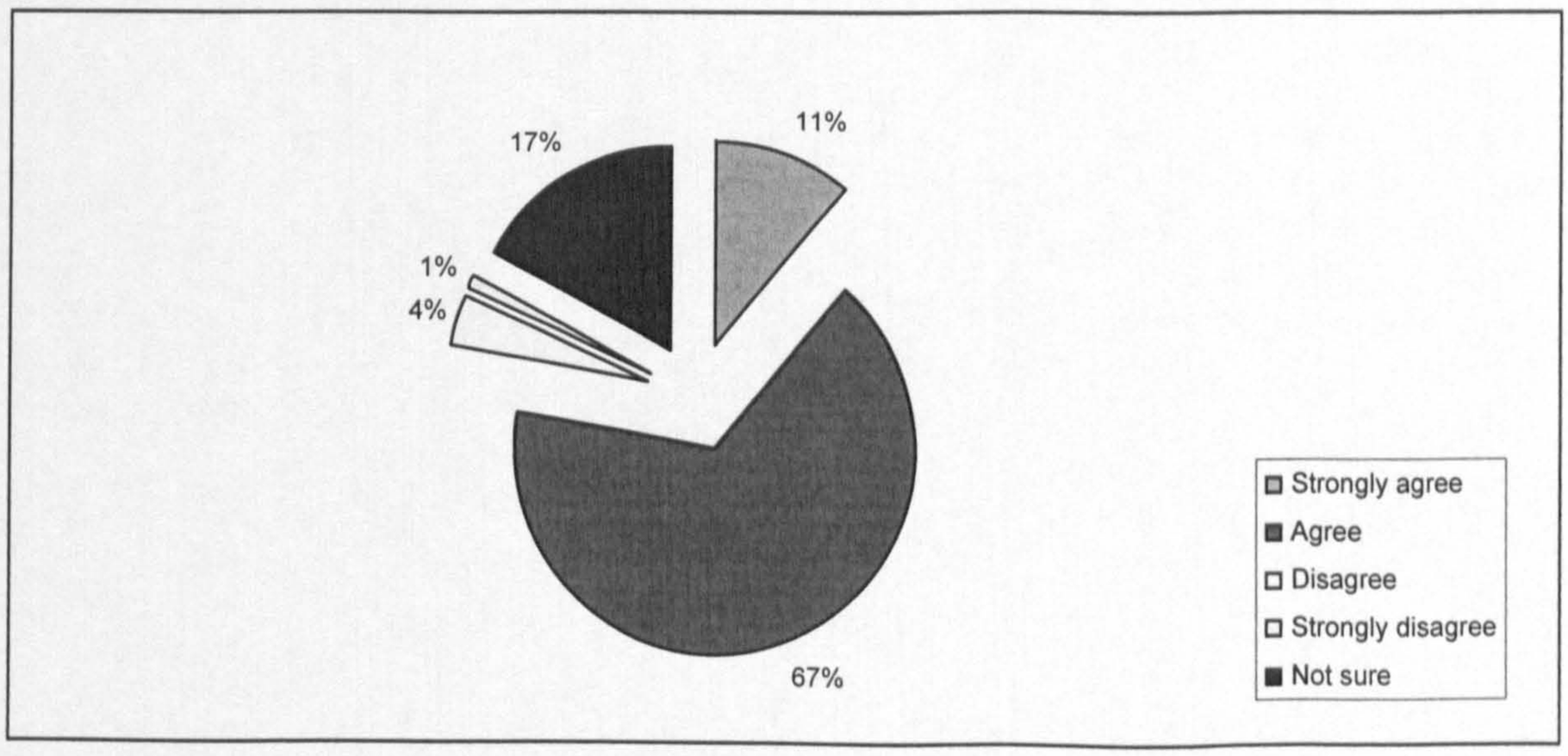
The findings of the study revealed that just over half of the respondents, 54 per cent, confirmed that they did not have the right level of security for the sensitive information and knowledge they had because they protected only the essential part of their information and knowledge. In addition, nearly 29 per cent of the participants indicated that their information and knowledge were not secured and everybody in the company could gain access. On the other hand, about 9 per cent of the participants acknowledged that their information and knowledge were securely protected, compared with only 2 per cent who pointed out that their information and knowledge were very securely protected. The findings also showed that around 6 per cent of the respondents indicated that they did not know about the security and protection of information and knowledge.

This survey included another question concerning the protection of knowledge and information resources owned by the foreign partner. In this case, local respondents had to answer. The findings of this question showed that nearly half of the respondents (48 per cent) indicated that these resources of knowledge and information were protected, whereas 10 per cent confirmed that they were very securely protected. However, nearly one third of the respondents, 33 per cent indicated that these knowledge and information resources were not protected and anyone could gain access. 9 per cent of the total participants surveyed stated that they were not sure about the protection of knowledge and information resources owned by the foreign partner.

6.2.8 Requesting knowledge

Libyan respondents were asked about requesting knowledge and information and whether they requested knowledge only when they really needed it. The findings revealed that nearly 69 per cent of the participants agreed that they actually requested knowledge only when they needed it, and around 4 per cent strongly agreed that this was so. However, about 18 per cent expressed disagreement; 4 per cent disagreed strongly, while 5 per cent indicated that they were not sure about whether they could request knowledge and information.

Figure: 6. 7 Explanation for knowledge request



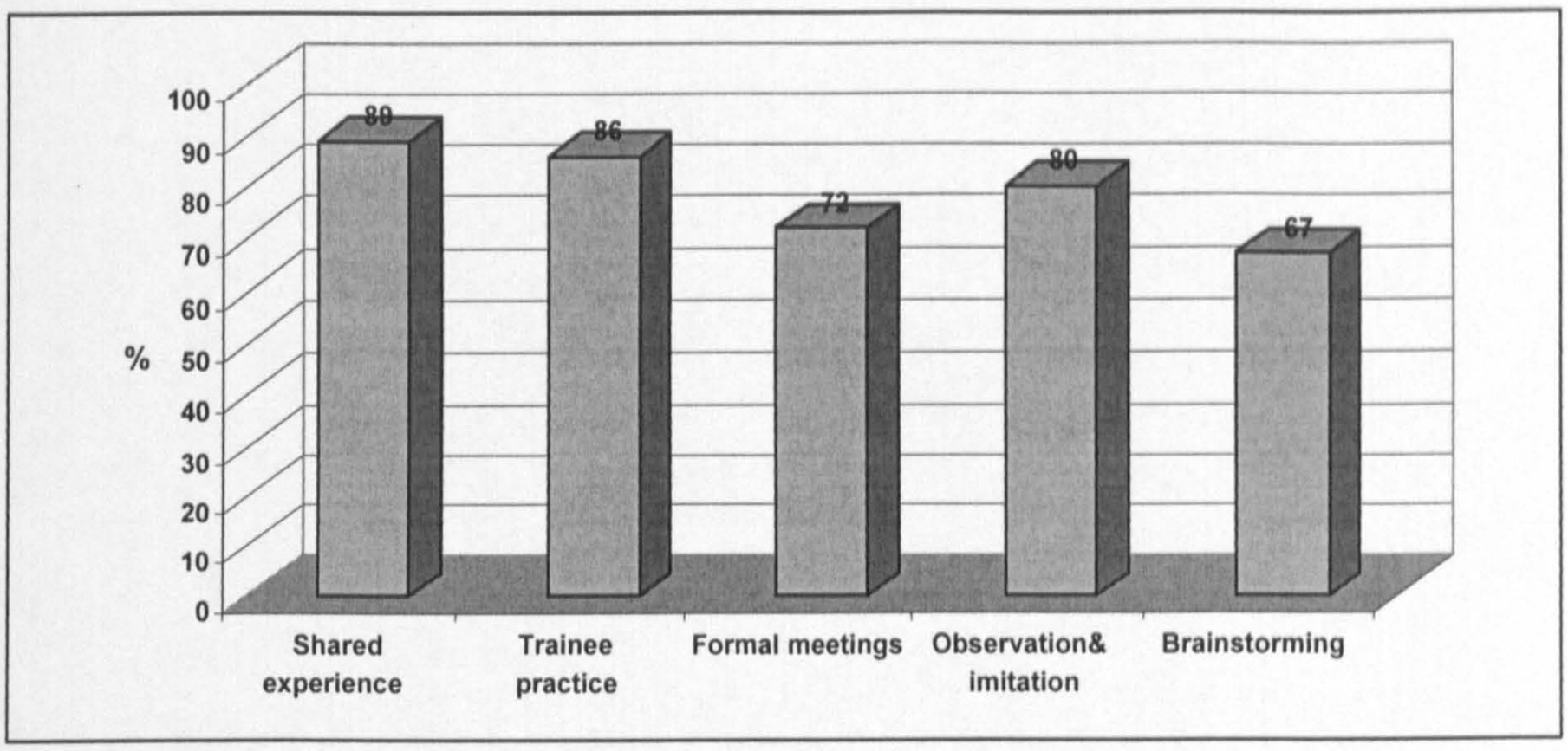
Furthermore, local respondents were allowed to indicate their agreement or disagreement that they needed to give a complete explanation when they were requesting knowledge and information from their foreign partner. Accordingly, as Figure 6.7 shows, nearly two thirds of the participants, 67 per cent, agreed, and about 11 per cent strongly agreed. On the other hand, only 4 per cent disagreed, and 1 per cent strongly disagreed, whereas 17 per cent of the total respondents indicated that they were not sure whether they needed to give a complete explanation for their request for knowledge and information from their foreign partner.

Local individuals were also asked to state whether they were restricted in their search for knowledge and information across a wide variety of applications and databases. The results of this question revealed that almost 29 per cent of the participants agreed they were restricted, and about 3 per cent strongly agreed. By contrast, more than half of the respondents (55 per cent) confirmed their disagreement and indicated that they were not restricted in their search for knowledge and information across a wide variety of application and databases. Moreover, approximately 8 per cent of the respondents strongly disagreed and nearly 5 per cent were not sure about the restriction.

6.2.9 Knowledge creation

Knowledge creation represents creating new knowledge based on ongoing experience in a specific field and then using the new knowledge in combination with the existing knowledge to come up with updated and newly created knowledge for knowledge sharing. In this survey, the Libyan respondents were asked to determine the main methods of creating knowledge in their company. They were given five possible answers (shared experience, trainee practice, formal meetings, observation and imitation, and brainstorming). Respondents were allowed to tick more than one choice if applicable.

Figure: 6. 8 Knowledge creation methods



As can be seen from the above figure (6.8), the majority of the participants, 89 per cent, revealed that shared experience was the main method for knowledge creation in their companies, whereas trainee practice came in second with 86 per cent of the total sample surveyed. In addition, 80 per cent of the respondents believed that observation and imitation were the main modes for knowledge creation, while 72 per cent chose formal meetings, and 67 per cent of the participants confirmed that brainstorming was the main method of creating knowledge in their companies.

Knowledge creation embraces the notion that organizational knowledge is created via an incessant dialogue between tacit and explicit knowledge through four models of interaction, tacit into tacit (socialization), explicit into explicit (combination), explicit into tacit (internalization) and tacit into explicit (externalization). To create knowledge, all these methods of knowledge conversion shape a continual chain which is activated by group interactions, discussions, dialogues, metaphors, coordination, documentation, experimentation, learning by doing, and the like.

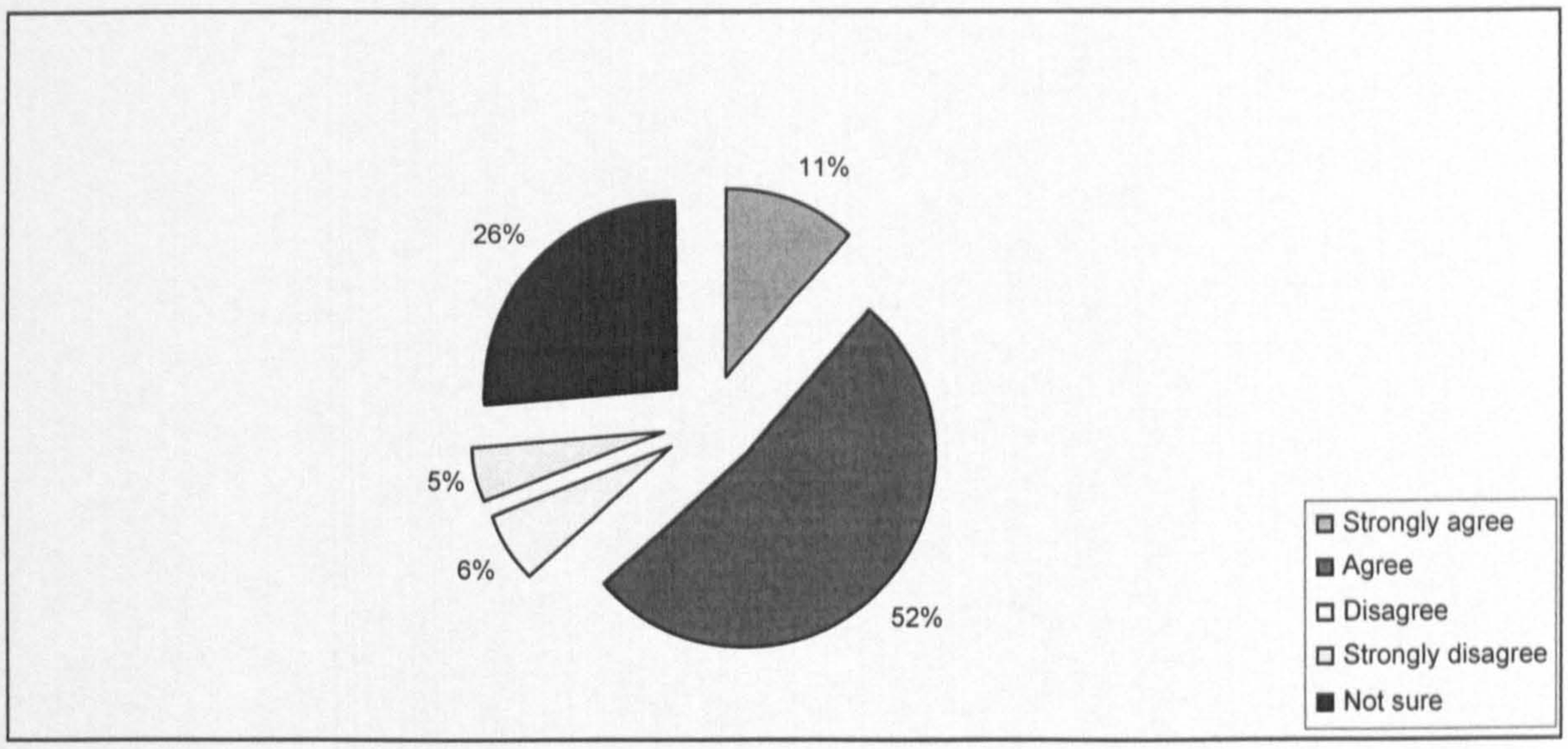
6.2.10 Knowledge sharing and transfer

Knowledge sharing takes place when a person is willing to help, as well as to learn from others in the development of new competences and skills. Knowledge transfer in organisations is "the process through which one unit (e.g. group, department or division) is affected by the experience of another" (Argote and Ingram, 2000, p. 151).

6.2.10.1 Recognition of knowledge sharing and transfer

As has been stated earlier, knowledge is very significant in general and always required in companies. In this survey, local respondents were asked to what extent they agreed or disagreed with the statement that knowledge sharing and transfer was widely recognized in their companies. They were given five possible answers (strongly agree, agree, disagree, strongly disagree, and not sure).

Figure: 6. 9 Knowledge recognition



The findings revealed that knowledge sharing was quite common: more than half of the participants (52 per cent) agreed with this statement, while about 11 per cent strongly agreed with it. On the other hand, about 6 per cent of the respondents disagreed with the statement that knowledge sharing and transfer is widely recognized in their companies, whereas, almost 5 per cent strongly disagreed. In addition, nearly 26 per cent were not sure about the recognition of knowledge sharing and transfer in their companies.

6.2.10.2 Knowledge to be shared and transferred

Libyan respondents were asked whether their partner company distinguished between the knowledge that should be centrally controlled and the knowledge that anyone should be free to share and transfer.

The analysis of the replies revealed that nearly two thirds of the respondents (67 per cent) confirmed that their partner company did make such a distinction, whereas almost one

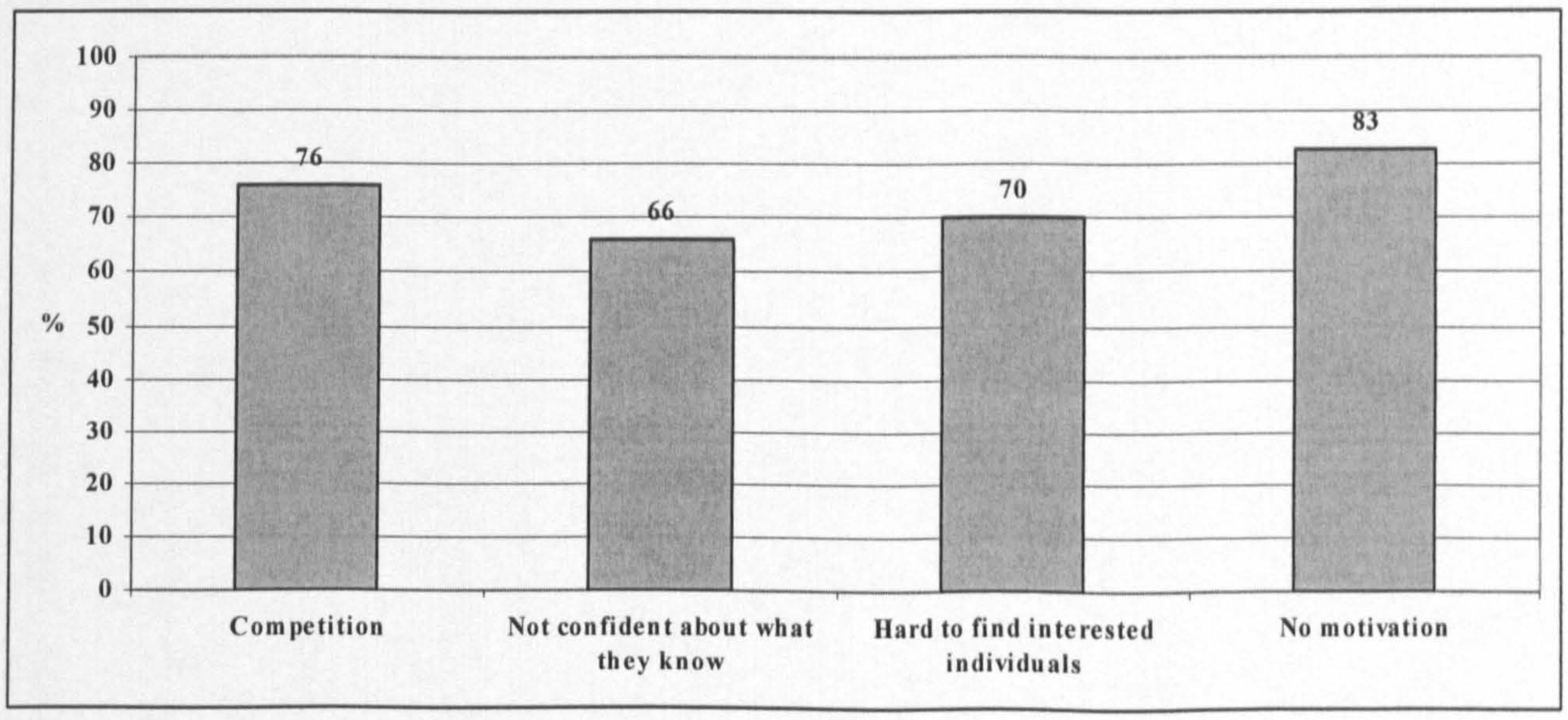
third of the participants (33 per cent) believed that their partner company did not distinguish between the knowledge that should be centrally controlled and the knowledge that anyone should be free to share and transfer.

6.2.10.3 Unwillingness to share and transfer knowledge

Libyan respondents were asked to state why they thought that individuals were sometimes reluctant to transfer and share their knowledge. They were given four possible options and allowed to choose more than one, if applicable. The choices given were:

1. There is no motivation or recognition for sharing knowledge
2. Individuals sometimes find it hard to know whether other employees would be interested in what they know
3. Individuals are sometimes not confident about what they know
4. Individuals are sometimes competitive and their knowledge increases their power and position

Figure: 6. 10 Unwillingness to transfer knowledge



The findings revealed that around 83 per cent of the participants were reluctant to transfer and share knowledge because they thought that there was no motivation or recognition for sharing knowledge. Nearly 76 per cent believed that the main reason was that individuals were sometimes competitive and their knowledge increased their power and position. Moreover, almost 70 per cent of the respondents indicated that individuals found it hard sometimes to know whether other employees would be interested in what they knew.

Finally, about 66 per cent thought that individuals were sometimes not sure and confident about what they knew.

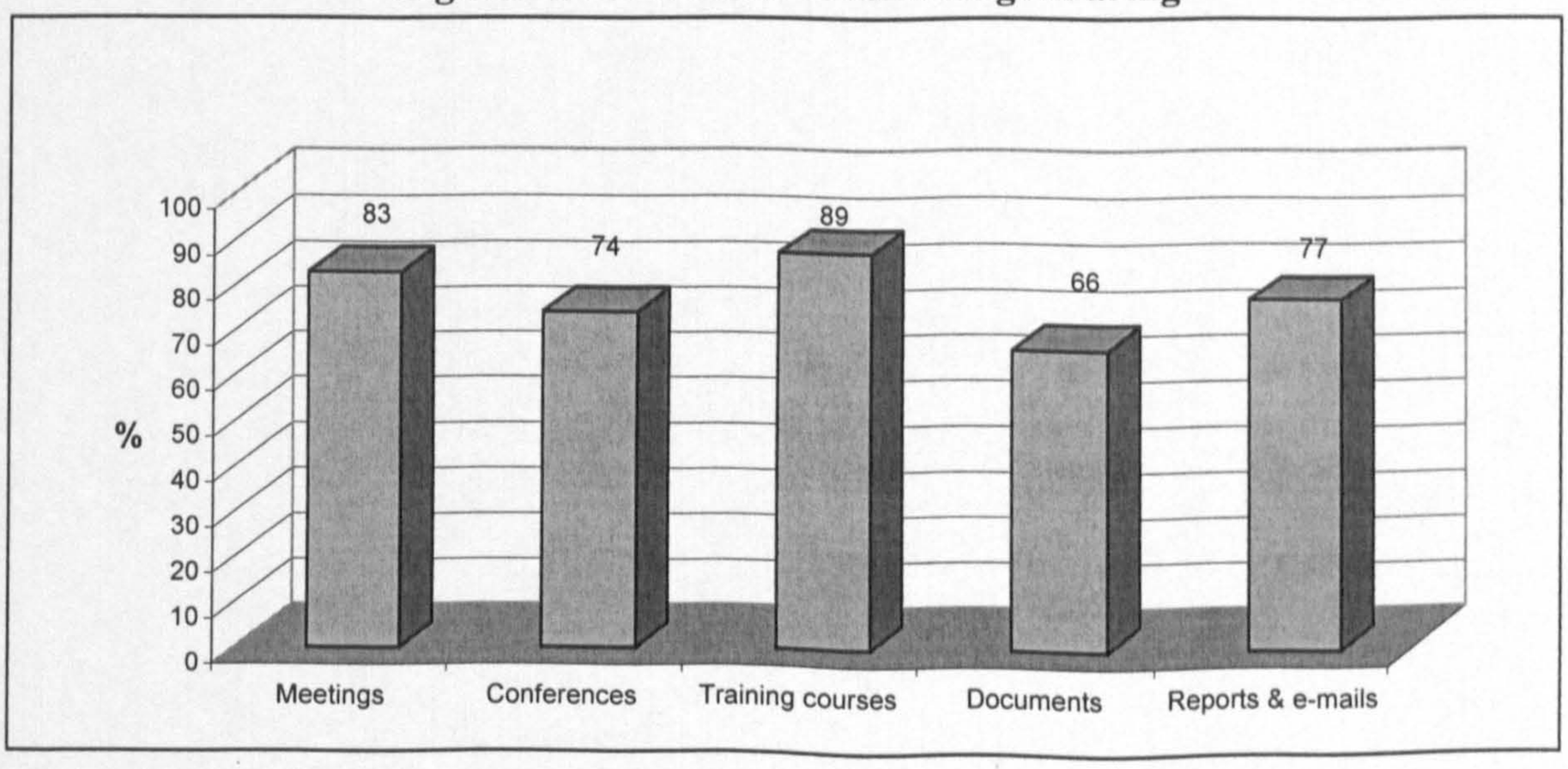
6.2.10.4 Methods of knowledge sharing

Foreign respondents were asked whether their companies established some methods for individuals to share knowledge. As a result, nearly 77 per cent of the participants said yes their companies set up some methods for individuals to share knowledge, compared with only 3 per cent who stated no. However, 20 per cent of the respondents were not sure whether their companies established some methods for individuals to share knowledge or not.

Furthermore, the foreign respondents were also asked to determine the main methods for individuals to share knowledge. They were given five probable answers (meetings, conferences, training courses, documents, and reports and e-mails). Participants were allowed to choose more than one option, if applicable.

The analysis of replies of the survey questionnaires showed that the majority of the respondents (89 per cent) believed that training courses were the most popular method for individuals to share knowledge. Meetings came second, with about 83 per cent of the total participants. Next came reports and e-mails, with almost 77 per cent, and then came conferences, with around 74 per cent, and, finally, documents with 66 per cent of the total sample surveyed. Figure 6.11 presents the methods of knowledge sharing.

Figure: 6. 11 Methods of knowledge sharing



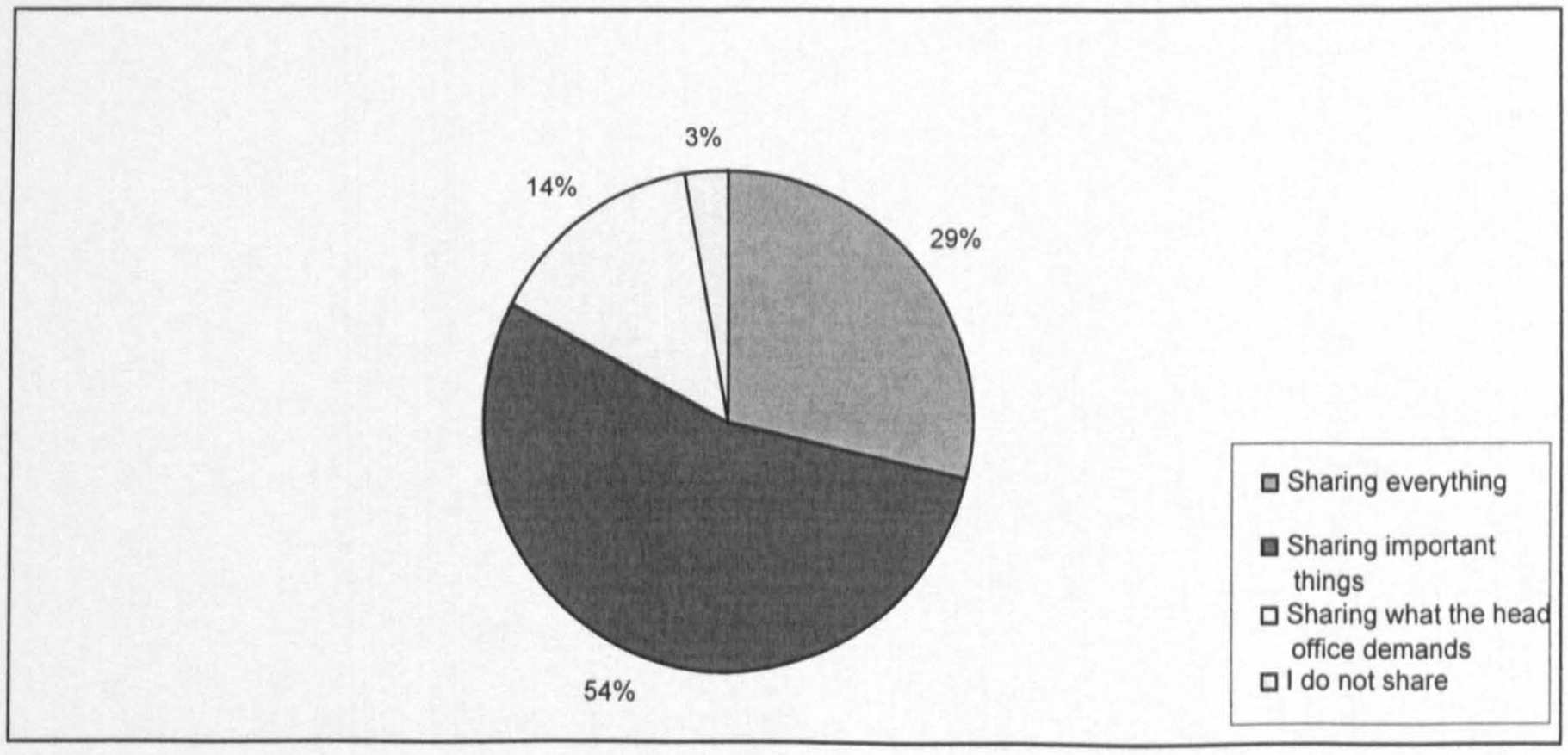
6.2.10.5 Parts of knowledge shared

The survey gathered data from the foreign participants on the parts of newly gained knowledge which individuals shared. They were given four possible choices and allowed to tick only one appropriate answer. The possible choices were:

1. I share everything that I know/ or have experienced
2. I share what I think is important for the company
3. I share what the head office asks me to share
4. I do not share knowledge

The results of the questionnaires revealed that about 54 per cent of the respondents shared what they thought was important for their company, whereas around 29 per cent shared everything they knew or had experienced. Furthermore, the findings indicated that almost 14 per cent of the respondents shared what the head office asked them to share. By contrast, only 3 per cent confirmed that they did not share knowledge at all. Figure 6.12 presents the parts of knowledge shared:

Figure: 6. 12 Parts of knowledge shared

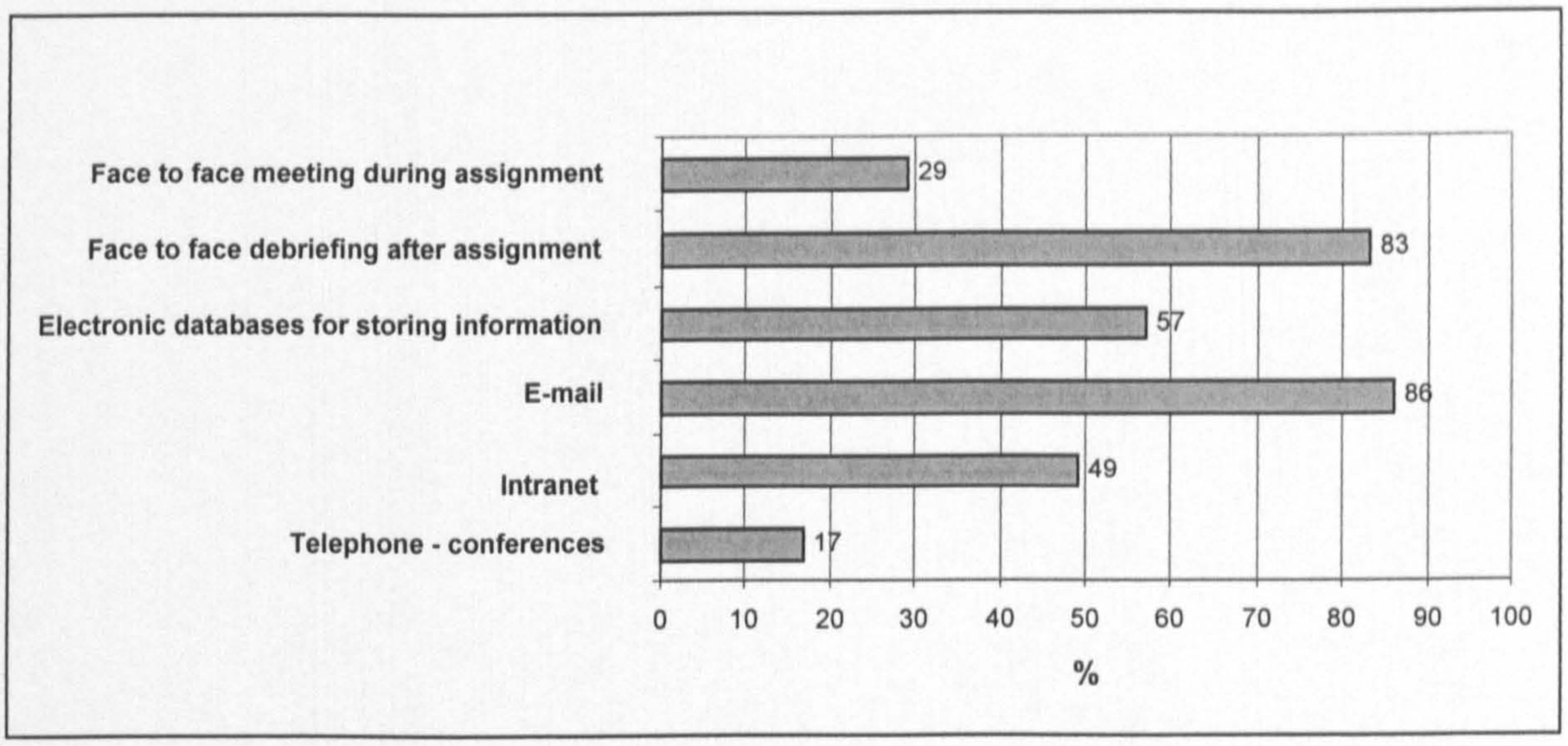


6.2.10.6 Knowledge sharing facilities

In order to assist in fostering vital knowledge sharing activities, companies should provide the appropriate facilities that can help to achieve this objective. Therefore, in this survey, foreign respondents were asked to determine the facilities for knowledge sharing provided by their companies. Several options were given, and the respondents were allowed to

choose more than one option if applicable. The options provided included: face to face meeting during the assignment (including video/web conferences), face to face debriefing after the assignment, electronic database for sorting information, e-mail, Intranet, and telephone (conferences).

Figure: 6. 13 Knowledge sharing facilities



As can be seen from the above figure (6.13), almost 86 per cent of the respondents believed that e-mail was the facility most available for knowledge sharing that was provided by their companies, while about 83 per cent confirmed that face to face debriefing after the assignment was widely provided. The facility of electronic database for sorting information came third, chosen by approximately 57 per cent of the respondents, whereas Intranet came fourth, with 49 per cent of the total participants. Next came face to face meeting during the assignment (including video/web conferences), with almost 29 per cent, and telephone (conferences) with around 17 per cent.

6.2.10.7 Knowledge sharing motivations

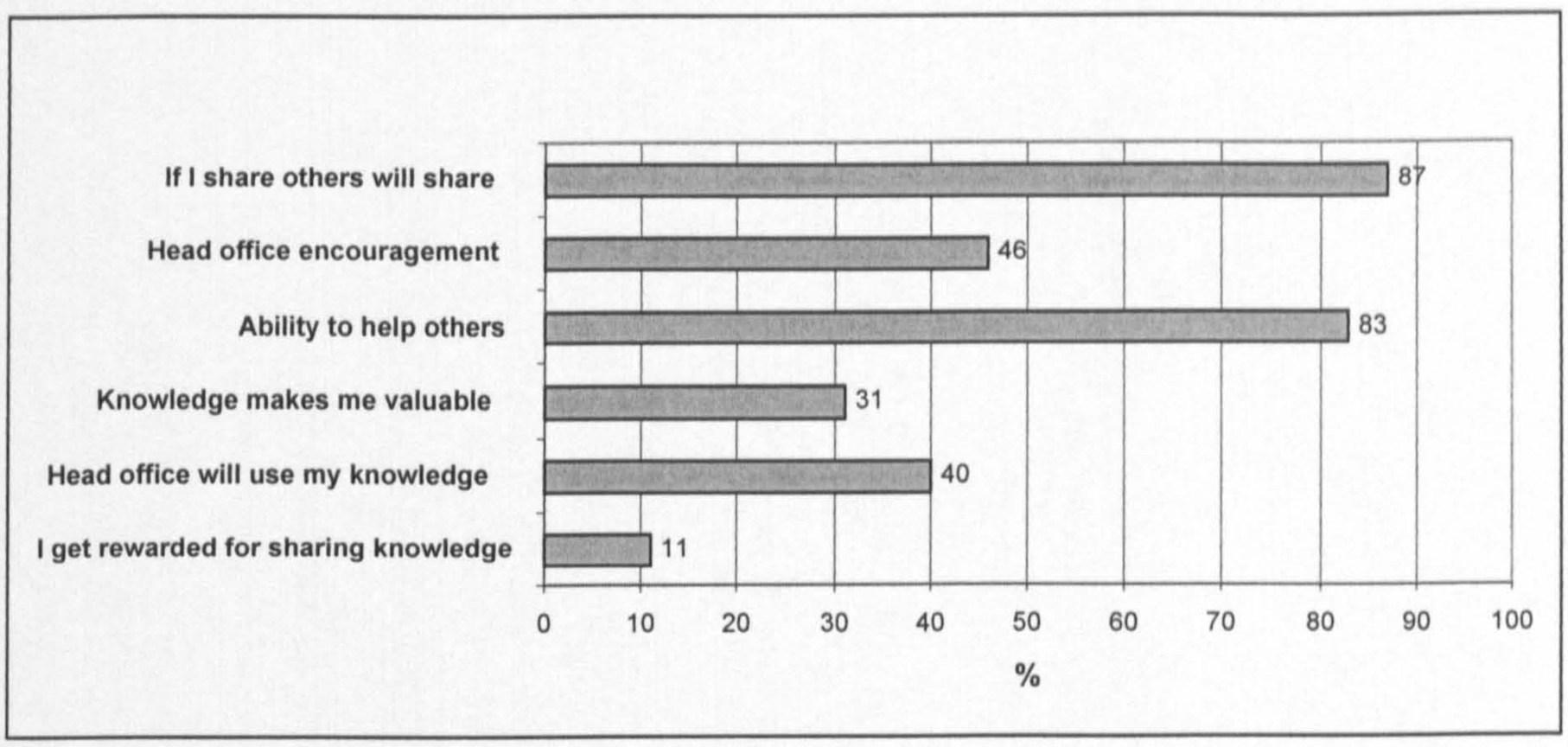
Foreign respondents were asked about the motivations for sharing their knowledge. They were given six options and allowed to select only three. The choices given were:

1. The idea that if I share, others will share their knowledge with me as well
2. Encouragement from head office
3. The feeling that I am able to help (others in) the company
4. The power that knowledge provides, making me valuable to the

company

5. Knowing that head office will actively use the knowledge I provide
6. Because I get rewarded for sharing knowledge from my head office

Figure: 6. 14 Motivations for sharing knowledge



The findings of the survey revealed that almost 87 per cent of the participants were motivated to share knowledge by the idea that if they shared, others would share their knowledge with them as well, while about 83 per cent noted that what encouraged them to share knowledge was the feeling that they were able to help others in the company. In addition, for approximately 46 per cent of the respondents the main incentive to share knowledge was encouragement from head office to do so, whereas around 40 per cent pointed out that knowing head office would actively use the knowledge they provided was their essential stimulus to share knowledge. On the other hand, about 31 per cent of the participants believed that the major inspiration for them to share knowledge was that the power that knowledge provides made them valuable to the company. Finally, only 11 per cent revealed that because they got rewarded from the head office for sharing knowledge this could motivate them to share.

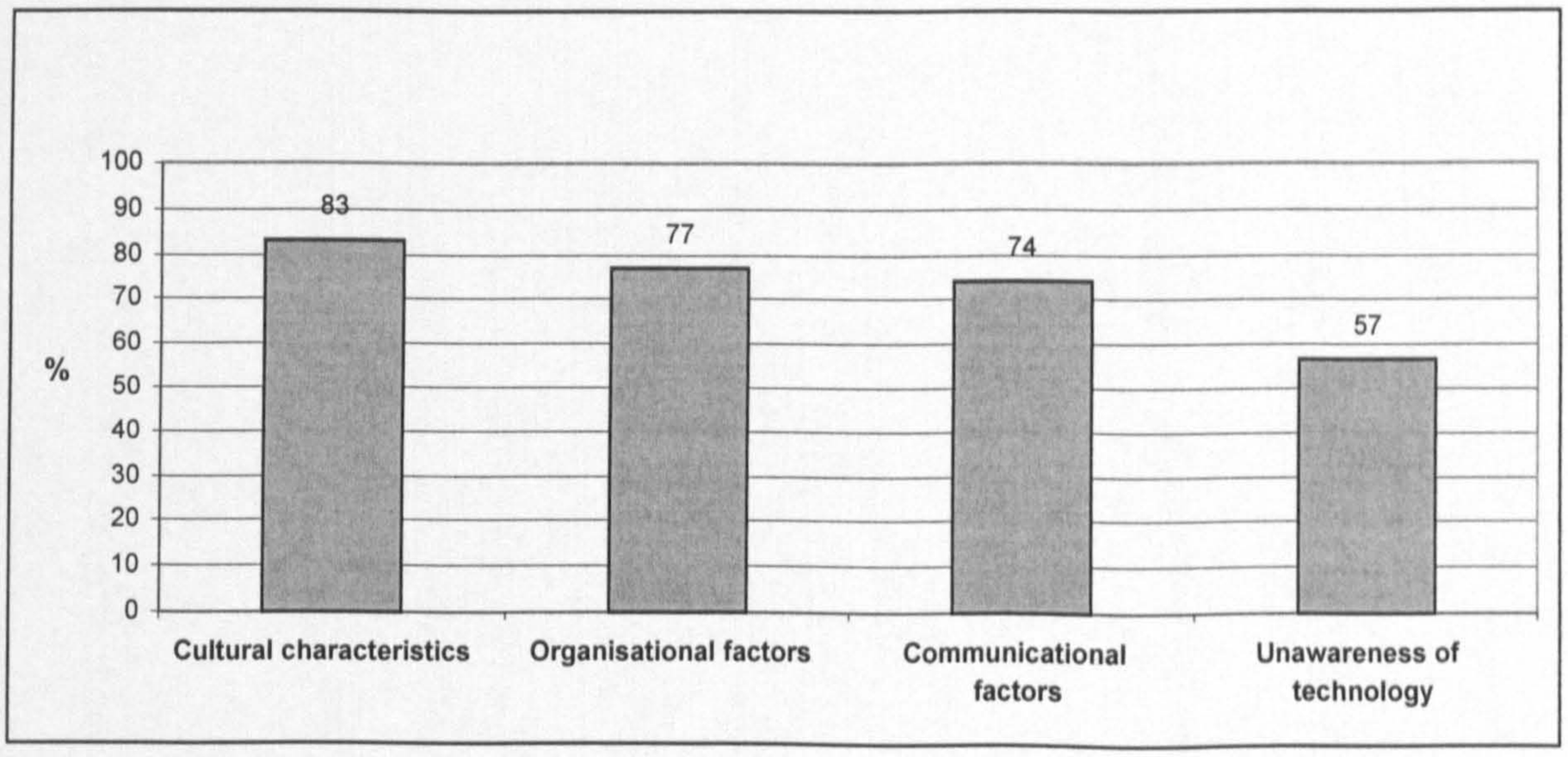
6.2.10.8 Knowledge sharing barriers

Foreign respondents were asked to determine the main barriers to knowledge sharing and transfer. They were given four choices and were allowed to choose more than one if applicable. The four options given were:

1. Partner's cultural characteristics
2. Organisational factors (organisational climate, relationships, systems and structures of the company)
3. Communicational factors e.g. language difficulties
4. Unawareness of the advantages of technology

The analysis of replies revealed that approximately 83 per cent of the total participants indicated that the partner's cultural characteristics were the main barrier to knowledge sharing and transfer, whereas almost 77 per cent confirmed that the main obstacle to sharing and transferring knowledge was the organisational factors (organisational climate, relationships, systems and structures of the company). Moreover, communicational factors, for example, language difficulties, could also be a barrier to sharing and transferring knowledge; this option was selected by about 74 per cent. However, more than half of the participants (57 per cent) believed that unawareness of the advantages of technology was a major obstruction to the sharing and transferring of knowledge. Figure 6.15 summarises the main barriers to transferring and sharing knowledge.

Figure: 6. 15 Barriers to knowledge transfer



Furthermore, foreign respondents were asked to indicate whether their companies looked for ways of removing barriers to knowledge sharing. It was found that slightly more than half of the respondents (52 per cent) agreed that their companies were always looking for ways to minimize the barriers to sharing knowledge. In addition, around 20 per cent strongly agreed that this was so. By contrast, almost 11 per cent disagreed and confirmed

that their companies did not look for ways to remove barriers to knowledge sharing; about 17 per cent of the total respondents surveyed revealed that they were not sure about ways of removing barriers to knowledge sharing.

6.3 Knowledge Management (KM)

Knowledge management is a broad term that includes many expressions such as knowledge creation; knowledge assessment; knowledge finding; and knowledge sharing and transfer. It usually refers to how a company obtains, conserves, stores and uses its intellectual capital. This section looks at knowledge management, examining its significance, programmes and activities.

6.3.1 Significance of knowledge management

Knowledge management can help companies achieve improved quality, more rapid development cycles, and cost saving. In this survey, local participants were asked to rank the significance of knowledge management in their companies. They were given four possible answers, and allowed to rate each option by its importance, from 1 to 4, where 1= very important, 2= quite important, 3= important, and 4= not important). The four options given were:

1. KM works continuously to evaluate the company's internal theories in order to progress effectively.
2. KM is the power of collective knowledge to enhance innovation and responsiveness.
3. KM increases the company's knowledge-related effectiveness from its knowledge resources to renew them continuously
4. KM strengthens organisational performance.

Table: 6. 5 Significance of knowledge management

Function	Rate			
	Very important	Quite important	Important	Not sure
Enhance innovation	81%	11%	7 %	1 %
Strengthen organisational performance	77 %	13 %	9 %	1 %
Increase the company's knowledge effectiveness	41 %	16 %	34 %	9 %
Evaluate internal theories	59 %	17 %	20%	4 %

As the above table (6.5) shows almost 81 per cent of the participants indicated that knowledge management being the power of collective knowledge to enhance innovation and responsiveness was a very important reason for knowledge management in their company, 11 per cent chose quite important, 7 per cent important, and 1 per cent of the respondents believed that this cause was not important. In addition, the findings also showed that nearly two thirds of the participants (77 per cent) confirmed that strengthening organisational performance was very important for knowledge management in their company; 13 per cent chose quite important, 9 per cent important, and 1 per cent of the respondents confirmed that this element was not important.

Furthermore, the study also revealed that about 59 per cent of the respondents selected as a very important reason for knowledge management in their companies that fact that knowledge management works continuously to evaluate the company's internal theories in order to progress effectively. 17 per cent found this quite important, 20 per cent important, and 4 per cent stated that this reason was not important. By contrast, approximately 41 per cent of the respondents agreed that knowledge management increased the company's knowledge-related effectiveness, via its knowledge resources. The continuous renewal of knowledge-related effectiveness is a very important part of knowledge management in their companies. 16 per cent found this quite important, 34 per cent important, and only 9 per cent of the respondents believed that this element was not important in their companies.

6.3.2 Knowledge management programmes

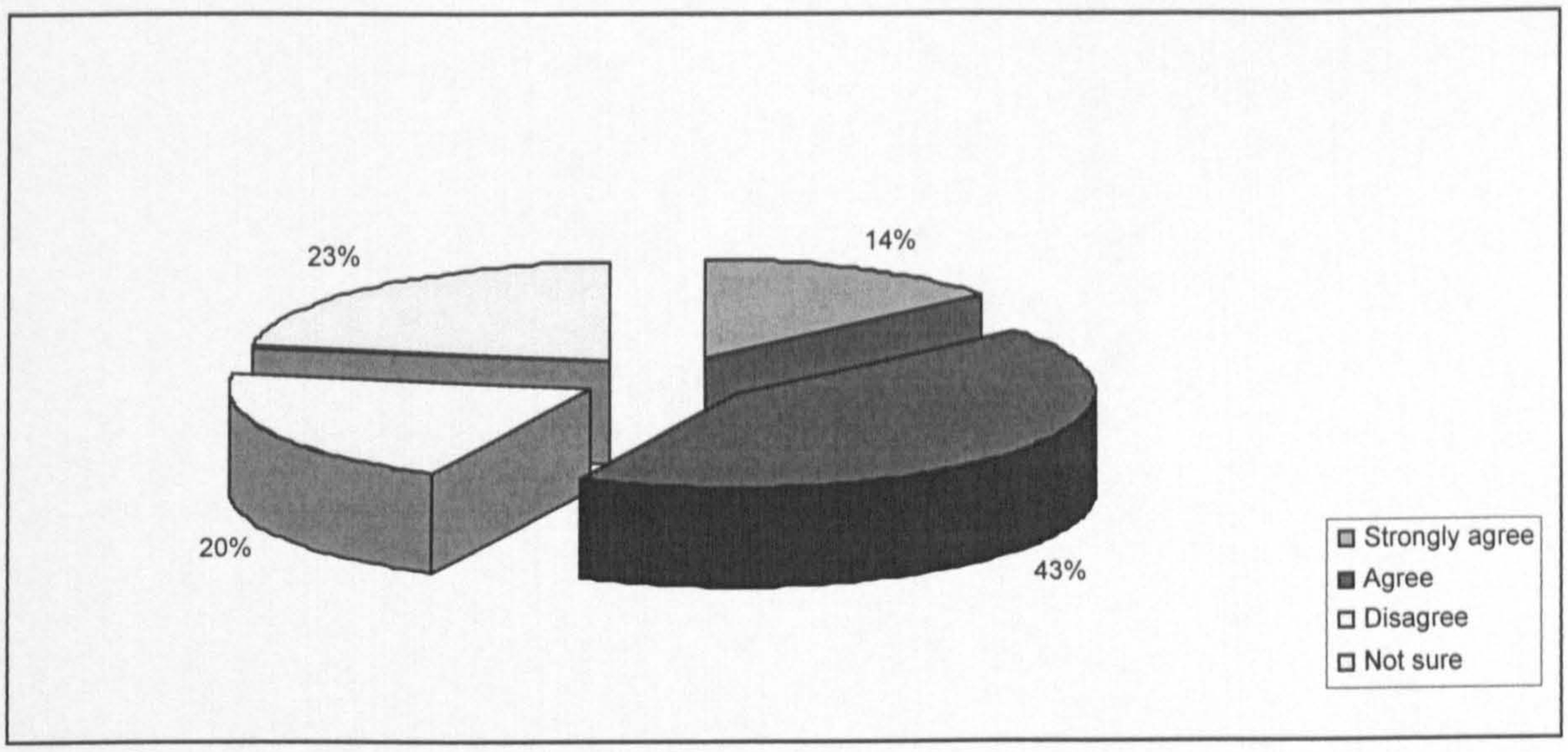
Libyan respondents were asked to state whether their foreign partners had a knowledge management programme to ensure maximum business benefits. Surprisingly, it was

discovered that less than half of the participants (40 per cent) revealed that their foreign partner had a knowledge management programme, compared to about 12 per cent who stated that their foreign company did not have such a programme. However, almost half of the respondents (48 per cent) were not sure whether their foreign partners had a knowledge management programme or not. Respondents interviewed confirmed that knowledge management offers a policy, tools and procedures to guarantee integration of the company's knowledge base. This allowed individuals to have an integrated view of what knowledge was offered and where it could be accessed

Local respondents were also asked whether they felt the manner of their foreign partner made it possible to acquire an effective knowledge management programme. The findings revealed that almost 23 per cent of the participants considered that the manner of their foreign partner did make it possible to acquire an effective knowledge management programme, while 16 per cent disagreed with this statement. However, around 61 per cent of the total participants were not sure about the manner of their foreign partner as regards creating a useful knowledge management programme.

On the other hand, foreign participants were asked about practising knowledge management: whether they thought that they had been practising knowledge management for some time without actually calling it that. It was found that about 43 per cent of the respondents agreed they had, while 14 per cent strongly agreed. However, around 20 per cent disagreed, and 23 per cent of the total participants were not sure whether they had been practising knowledge management without calling it that.

Figure: 6. 16 Practice of knowledge management



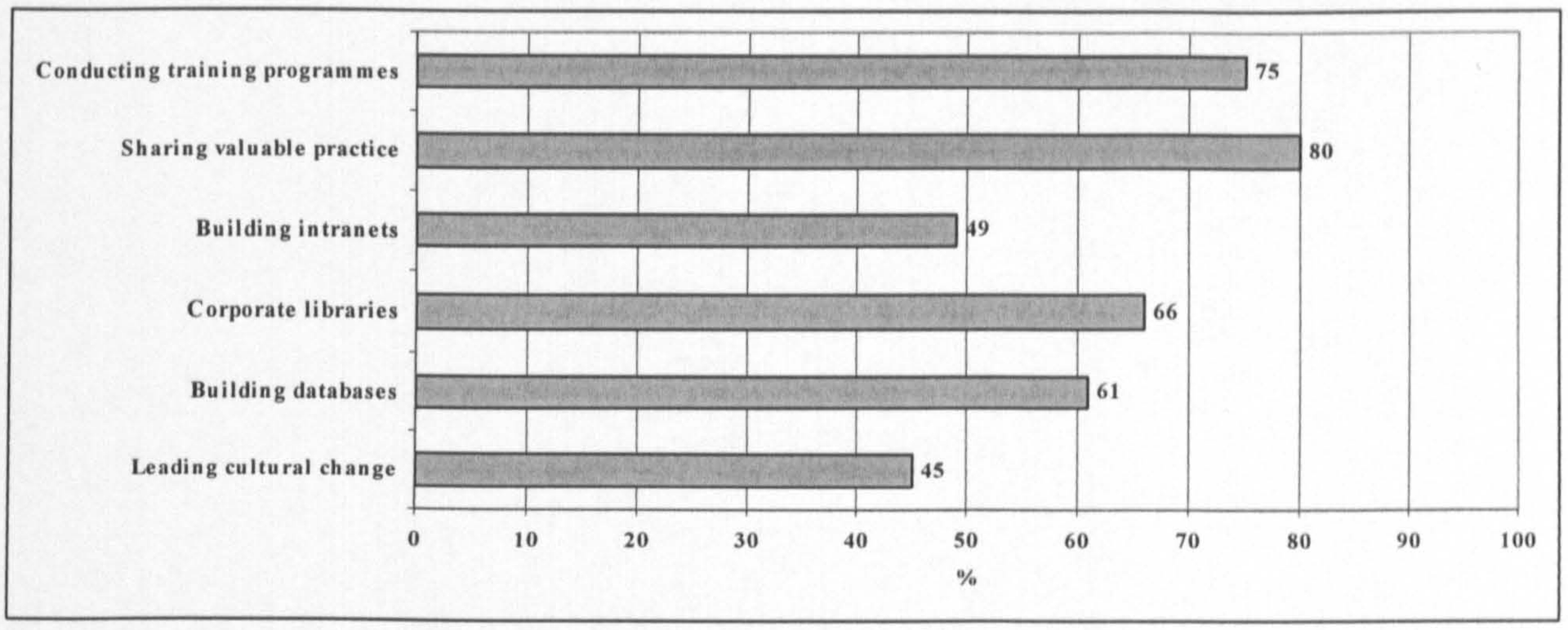
Furthermore, foreign respondents were asked whether the members of the senior management team in the company frequently talked about knowledge management when reporting on the state of the company to the local partner. The results of this question showed that about 29 per cent of the respondents surveyed confirmed that members of the senior management team did not frequently talk about knowledge management, while almost 17 per cent indicated that they did frequently talk about it. However, about 54 per cent of the participants revealed that they were not sure whether the members of the senior management team in the company frequently talked about knowledge management or not when reporting on the state of the company to the local partner.

It has been revealed that achieving a knowledge management programme usually required a suitable mixture of organisational, social, and managerial programmes in addition to a decent margin of state of the art technology.

6.3.3 Knowledge management activities

Knowledge management involves several activities. Therefore, national respondents were asked to rank the key activities of knowledge management in their companies. They were given six main activities (building databases, sharing the most valuable practice, conducting training programmes, leading cultural change, setting up corporate libraries, and building Intranets). Respondents were allowed to choose more than one option, if applicable.

Figure: 6. 17 Knowledge management activities



The findings of this survey found that around 80 per cent of the participants indicated that sharing the most valuable practice was the main activity in knowledge management, whereas around 75 per cent believed that conducting training programmes was the key activity. Nearly two thirds of the total respondents, 66 per cent, acknowledged that the main activity in knowledge management was setting up corporate libraries. Moreover, about 61 per cent noted that building databases was the essential activity. On the other hand, nearly half of the participants (49 per cent) chose building Intranets, and almost 45 per cent chose leading cultural change as key activities of knowledge management in their companies.

When the researcher discussed this question with the interviewees, one interviewee pointed out that knowledge management had always been connected with learning and training in his company and that the use of knowledge management in general improves management potential and techniques.

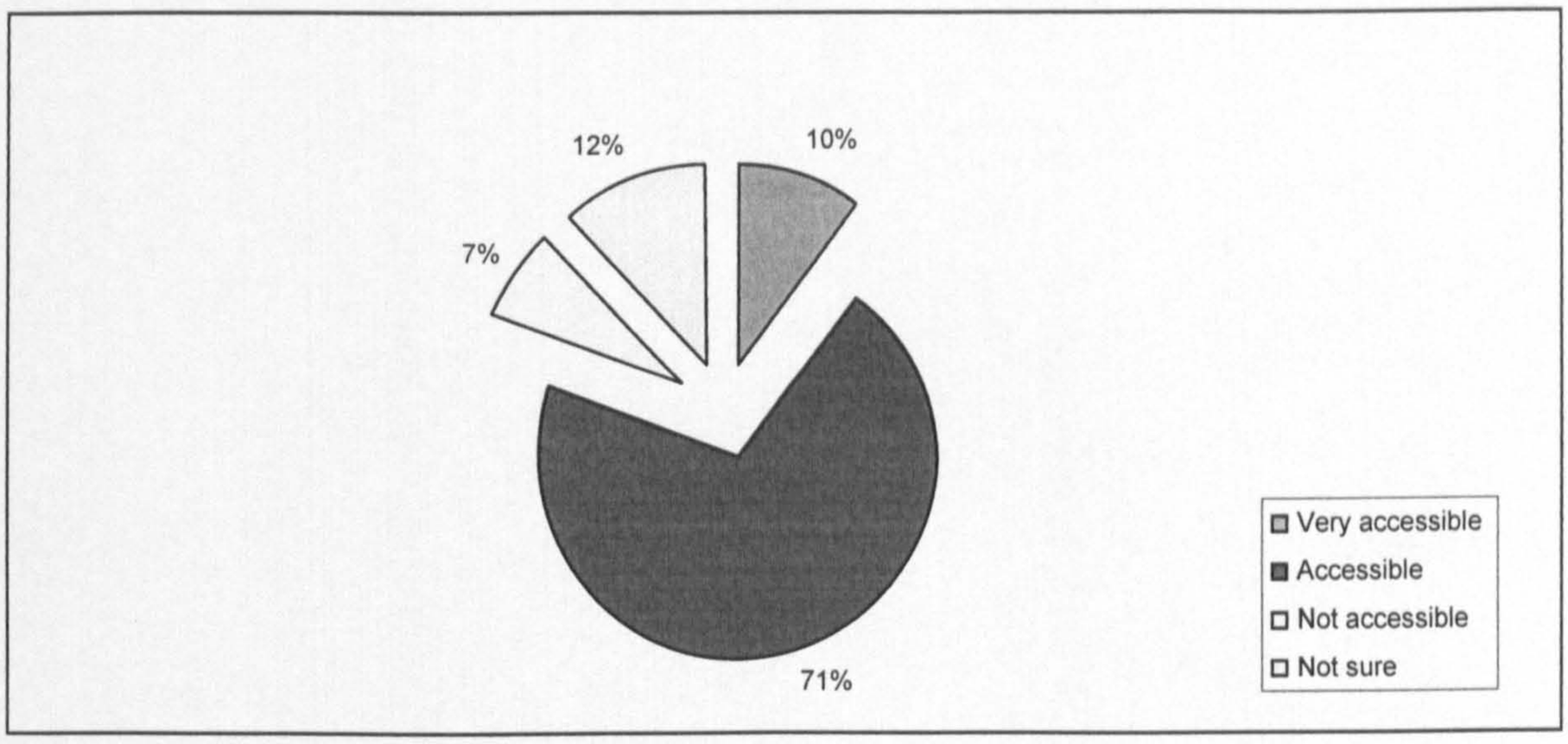
6.4 Knowledge management systems

Knowledge management systems refer to a category of information systems applied to manage organisational knowledge; they are usually IT-based systems established to support and improve the organisational processes of knowledge creation, transfer, and application (Alavi and Leidner, 1999). This section looks at the accessibility and main functions of knowledge management systems.

6.4.1 Knowledge management system accessibility

Local respondents were asked to determine the accessibility of knowledge management systems provided by their foreign partner. They were given four possible choices (very accessible, accessible, not accessible, and not sure). Respondents were allowed to tick only one appropriate box.

Figure: 6. 18 Accessibility of knowledge management systems



The findings indicated that nearly two thirds of the participants (71 per cent) believed that knowledge management systems were accessible, whereas almost 10 per cent confirmed that these systems were very accessible. By contrast, about 7 per cent stated that they were not accessible, and around 12 per cent of the total respondents revealed that they were not sure about the accessibility of knowledge management systems provided by their foreign partner.

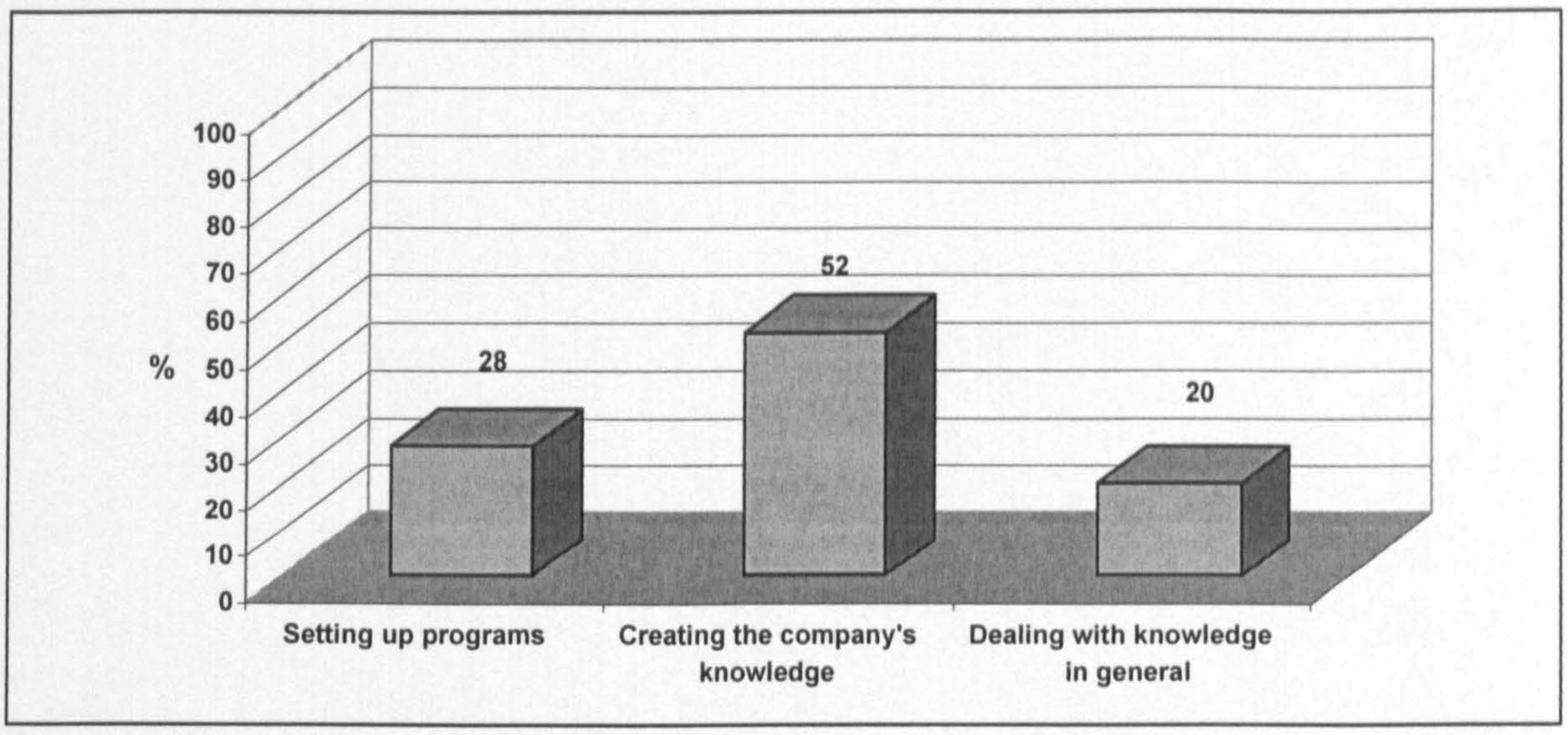
6.4.2 Function of knowledge management systems

Knowledge Management System (KMS) is a networked system which mainly relates to those information systems designed and implemented, which effectively and successfully influence the communal experience and knowledge of individuals in order to back information processing needs. KMS also has many functions. In this survey, Libyan respondents were asked to mention the main purpose of the KMS in their companies. They were given three choices, and allowed to tick only one option. The purposes given were:

1. KMS deals with setting up programs which facilitate its existence and availability.

2. KMS focuses on creating, gathering and organising the company's knowledge.
3. KMS deals with knowledge issues in general.

Figure: 6. 19 Purpose of knowledge management system



The analysis of replies revealed that approximately 52 per cent of the total participants indicated that the main purpose of KMS was focussing on creating, gathering and organising the company's knowledge. Nearly 28 per cent chose dealing with setting up programs which facilitate its existence and availability. However, about 20 per cent of the respondents believed that dealing with knowledge issues in general was the key purpose of the KMS.

6.5 Foreign publications

This survey also included a question regarding the foreign publications issued. The reason for including this question was simply to find out whether the foreign partners published any materials and sources to be read by local individuals covering certain company topics. Therefore, the national respondents were asked whether they often received their foreign partner's publications. The findings of this question showed that slightly more than half of the participants (52 per cent) did not receive the company's publications, whereas about 48 per cent confirmed that they received their foreign partner's publication. Moreover, from those participants who received the publications, about 22 per cent revealed that they received them monthly, around 11 per cent every three months, almost 5 per cent every six

months, and approximately 10 per cent of the respondents indicated that they rarely received their foreign partner's publications.

Furthermore, with regard to the foreign partner's publications, the local respondents were also asked in this study to state whether their partner company issued an internal document reporting on how their company managed knowledge. The findings of this question revealed that around 28 per cent of the participants indicated that their company did not issue internal documents regarding managing knowledge, while about 24 per cent believed that their company issue some internal reports related to knowledge. However, almost 48 per cent of the total respondents surveyed were not sure whether their companies issued these types of documents or not.

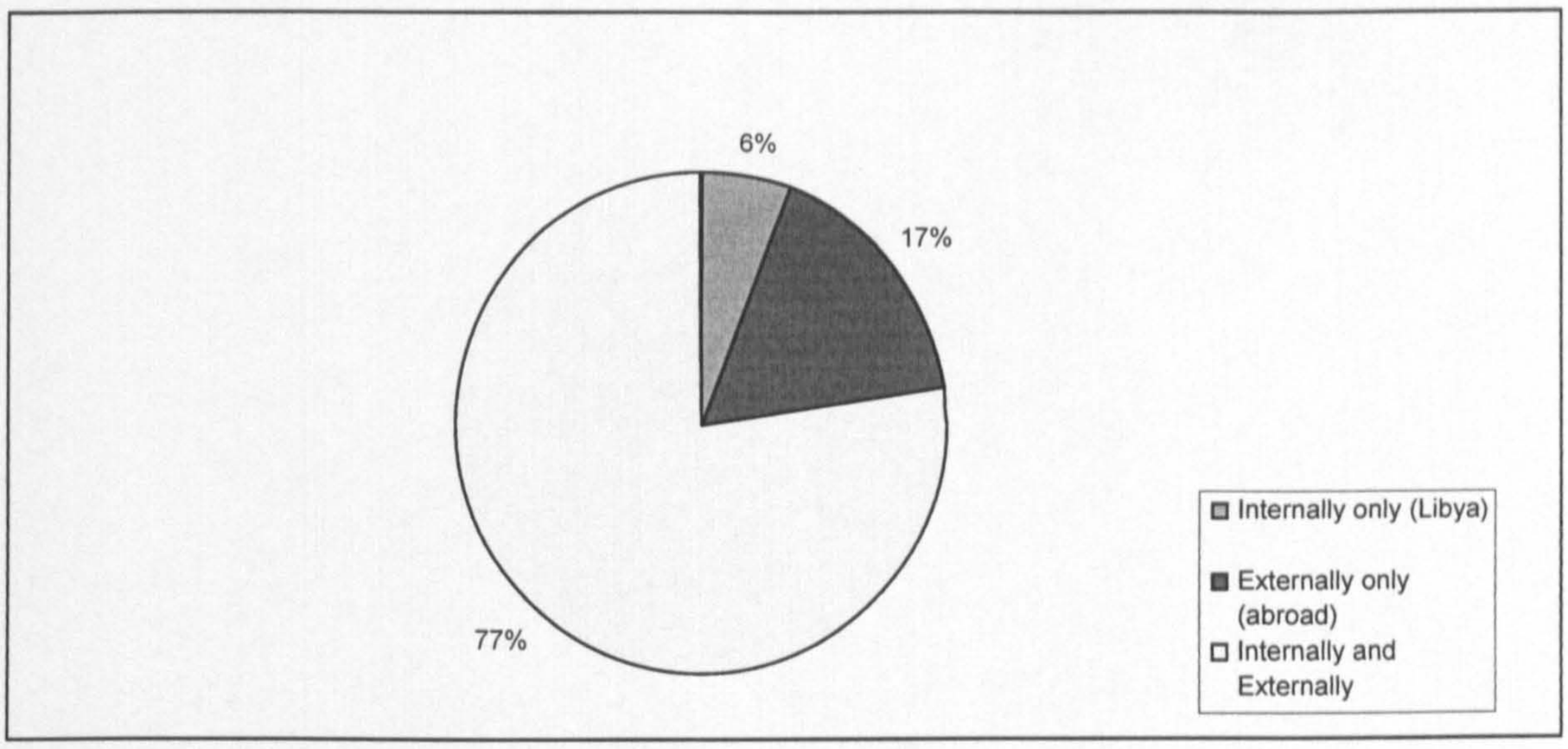
6.6 Training programmes

Local respondents were asked to state whether their partner companies organised training programmes for the Libyan personnel. It was discovered that around 88 per cent of the participants agreed that this was so, while about 12 per cent stated that their partner companies did not organise such training programmes for the Libyan personnel. The findings also revealed that almost 80 per cent of the total sample of local respondents surveyed had joined a training course provided by their foreign partner, whereas almost 20 per cent had not taken part in any training course organised by their foreign company.

Moreover, nearly 36 per cent of the respondents who confirmed that they had joined a training course indicated that the course delivered had been beneficial, compared with around 28 per cent who revealed that it was very beneficial. On the other hand, about 16 per cent of the respondents believed that the training course had not been not beneficial.

The survey also included a question about course location. Accordingly, nearly three quarters of the participants (77 per cent) indicated that these training courses were held internally and externally (abroad and in Libya). However, almost 17 per cent of the respondents confirmed that they were carried out externally only (abroad), whereas around 6 per cent indicated that these training courses were held internally only (in Libya).

Figure: 6. 20 Places of training



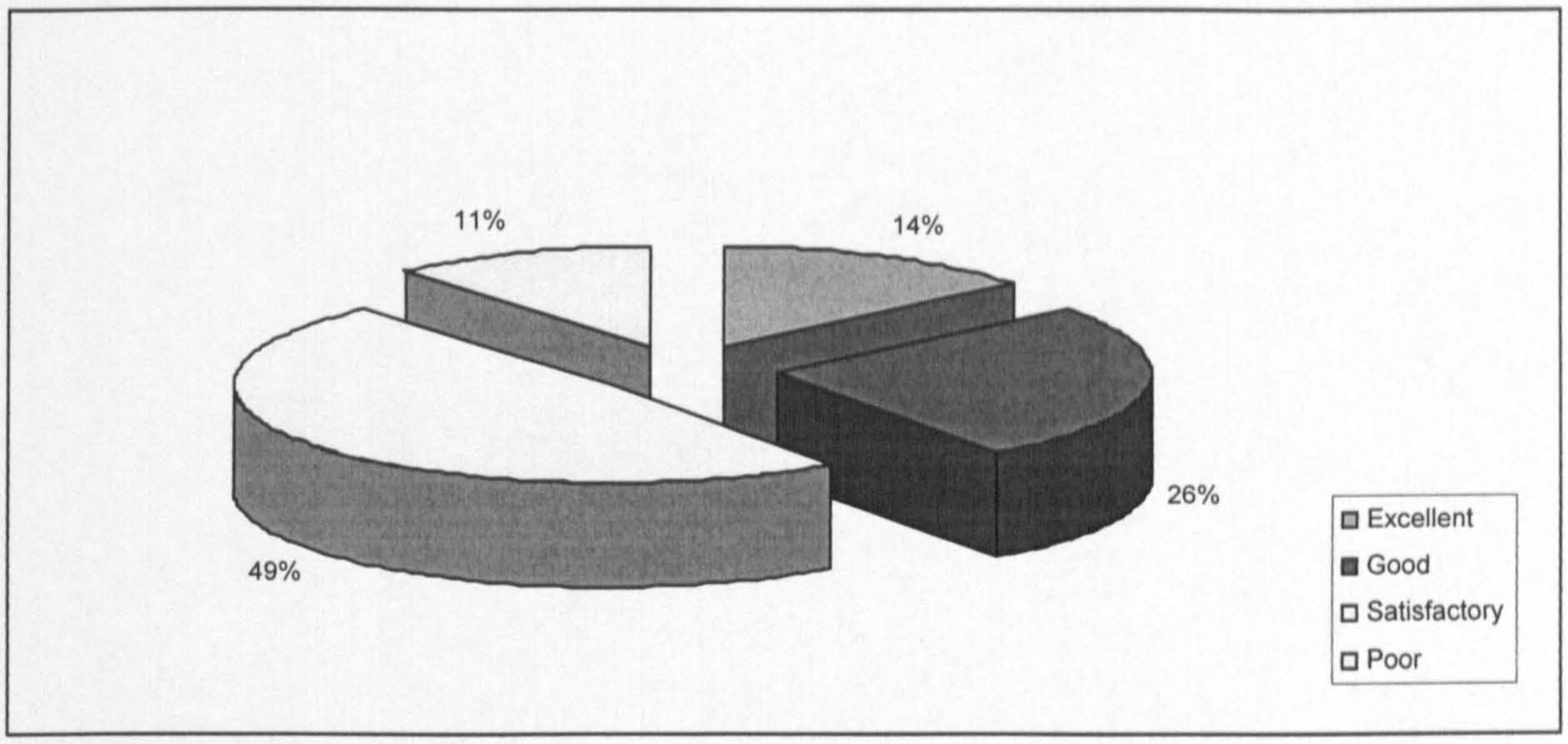
6.6.1 Training course delivery

Libyan respondents were also asked about the personnel delivering these training courses. They were given three main options (foreign partner, Libyan nationals, private companies arranged by the foreign partner). Respondents were allowed to choose more than one option, if applicable.

The findings discovered that about 82 per cent of the respondents confirmed that these courses were delivered by private companies arranged by the foreign partner. Nearly 77 per cent revealed that they were delivered by the foreign partner. However, almost 71 per cent indicated that these training courses were delivered by Libyan nationals.

Training courses provided to the Libyans were delivered either in Arabic or English or in both languages. Foreign participants were asked to determine the language of delivery. The results showed that nearly 63 per cent of the respondents indicated that these courses were delivered in both languages (Arabic and English), whereas about 31 per cent confirmed that the medium of delivery was English only. However, only 6 per cent revealed that the language of training course delivery was Arabic.

Figure: 6. 21 Training courses provided



Foreign respondents were also asked to assess the quality of the training courses provided to train the Libyan personnel. The findings of this question revealed that close to half of the participants, 49 per cent, indicated that these courses were satisfactory, while almost 26 per cent believed that they were good courses. Furthermore, nearly 14 per cent confirmed that the courses provided were excellent. By contrast, around 11 per cent of the total sample stated that these courses provided to train the Libyan personnel were poor.

6.6.2 Training programmes organisation

Foreign participants were asked to describe the organised training programmes provided for national personnel. They were given five options, and they were allowed to choose only three. The options given were:

1. The documentation of the training programmes is clear and comprehensible

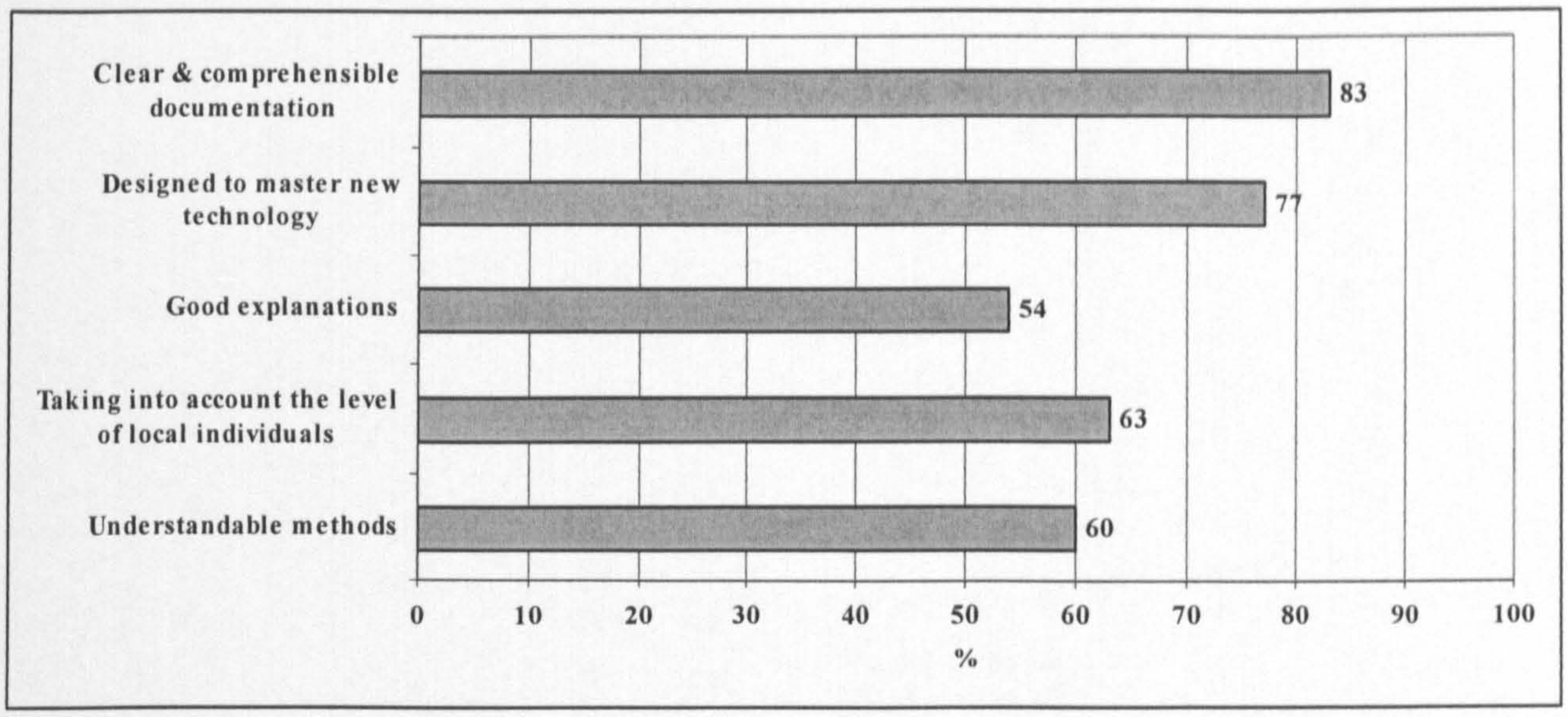
2. The training programmes are designed to help the local personnel master the new technology

3. During the training programmes all the technical details and most frequent technological problems are well explained to the local personnel

4. The training programmes take into account the technical level of the local personnel

5. The main elements of the training programmes are presented in a way that the local personnel can easily understand and apply.

Figure: 6. 22 Organisation of training courses



As can be seen from the above figure (6.22), about 83 per cent of the participants confirmed that the documentation of the training programme was clear and comprehensible, whereas almost 77 per cent believed that these programmes were designed to help the local personnel master the new technology. In addition, approximately 63 per cent revealed that the training programmes took into account the technical level of the local personnel. Nearly, 60 per cent of the respondents indicated that the main elements of the training programmes were presented in a way that the local personnel could easily understand and apply, while about 54 per cent stated that during the training programmes all the technical details and most frequent technological problems were well explained to the local personnel.

6.7 Summary

This chapter has discussed some issues relating to knowledge in joint venture companies in the oil and gas industry in Libya. It has covered certain areas regarding knowledge, such as, its significance, requirement, creation, protection, sharing and transfer. In addition, it has commented on the conversion processes of knowledge, examining the main modes of transferring knowledge; in this regard: explicit into explicit knowledge (combination

mode); tacit into explicit knowledge (externalization mode); explicit into tacit knowledge (internalisation mode); and tacit into tacit knowledge (socialisation mode). It has, furthermore, looked at other terms relating to knowledge, such as knowledge management, indicating its main activities; as well as knowledge management systems, giving the major functions.

This chapter has pointed out that knowledge is becoming increasingly more beneficial and important, this was confirmed by the majority of the survey participants, who believed that it was very significant in their companies and it was known as a resource that was important to their companies' development, as well as to increase their competitive advantage. In addition, it was discovered that knowledge was always required, and the main reason for its requirement as indicated by the respondents was simply for the individuals to be more reliable and adaptable to change, as well as to follow the latest innovation.

Knowledge can be either explicit or tacit. This chapter has revealed that transferring explicit knowledge was a very common mode of knowledge transfer in the companies surveyed as it was mainly shared without difficulty and usually via meetings, documents and the company's databases, which were considered as the most important channels for transferring this type of knowledge. However, tacit knowledge is by nature difficult and uncommon to transfer, and its transference was very low by foreign partners but this did often occur via face to face meetings, where this channel could produce new ideas that could be shared among individuals.

Furthermore, this chapter has also looked at knowledge creation, which represents creating new knowledge based on ongoing experience in a certain field and then using the new knowledge in combination with existing knowledge to come up with updated and newly created knowledge for knowledge sharing. This study has indicated that there are several methods where knowledge can be created, such as, shared experience, trainee practice, formal meetings, observation and imitation, and brainstorming. It was found that shared experience was considered as the main method for knowledge creation in the companies surveyed, followed by trainee practices.

This chapter has also covered the area relating to knowledge management, indicating its significance and its main activities. It has revealed that knowledge management is important because knowledge management is the power of collective knowledge to enhance innovation and responsiveness, it also strengthens organisational performance, as the respondents surveyed pointed out. In addition, it was reported that knowledge management involves many activities, whereby sharing the most valuable practice remained the most important activity in knowledge management in the companies surveyed, followed by conducting training programmes.

This chapter has, moreover, discussed knowledge management systems in the companies surveyed and illustrated that these systems were accessible to local individuals and that the main function of a knowledge management system, as indicated by the local participants, was to concentrate on creating, gathering, as well as organising, their company's knowledge.

Chapter Seven

Cross Tabulation of the Results

7.1 Introduction

This chapter concentrates mainly on the cross tabulations of the research results, it compares the key elements of the study results obtained from the Libyan respondents in order to gain a clear idea about the research sample, as well as to investigate the results acquired in each company involved.

This chapter is divided into three main sections. The first looks at the personal profile of the respondents surveyed and crosses tabulates their age, employment positions, sex, qualifications, and also their years of experience in each company surveyed. The second section introduces the term "technology", showing its types and cross tabulating them with the age and employment positions of the local respondents. In addition, this section pays particular attention to equipment, which is regarded as an important source of technology. Finally, the third section is entirely devoted to knowledge in general, including its types and cross tabulating them with the age and employment positions of the respondents. It also shows the cross tabulation relating to the tacit and explicit knowledge channels. Moreover, in this section certain issues regarding knowledge management and knowledge management systems are examined.

7.2 Respondents' profile

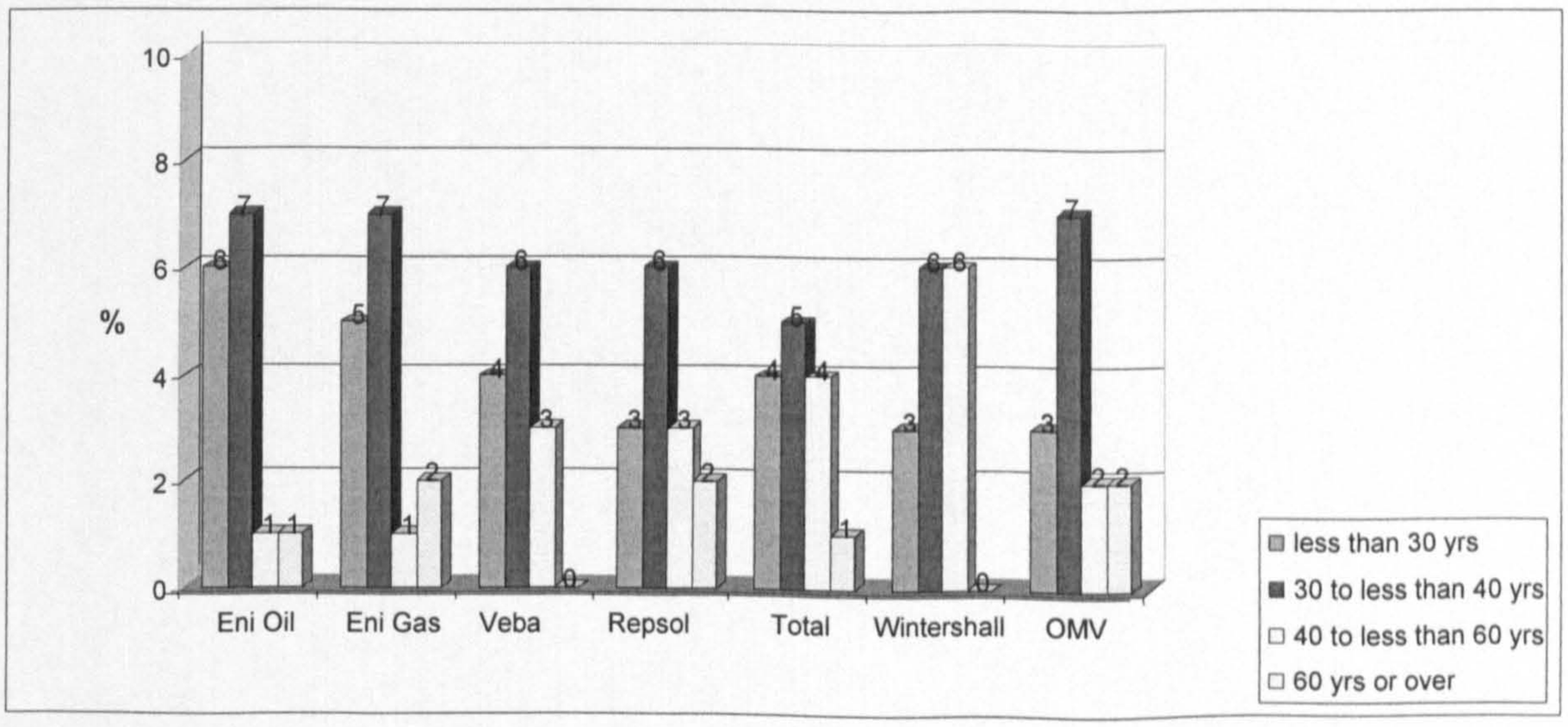
This section looks at the respondents in each company as a research sample in this study, cross tabulating their age, qualifications, sex, and employment positions, as well as their years of employment experience.

7.2.1 Age distribution in each company

As indicated in Chapter Five, the age of local participants in this survey varied from less than 30 to more than 60 years of age. The group of respondents who were from 30 to less than 40 years old participated most in this survey, at around 44 per cent of the total number of participants. In this respect, respondents from OMV, Eni Gas and Eni Oil company came first, with almost 7 per cent from each company, then came the participants from Veba Oil operations, Wintershall and Repsol Oil operations, with almost 6 per cent from each company, and finally came Total, with about 5 per cent of the total number of participants.

The group of participants who were less than 30 years old constituted about 28 per cent of the total sample. Nearly 6 per cent of them were found in Eni Oil, while about 5 per cent were in Eni Gas, almost 4 per cent in Veba and the same number in Total, whereas about 3 per cent of this group age were placed in each of Repsol, Wintershall and OMV. Figure 7.1 shows the entire age distribution in each participant company.

Figure: 7. 1 Age distribution in each company



7.2.2 Age and qualifications of respondents

The cross tabulation relating to the age of respondents and their qualifications indicated that about 11 per cent of the total number of individuals who had a Master's degree were in the group aged from 30 to less that 40 years of age, and nearly 10 per cent of the total percentage who had a first degree were in this age group, while none of the respondents in this group had a PhD. However, almost 5 per cent of the total individuals who had a PhD were aged 60 years or over (which is a high percentage compared with the total PhD respondents, 9 per cent), whereas approximately 4 per cent had the same qualification in the group of respondents who were from 40 to less than 60 years old. Table 7.1 presents the complete percentages of the cross tabulation relating to the age of respondents and their qualifications.

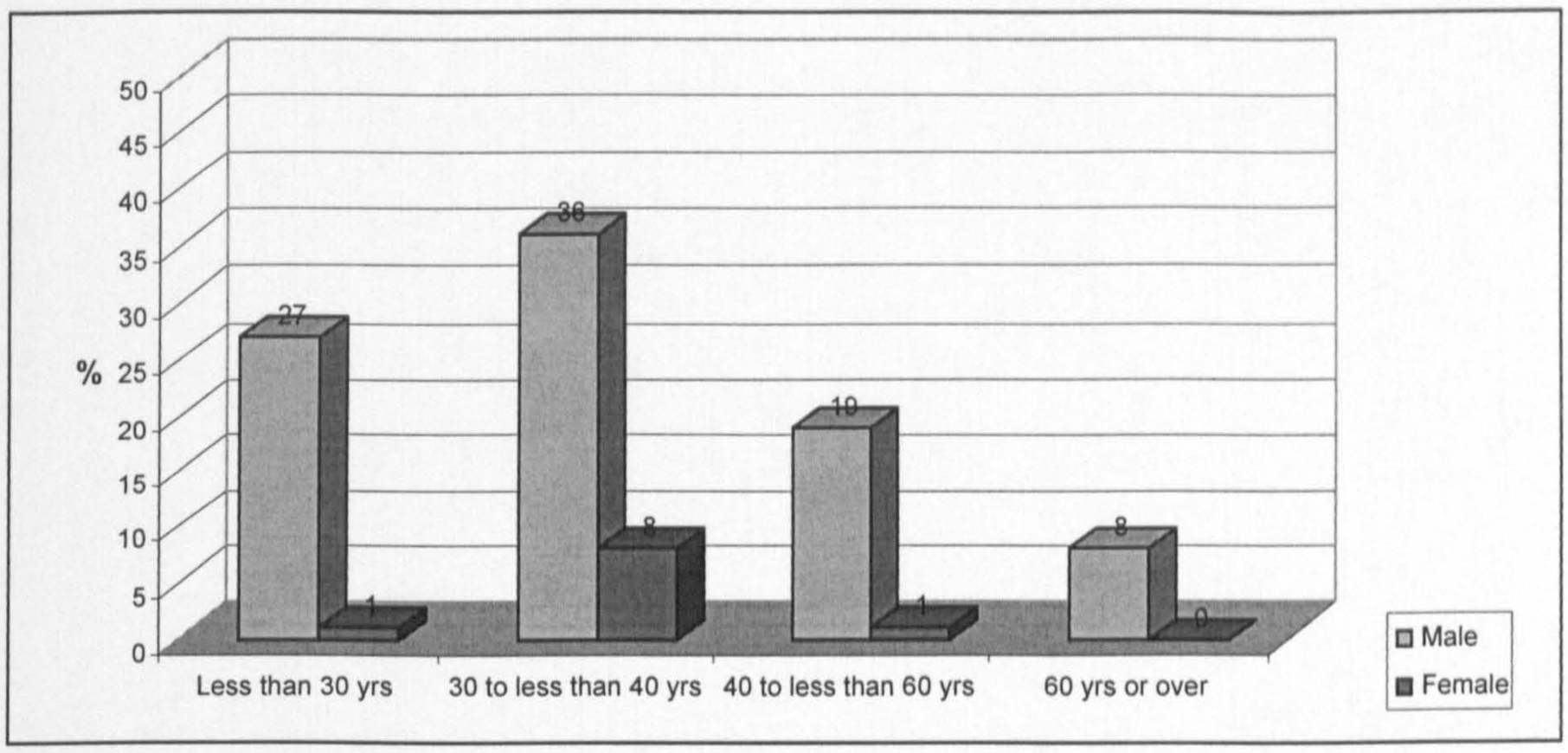
Table: 7. 1 Age of respondents and their qualifications

Qualifications	Age of respondents			
	Less than 30 yrs	30 to less than 40 yrs	40 to less than 60 yrs	60 yrs or over
PhD	–	–	4 %	5 %
Master's Degree	6 %	11 %	5 %	1 %
Postgraduate Dip.	7 %	8 %	3 %	1 %
Higher National Dip.	3 %	9 %	4 %	–
First Degree	6 %	10 %	3 %	1 %
Intermediate Dip.	6 %	6 %	1 %	–

7.2.3 Age and sex of respondents

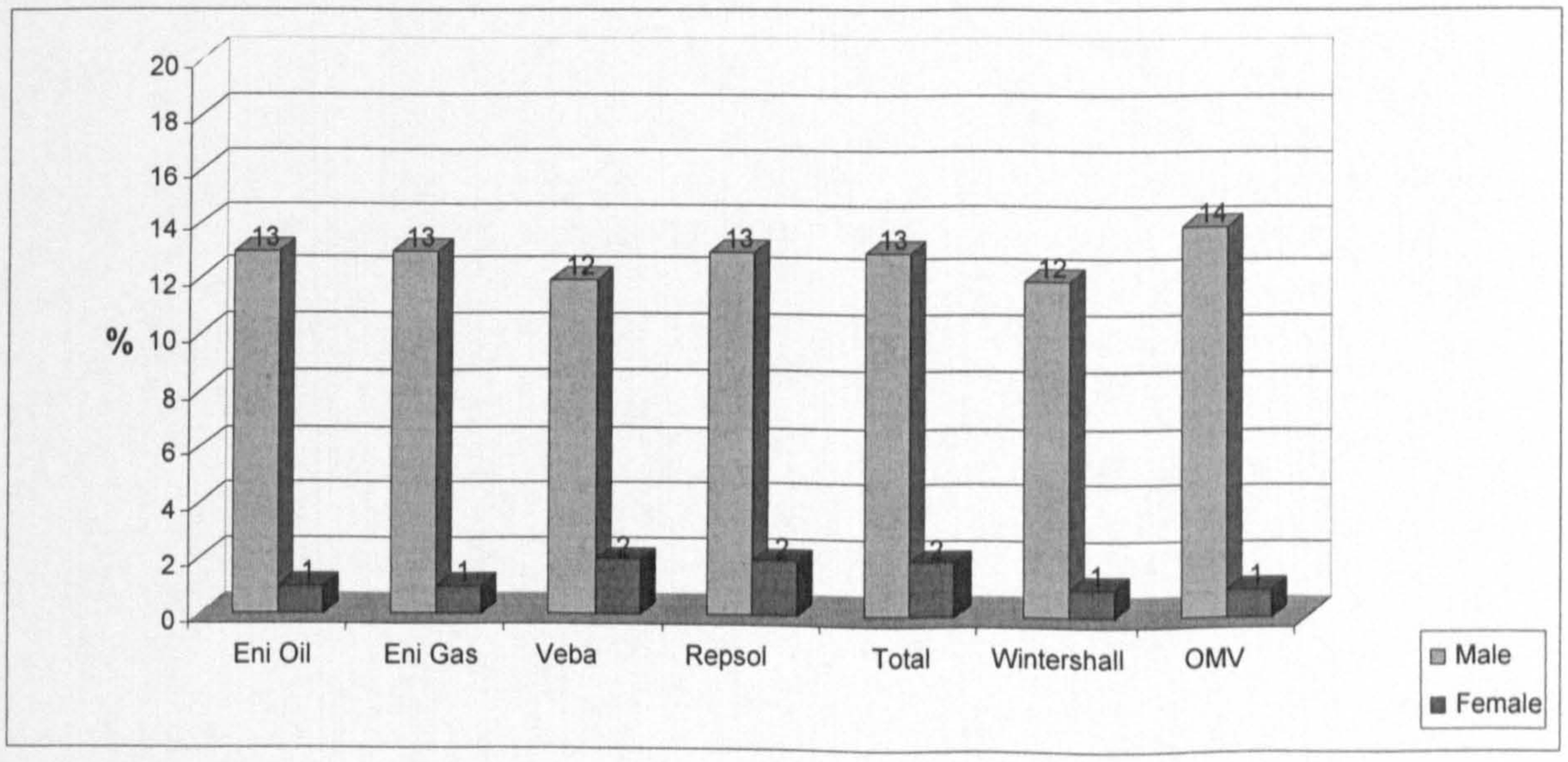
The results of this study showed that nearly 90 per cent of the respondents who participated in this survey were male, and only 10 per cent were female. The cross tabulation regarding the age of respondents and their sex revealed that nearly 36 per cent of the male respondents were aged from 30 to less than 40 years old, whereas almost 8 per cent of this group age were female. In addition, almost 27 per cent of the male participants were less than 30 years old, while only 1 per cent were female. Figure 7.2 indicates the cross tabulation relating to the age of respondents and their sex.

Figure: 7. 2 Age and sex of respondents



Furthermore, with regard to the sex distribution of the respondents in each company, the cross tabulation illustrated that almost 13 per cent of the total number of male respondents were from Eni Oil, while only 1 per cent from the same company were female. In addition, approximately 12 per cent of the total male respondents were from Veba, and around 2 per cent were female from the same company. Figure 7.3 displays the sex distribution of the participants in each company.

Figure: 7. 3 Sex distribution of the participants in each company



7.2.4 Age and employment positions of respondents

The cross tabulation of the age of respondents and employment positions revealed that the age group of participants from 30 to less than 40 years of age held a variety of employment positions, each showing a relatively high percentage compared with the other age groups, for instance nearly 18 per cent of the total number of operators were from this age group, compared with only 1 per cent of operators in the group of 60 years old or over. In addition, about 10 per cent of the respondents who were less than 30 years old were technicians, compared with only 3 per cent who were technicians in the age group from 30 to less than 40 years old.

Respondents who were Head of Department generally constituted a small sample in this survey; approximately 5 per cent in the age group from 40 to less than 60 years of age, and about 2 per cent in the 60 years or over group. Furthermore, none of the Head of Department participants were found in the age groups from less than 30 years old or from 30 to less than 40 years old. Table 7.2 presents full cross tabulation results for the age of respondents and their employment positions.

Table: 7. 2 Age and employment positions of respondents

Job position	Age of respondents			
	Less than 30 yrs	30 to less than 40 yrs	40 to less than 60 yrs	60 yrs or over
Head of Department	–	–	5 %	2 %
Administrator	7 %	13 %	3 %	3 %
Technician	10 %	3 %	1 %	–
Supervisor	1 %	10 %	6 %	2 %
Operator	10 %	18 %	5 %	1 %

7.2.5 Employment positions in each company

As revealed in Chapter Five, the highest percentage of participants in this survey were operators; they constituted nearly 34 per cent of the total number surveyed. The distribution of the operators in each company indicated that around 8 per cent were in OMV, nearly 8 per cent in Wintershall, almost 6 per cent in Total, about 5 per cent in Veba, 4 per cent in Repsol, approximately 2 per cent in Eni Gas, and only 1 per cent in Eni Oil. The following table (7.3) illustrates the employment positions regarding the participants in each of the companies surveyed.

Table: 7. 3 Employment positions of the participants in each company

Job position	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershell	OMV
Head of Department	1 %	1 %	1 %	1 %	2 %	_	1 %
Administrator	5 %	4 %	3 %	5 %	3 %	3 %	3 %
Technician	3 %	3 %	2 %	3 %	1 %	1 %	1 %
Supervisor	4 %	4 %	3 %	2 %	3 %	2 %	1 %
Operator	1 %	2 %	5 %	4 %	6 %	8 %	8 %

7.2.6 Qualifications of employees in each company

As indicated earlier, the holders of a Master's degree represented almost 23 per cent of the total sample and, thus, constituted the highest percentage among the other qualifications in this survey.

As can be seen in Table 7.4, nearly 4 per cent of the total number of the Master's degree holders were found in Wintershall, and the same percentage in Eni Oil, while about 3 per cent of them were in Veba, and the same number in each of Repsol, Eni Gas, Total and OMV. The following table (7.4) indicates the distribution of respondents' qualifications in each company.

Table: 7. 4 Distribution of respondents' qualifications in each company

Qualification	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershall	OMV
PhD	1 %	1 %	1 %	2 %	2 %	1 %	1 %
Master's Degree	3 %	4 %	3 %	3 %	3 %	4 %	3 %
Postgraduate Dip.	3 %	3 %	3 %	2 %	2 %	2 %	4 %
Higher National Dip.	2 %	2 %	2 %	3 %	2 %	2 %	3 %
First Degree	3 %	3 %	3 %	2 %	3 %	3 %	3 %
Intermediate Dip.	3 %	1 %	3 %	2 %	2 %	2 %	0

7.2.7 Age and years of experience

The cross tabulation of the age of respondents and their years of employment experience revealed that almost 23 per cent of the total respondents who had three to five years' experience were aged from 30 to less than 40 years, while around 16 per cent of the total

number of participants who had less than one year's experience were aged less than 30 years old. In addition, the cross tabulation also indicated that nearly 15 per cent of the total number of respondents who had five to ten years' experience were aged from 40 to less than 60 years of age, whereas approximately 7 per cent of the total respondents who had more than ten years' experience were aged 60 or over.

Furthermore, as can be seen from Table 7.5, all the respondents who were 60 years of age or over had from 5 to more than 10 year's experience. On the other hand, none of the respondents who were less than 30 years to less than 40 had more than 10 years' experience. The following table (7.5) shows the complete cross tabulation regarding the age of participants and their years of employment experience.

Table: 7. 5 Age of participants and their years of experience

Years of experience	Age of respondents			
	Less than 30 yrs	30 to less than 40 yrs	40 to less than 60 yrs	60 yrs or over
Less than one year	16 %	–	–	–
From 1 to 3 yrs	9 %	11 %	–	–
From 3 to 5 yrs	3 %	23 %	2 %	–
From 5 to 10 yrs	–	10 %	15 %	1 %
More than 10 yrs	–	–	3 %	7 %

7.2.8 Participants' years of experience in each company

Respondents with three to five years' experience participated more in this survey than did others whose experience was of a different length, they represented almost 28 per cent of the total number. The cross tabulation of this category to each company involved indicated that approximately 7 per cent of them were in Wintershall and the same percentage were in OMV, around 6 per cent were in Repsol, about 5 per cent in Total, almost 2 per cent in Veba, and only 1 per cent in Eni Oil, whereas none of the participants in this group were in Eni Gas. The following table (7.6) illustrates the participants' years of experience in each company.

Table: 7. 6 Participants' years of experience in each company

Years of experience	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershall	OMV
Less than one year	5 %	2 %	2 %	2 %	2 %	1 %	2 %
From 1 to 3 yrs	3 %	6 %	5 %	1 %	2 %	2 %	1 %
From 3 to 5 yrs	1 %	_	2 %	6 %	5 %	7 %	7 %
From 5 to 10 yrs	4 %	4 %	3 %	3 %	5 %	5 %	2 %
More than 10 yrs	2 %	2 %	1 %	2 %	1 %	_	2 %

7.3 Technology

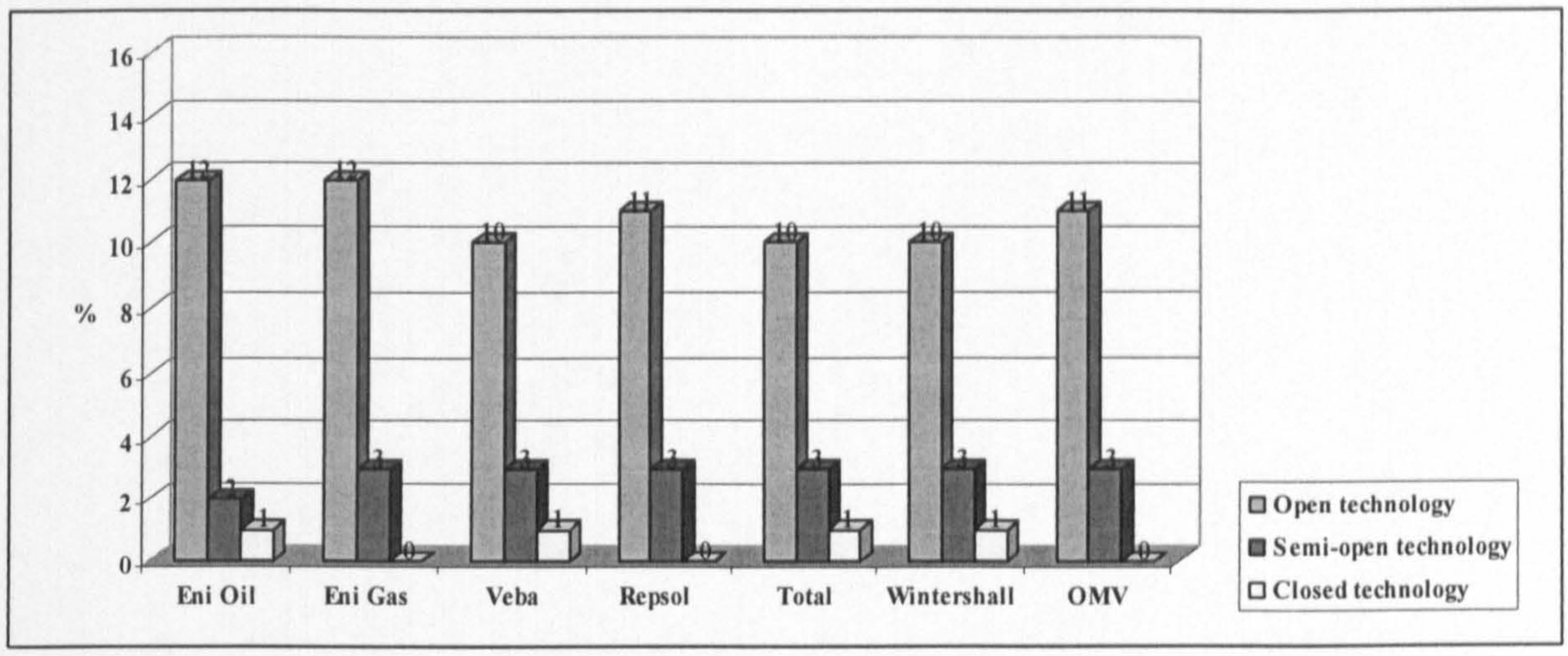
This section introduces the term "technology", including its main types and cross tabulating them with the age and the employment positions of respondents. It also seeks to cross tabulate the accessibility and transfer of technology, as well as looking at the equipment, as an important source of technology.

7.3.1 Types of technology

As mentioned in Chapter Five, open technology was widely transferred by foreign companies in the oil and gas industry in Libya. This was confirmed by over three quarters (76 per cent) of the participants, nearly 12 per cent of them were from Eni Oil, while almost 12 per cent were from Eni Gas, about 11 per cent from Repsol, and the same percentage from OMV, whereas approximately 10 per cent were from Veba, and the same number for each company were from Total and Wintershall.

Furthermore, it was revealed that the transfer of closed technology was very low. As can be seen from Figure 7.4, none of the respondents from Eni Gas, Respsol and OMV indicated that this type of technology is transferred. By contrast, only 1 per cent for each of Eni Oil, Veba, Total and Wintershall believed that closed technology is transferred to their companies. Figure 7.4 presents all types of transferred technology in each company surveyed.

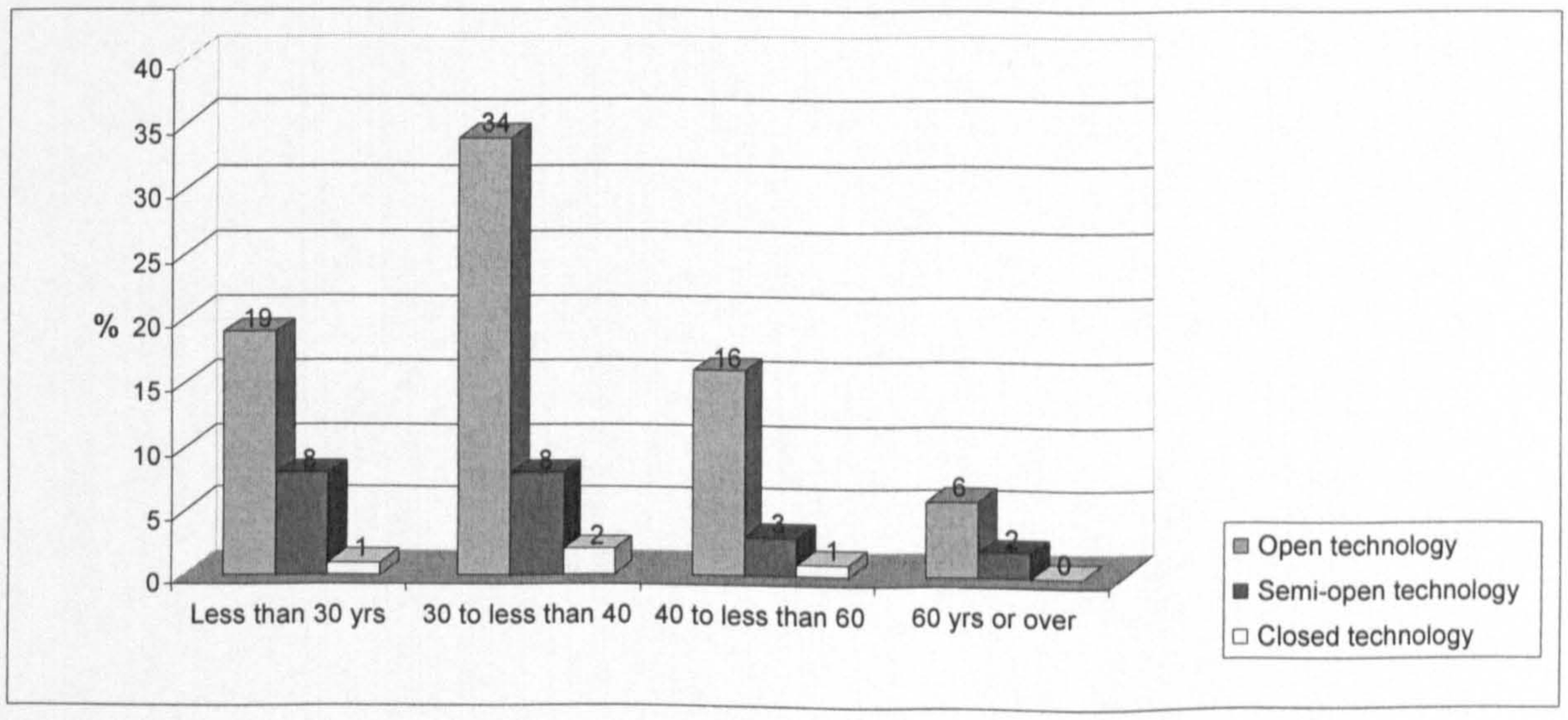
Figure: 7. 4 Types of technology in each company



7.3.2 Types of technology and age of respondents

The cross tabulation of the age of respondents and the types of technology revealed that open technology was much transferred by different age groups. Thus, about 34 per cent of the total participants who confirmed that this type of technology was being transferred were aged from 30 to less than 40 years of age, compared with almost 8 per cent of the participants who indicated semi-open technology, and only 2 per cent who indicated closed technology in the same age group. In addition, the majority of the respondents who were aged 60 or over (6 per cent out of 8) believed that open technology was widely transferred, whereas only 2 per cent selected semi-open technology, and none of the respondents within this age of group chose closed technology. The rest of the results relating to cross tabulation of age of respondents and types of technology can be seen in the figure (7.5) below.

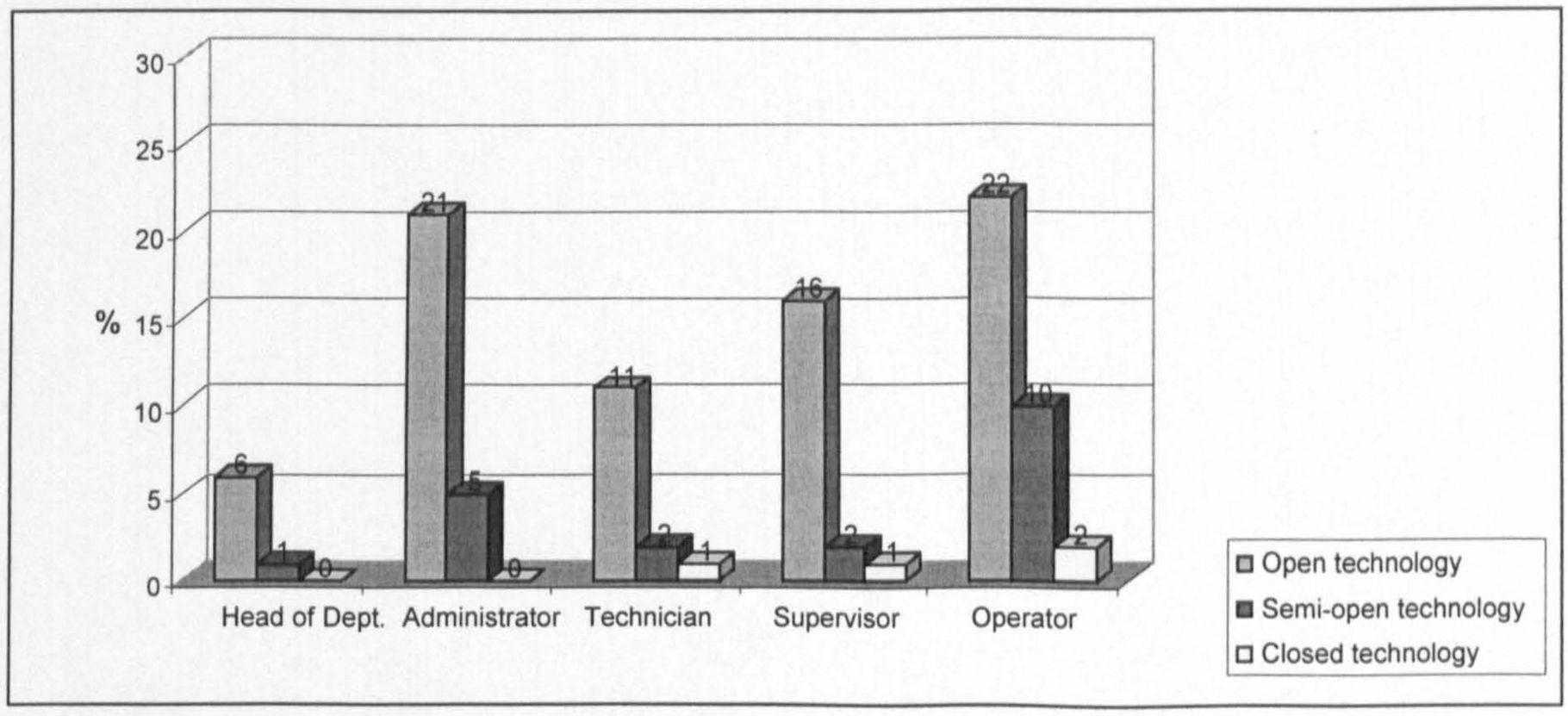
Figure: 7. 5 Types of technology and age of respondents



7.3.3 Types of technology and employment positions of respondents

With regard to the cross tabulation between the respondents' employment positions and the types of technology transferred, the results showed that around 22 per cent of the operators, who represented nearly 34 per cent of the total participants in this survey, stated that open technology was usually transferred to their companies, while about 10 per cent indicated semi-open technology, and almost 2 per cent of them reported that closed technology was regularly transferred. However, regarding the Head of Department personnel, who constituted about 7 per cent of the total participants, the results indicated that almost 6 per cent of them believed that open technology was widely transferred; this percentage being very high in relation to the total sample of Head of Department participants. Moreover, only 1 per cent of the total sample selected semi-open technology, and none of the participants in this category ranked closed technology. The following figure (7.6) presents the cross tabulation of the respondents' employment positions and the types of technology.

Figure: 7. 6 Types of technology and employment positions of respondents

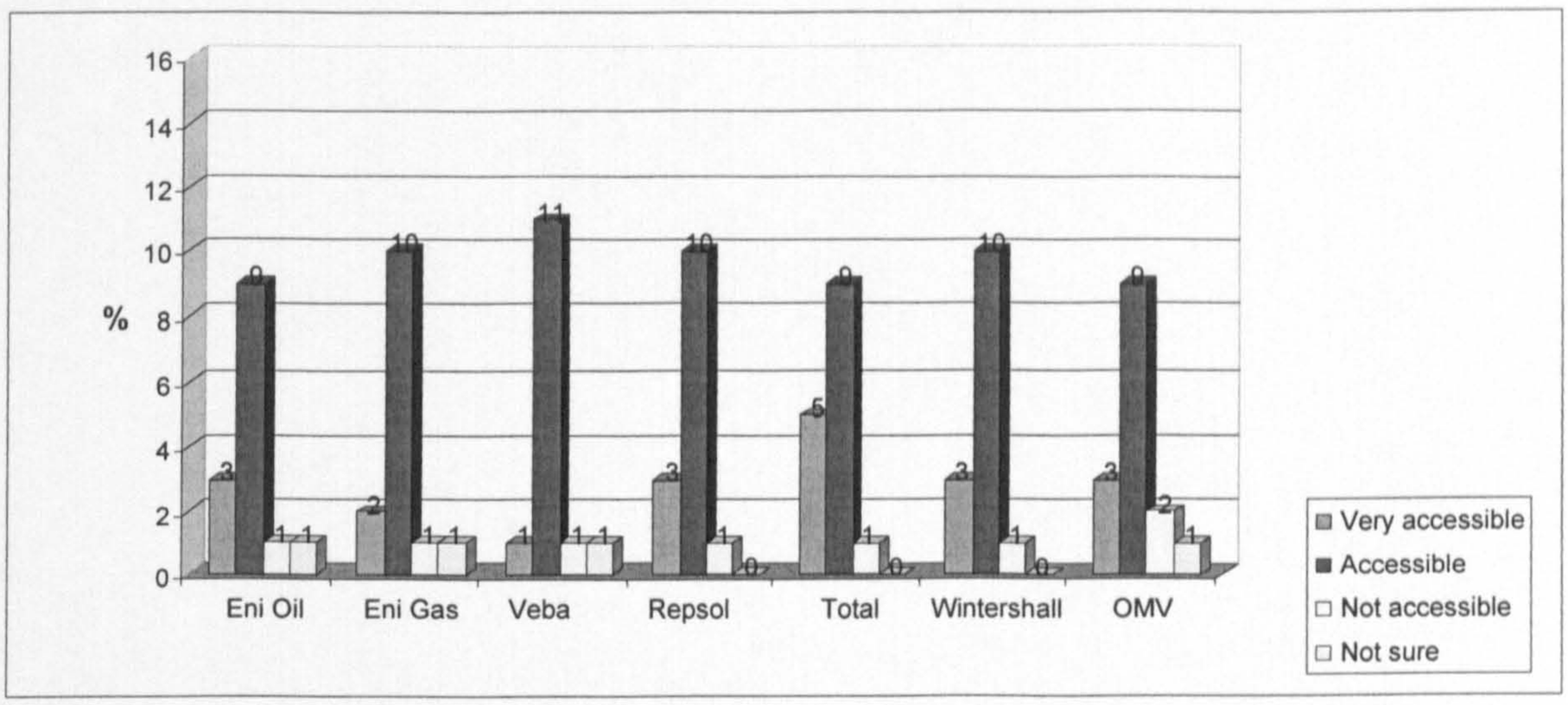


7.3.4 Accessibility of technology

As indicated by the respondents, the accessibility of transferred technology was generally high. Nearly 68 per cent of the total number who participated in this survey confirmed that it was accessible, while around 20 per cent indicated that technology was very accessible. As can be seen from Figure 7.7, almost 11 per cent of the total number of respondents who acknowledged that it was accessible were from Veba, while only 1 per cent who believed that it was very accessible were from the same company. In addition, approximately 9 per

cent who stated that the technology transferred was accessible were from Eni Oil, and 3 per cent of the total number who revealed that it was very accessible were from the same company. Figure 7.7 illustrates the accessibility of technology in each company.

Figure: 7. 7 Accessibility of technology in each company



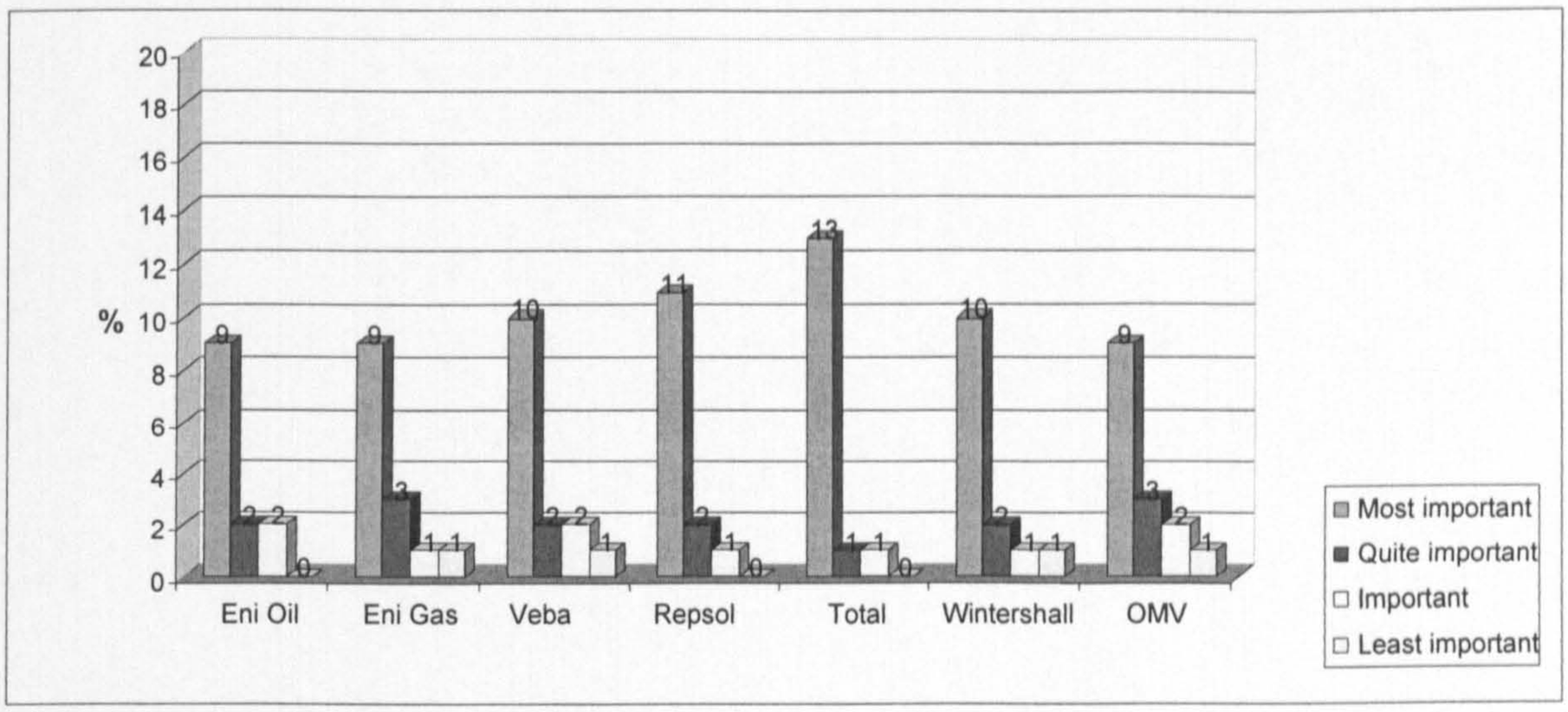
7.3.5 Equipment as a source of technology

Equipment was considered as the most important source of technology among the other types of sources given, such as training, consultancy, and manpower. Nearly 71 per cent of the total number of respondents confirmed equipment to be the most important type. The figure (7.8) shows that almost 13 per cent of the total number of participants who named it as the most important source were from Total, while about 11 per cent from Repsol did so, almost 10 per cent each for Veba and Wintershall, and approximately 9 per cent for each of the following companies: Eni Oil, Eni Gas and OMV.

Furthermore, it was indicated that none of the respondents from Eni Oil, Repsol, and Total believed that equipment was the least important source of technology in their company. However, the highest number who indicated that equipment was the most important source of technology was from Total (13 per cent).

Figure 7.8 indicates the significance of equipment as a source of technology in each company involved, as revealed by its respondents.

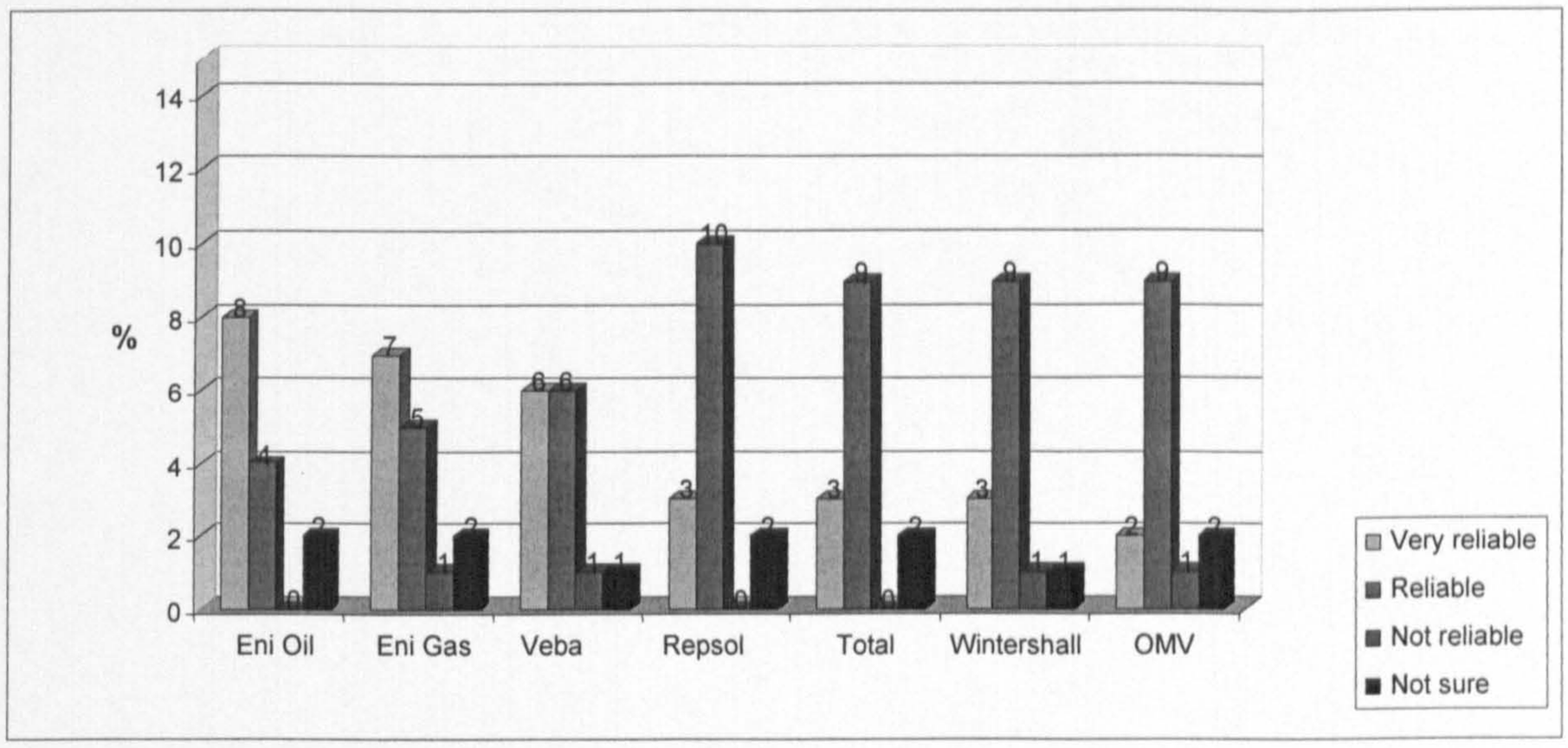
Figure: 7. 8 Significance of equipment as a source of technology in each company



7.3.6 Reliability of equipment

As indicated by the respondents in Chapter Five, the equipment transferred was commonly reliable, to very reliable. Nearly 52 per cent of the total number participating in this survey confirmed its reliability, while almost 32 per cent indicated that equipment was very reliable. However, only 4 per cent stated that it was not reliable and 12 per cent were not sure about its reliability. As can be seen from Figure 7.9, almost 10 per cent of the total number of respondents who indicated that the transferred equipment was reliable were from Repsol, compared with about 3 per cent from the same company who claimed that it was very reliable. On the other hand, around 8 per cent of the total number of participants who believed that the transferred equipment was very reliable were from Eni Oil, compared with approximately 4 per cent from the same company who acknowledged that it was reliable equipment. Figure (7.9) shows the reliability of transferred equipment in each company.

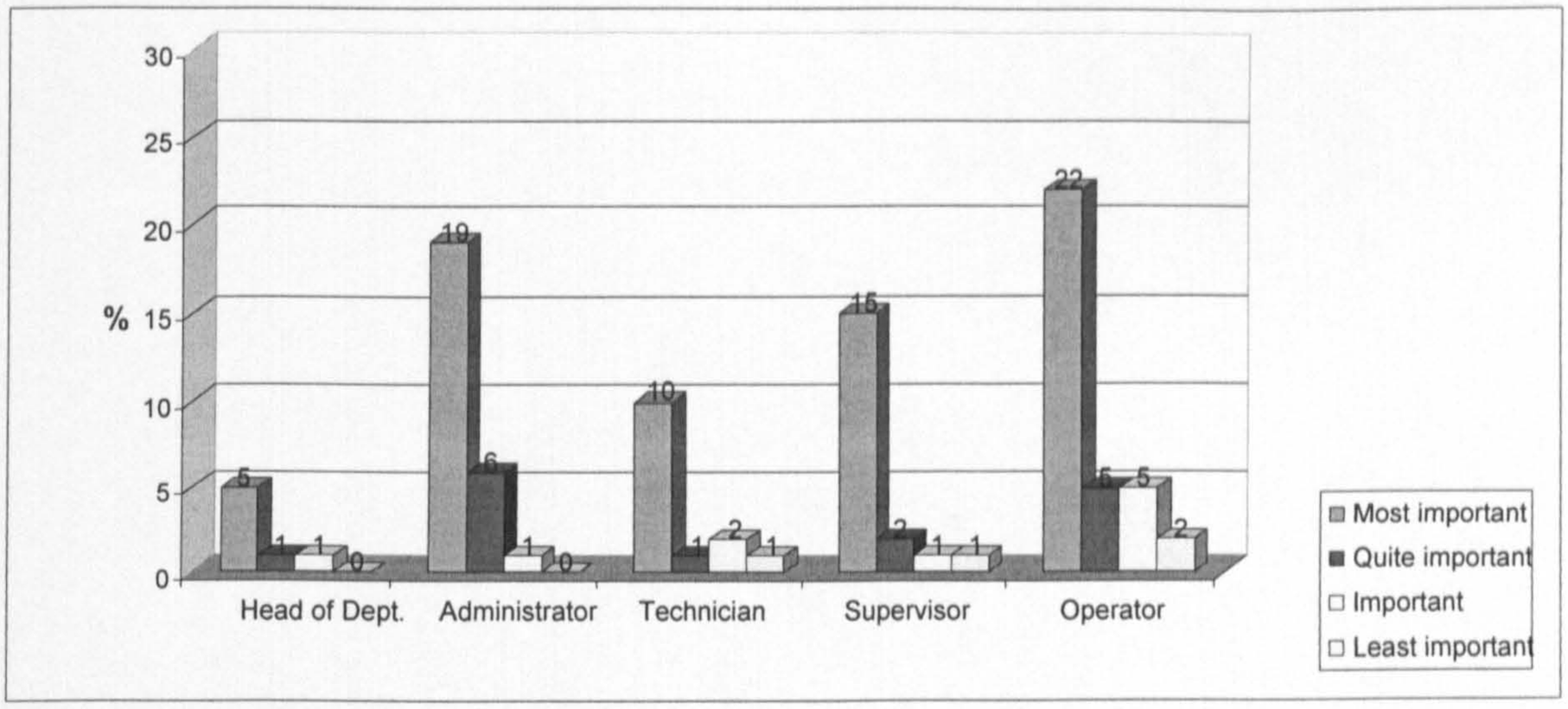
Figure: 7. 9 Reliability of transferred equipment in each company



7.3.7 Employment positions of respondents and equipment as a source of technology

The cross tabulation relating to the respondents' employment positions and the equipment as a source of technology revealed that the supervisors, who constituted about 19 per cent of the total participants, had rated equipment differently within their group, for instance almost 15 per cent of them believed that it was the most important source of technology, whereas approximately 2 per cent considered it as quite important, while 1 per cent regarded it as an important source of technology, and the same figure (1 per cent) considered it as the least important source of technology. In addition, administrators, who represented about 26 per cent of the total participants, had also various views towards it, nearly 19 per cent of them acknowledged that equipment was the most important source of technology, whereas almost 6 per cent reported that it was quite an important source, and only 1 per cent considered it as an important source of technology, whereas none of the participants who were administrators rated equipment as the least important source of technology. Figure 7.10 indicates the complete results of the cross tabulation of respondents' employment positions and equipment as a source of technology.

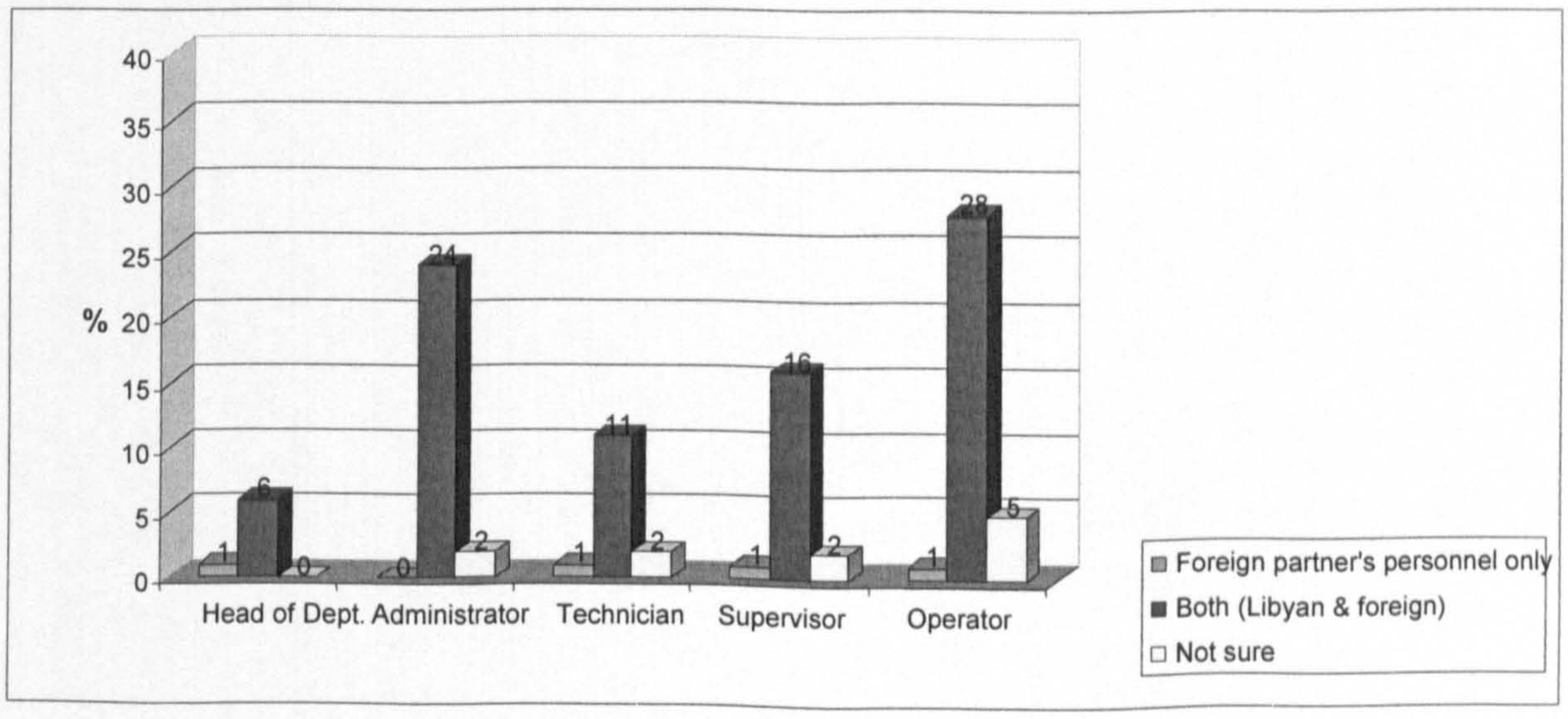
Figure: 7. 10 Employment positions and equipment as a source of technology



7.3.8 Usage of equipment and employment positions of respondents

The cross tabulation of the employment positions of respondents and the usage of equipment indicated that most of the participants, in all their various positions, considered that the transferred equipment was widely used by both Libyan and foreign individuals. This was confirmed by about 85 per cent of the total participants. The Head of Department participants constituted about 6 per cent of these, while the administrators were around 24 per cent, whereas the technicians represented about 11 per cent, supervisors almost 16 per cent, and, finally, the operators approximately 28 per cent. The following figure (7.11) shows the cross tabulation of the employment positions of the respondents and the usage of equipment, as indicated by the respondents in this survey.

Figure: 7. 11 Usage of equipment and employment positions of respondents

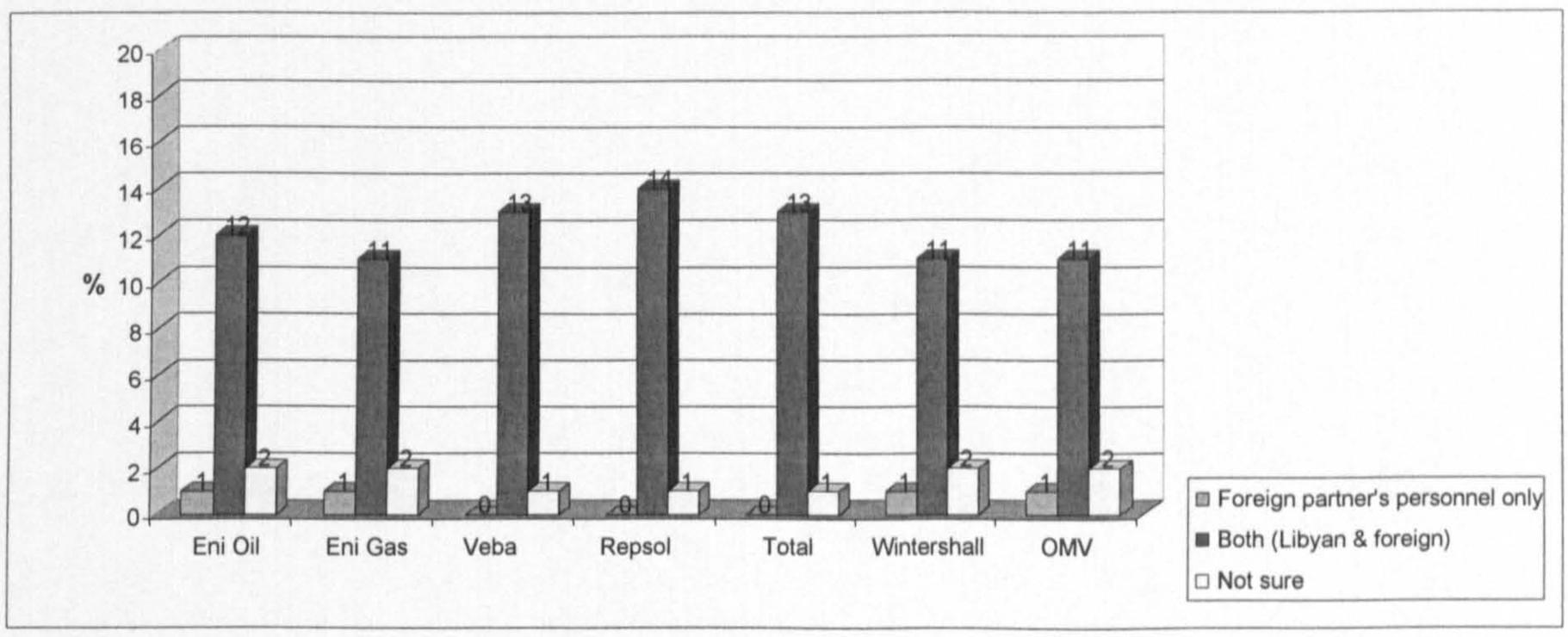


7.3.9 Usage of transferred equipment in each company

As indicated earlier, around 85 per cent of the participants reported that the transferred equipment was usually used by both Libyan and foreign personnel. By contrast, only 4 per cent revealed that it was used by foreign partner's personnel only, whereas almost 11 per cent of the participants were not sure about the usage of equipment.

As can be seen from the figure (7.12) below, approximately 14 per cent of the total percentage of participants who confirmed that the transferred equipment was usually used by both Libyan and foreign personnel were from Repsol, while only 1 per cent from the same company were not sure about the usage of transferred equipment f, and none of them believed that it was only used by the foreign partner's personnel. Figure 7.12 shows the usage of transferred equipment in each company, as revealed by the participants.

Figure: 7. 12 Usage of transferred equipment in each company



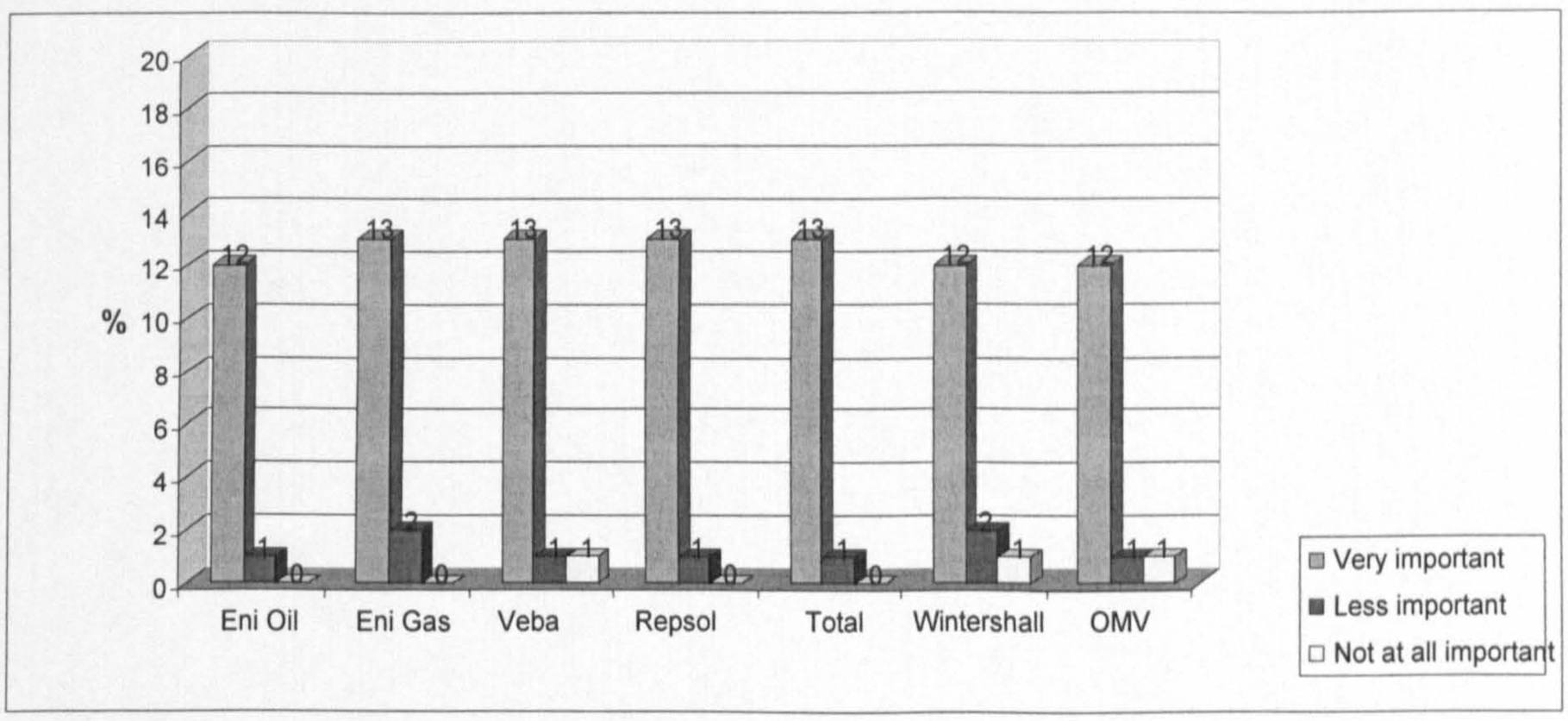
7.4 Knowledge

This section focuses on knowledge, including its main types and cross tabulating them with the age and employment positions of the respondents. It also shows the cross tabulation of tacit and explicit knowledge channels, as well as the creation process and sharing of knowledge. Some issues regarding knowledge management and knowledge management systems are also considered.

7.4.1 Significance of knowledge

Knowledge is very important. This was confirmed by the majority of local respondents (88 per cent), who acknowledged that it was very important in their companies, compared with only 9 per cent who believed that it was less important, and only 3 per cent who believed that it was not at all important in their companies. From those who mentioned that knowledge was very important (88 per cent), nearly 13 per cent of them were from Eni Gas, and the same percentage were from each of Veba, Repsol, and Total, whereas about 12 per cent of the total participants were from OMV, and the same figure for each company was from Eni Oil and Wintershall. However, none of the respondents from Repsol, Total, Eni Gas, and Eni Oil indicated that knowledge was not at all important. Figure 7.13 illustrates the significance of knowledge in each company.

Figure: 7. 13 Significance of knowledge in each company



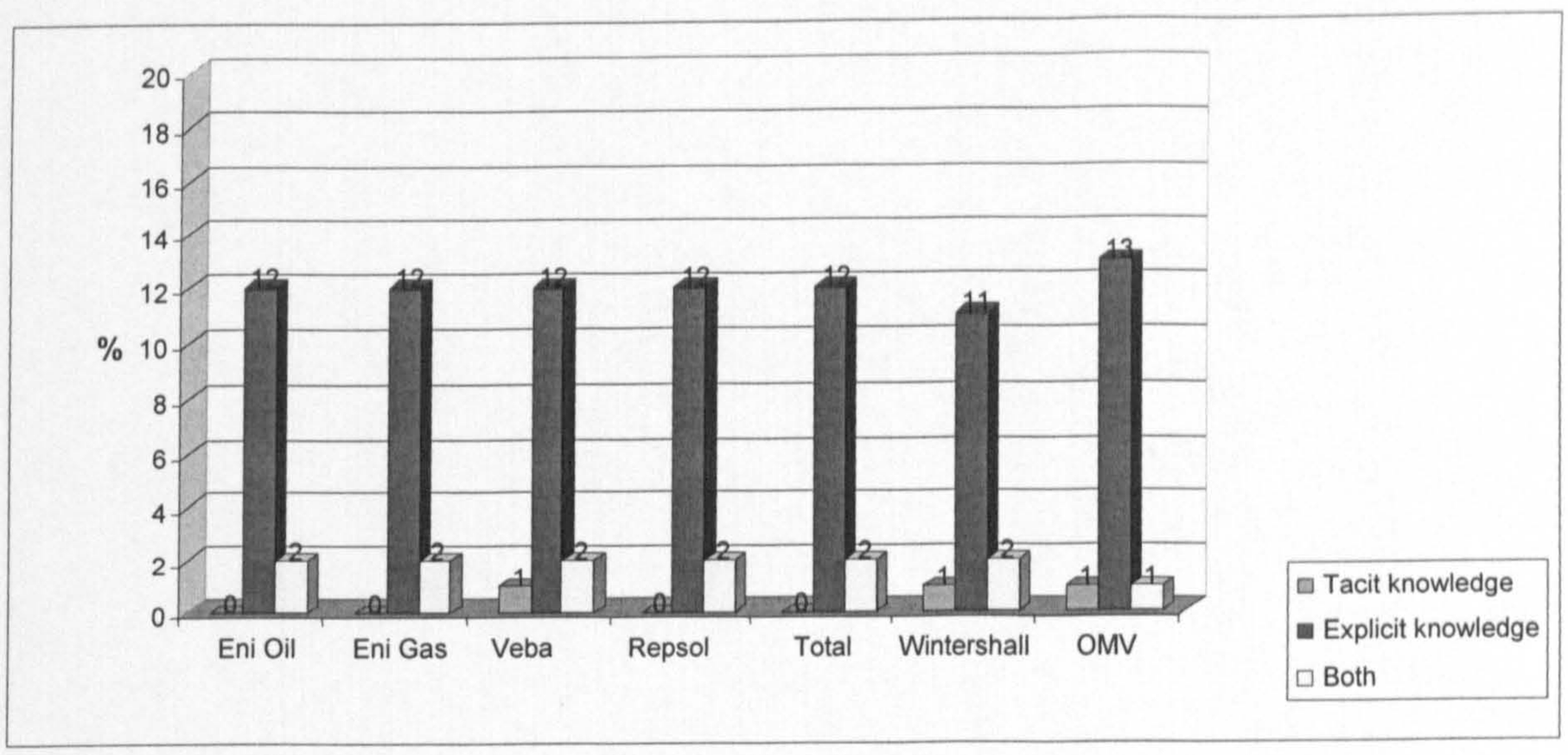
7.4.2 Types of knowledge

As mentioned in previous chapters, knowledge can be explicit or tacit. As the findings revealed, transferring explicit knowledge was a regular process of knowledge transfer provision; this was confirmed by nearly 84 per cent of the total number of local respondents, who believed that their foreign partners transferred it to their companies.

As can be seen from Figure 7.14, around 13 per cent of the total respondents who confirmed explicit knowledge as a type of transfer were from OMV, while approximately 11 per cent were from Wintershall, and nearly 12 per cent of the participants who indicated

that their companies transferred explicit knowledge were from Eni Oil, and the same percentage was from each of Eni Gas, Veba, Total, and Repsol. Figure 7.14 indicates the types of knowledge transferred in each company.

Figure: 7. 14 Types of knowledge transferred in each company



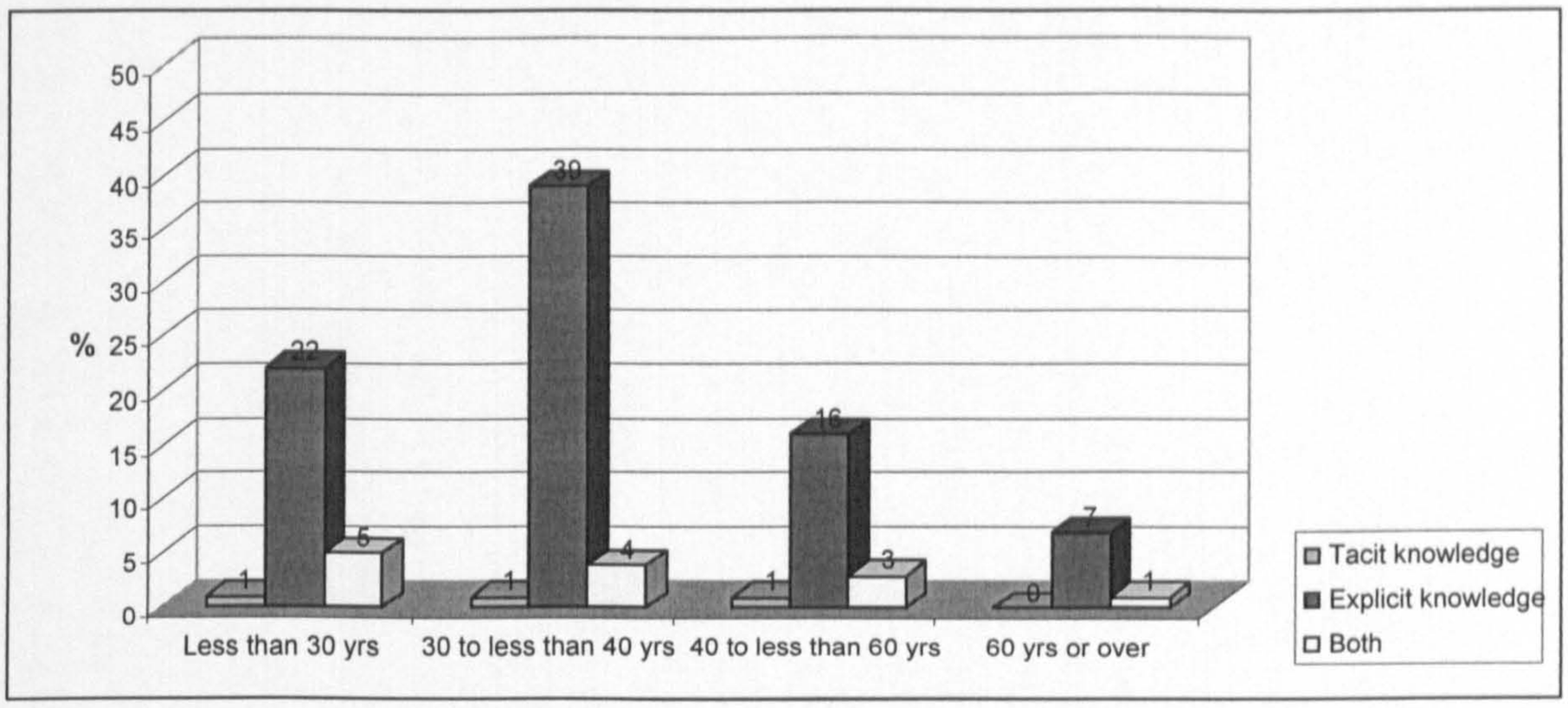
7.4.3 Types of knowledge and age of respondents

The cross tabulation related to the age of respondents and the types of knowledge showed that explicit knowledge was a very common type of knowledge transfer in different age groups. Thus, about 39 per cent of the total participants who confirmed that this type of knowledge was being transferred were aged from 30 to less than 40 years old, compared with only 4 per cent of the participants from the same age group who pointed out that both types of knowledge were transferred and only 1 per cent who indicated the transfer of tacit knowledge.

Furthermore, almost 7 per cent of the total participants who believed that explicit knowledge was widely transferred were aged 60 years or over, whereas only 1 per cent believed both types of knowledge were transferred, and none of the respondents within this age group selected tacit knowledge. It can be noticed that among the percentage of older respondents (aged 60 years or over) who confirmed that the transfer of explicit knowledge was very high, none of them selected only tacit knowledge as a type of knowledge transferred to their companies. However, the views of younger respondents were varied, where some of them believed that knowledge in general was transferred, including both

types, or only tacit knowledge. The rest of the results relating to the cross tabulation of age of respondents and types of knowledge can be seen in Figure 7.15.

Figure: 7. 15 Types of knowledge and age of respondents



7.4.4 Types of knowledge and employment positions of respondents

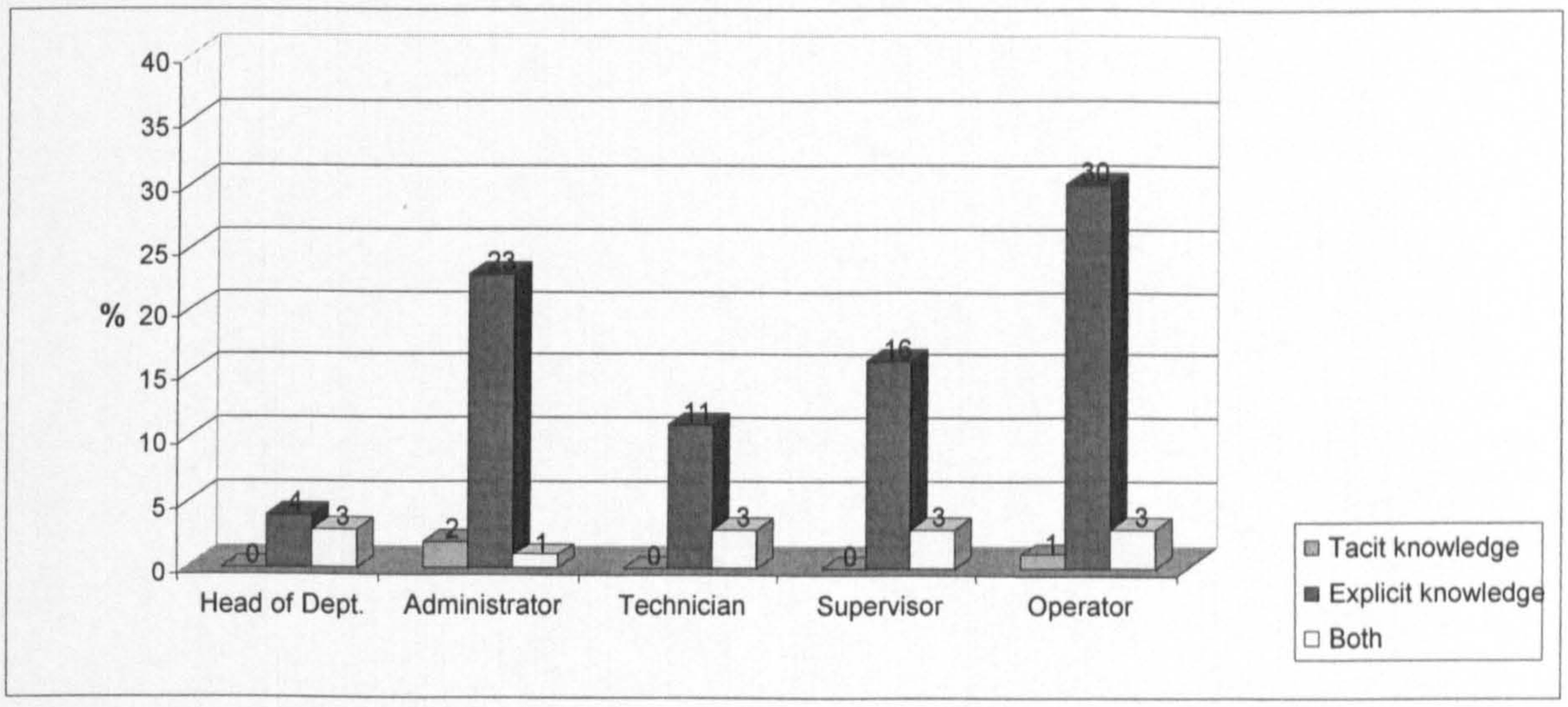
With regard to the cross tabulation between the job position of respondents and the types of knowledge transferred, the results showed that nearly 30 per cent of the respondents whose employment position was that of operator revealed that explicit knowledge was usually transferred to their companies, while around 3 per cent stated both (explicit and tacit) knowledge were, and only 1 per cent of them claimed that tacit knowledge was regularly transferred.

On the other hand, regarding the Heads of Department, who constituted about 7 per cent of total participants, the results indicated that almost 4 per cent of them believed that explicit knowledge was widely transferred; this percentage was quite high in relation to the total sample size of Heads of Department. Moreover, about 3 per cent of the total sample selected both types of knowledge, whereas none of the Heads of Department indicated that only tacit knowledge was the type transferred.

As can be seen from Figure 7.16, respondents whose employment positions require their using knowledge and technology most, such as technicians, supervisors, and even Heads of Department personnel, who know the type of knowledge transferred to their companies,

indicated that tacit knowledge was not transferred at all, while the operators believed that it was rarely transferred. However, it was shown that the administrators who work mainly in offices indicated that there was a transfer of tacit knowledge, but also only in a small percentage. The following figure (7.16) presents the cross tabulation of employment positions of respondents and the types of knowledge transferred, as indicated by the respondents.

Figure: 7. 16 Types of knowledge and employment positions of respondents



7.4.5 Explicit knowledge channels

There are several channels for the transfer of explicit knowledge. Meetings remained the most popular channel provided, the vast majority of the local participants (91 per cent) considering it as the main channel for transferring explicit knowledge to their companies. As can be seen from Table 7.8, approximately 14 per cent of the total respondents who chose meetings were from Wintershall, and the same figure were from Total, whereas around 12 per cent were from Veba, and the same number were from Eni Oil. In addition, about 13 per cent of the total number of respondents who considered meetings as the most important channel for transferring explicit knowledge were from OMV, and the same percentage for each company were from Eni Gas and Repsol. Table 7.7 illustrates the entire distribution of the channels of explicit knowledge in each company surveyed.

Table: 7. 7 Channels of explicit knowledge in each company

Explicit knowledge channels	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershall	OMV
Company's database	13 %	11 %	13 %	12 %	12 %	9 %	13 %
Meetings	12 %	13 %	12 %	13 %	14 %	14 %	13 %
Training programmes	10 %	8 %	10 %	13 %	14 %	12 %	13 %
Conferences	11 %	10 %	10 %	9 %	10 %	9 %	10 %
Seminars & workshops	13 %	13 %	10 %	7 %	7 %	10 %	11 %
Printed materials, reports	12 %	12 %	10 %	12 %	10 %	11 %	10 %

7.4.6 Tacit knowledge channels

There are also several channels for the transfer of tacit knowledge, face to face meetings still being the most widespread channel provided. Thus, the vast majority of the respondents (95 per cent) argued that face to face meetings were the main channel for gaining tacit knowledge. As can be seen from Table 7.9, about 14 per cent of the total respondents who chose this channel were from OMV, and the same percentage for each company were from Wintershall, Total and Repsol, while nearly 13 per cent were from Eni Oil, and the same number applied to Veba and to Eni Gas. Table 7.8 presents the entire distribution of the channels of tacit knowledge in each company.

Table: 7. 8 Channels of tacit knowledge in each company

Tacit knowledge channels	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershall	OMV
Face to face meetings	13 %	13 %	13 %	14 %	14 %	14 %	14 %
Social activities	10 %	9 %	9 %	12 %	10 %	9 %	10 %
Accidental meetings	12 %	11 %	11 %	9 %	7 %	13 %	12 %
Specialised training courses	10 %	11 %	12 %	11 %	12 %	14 %	12 %
Shared experience	13 %	12 %	14 %	13 %	14 %	12 %	13 %
Interaction with consulting groups	12 %	12 %	12 %	14 %	11 %	14 %	12 %

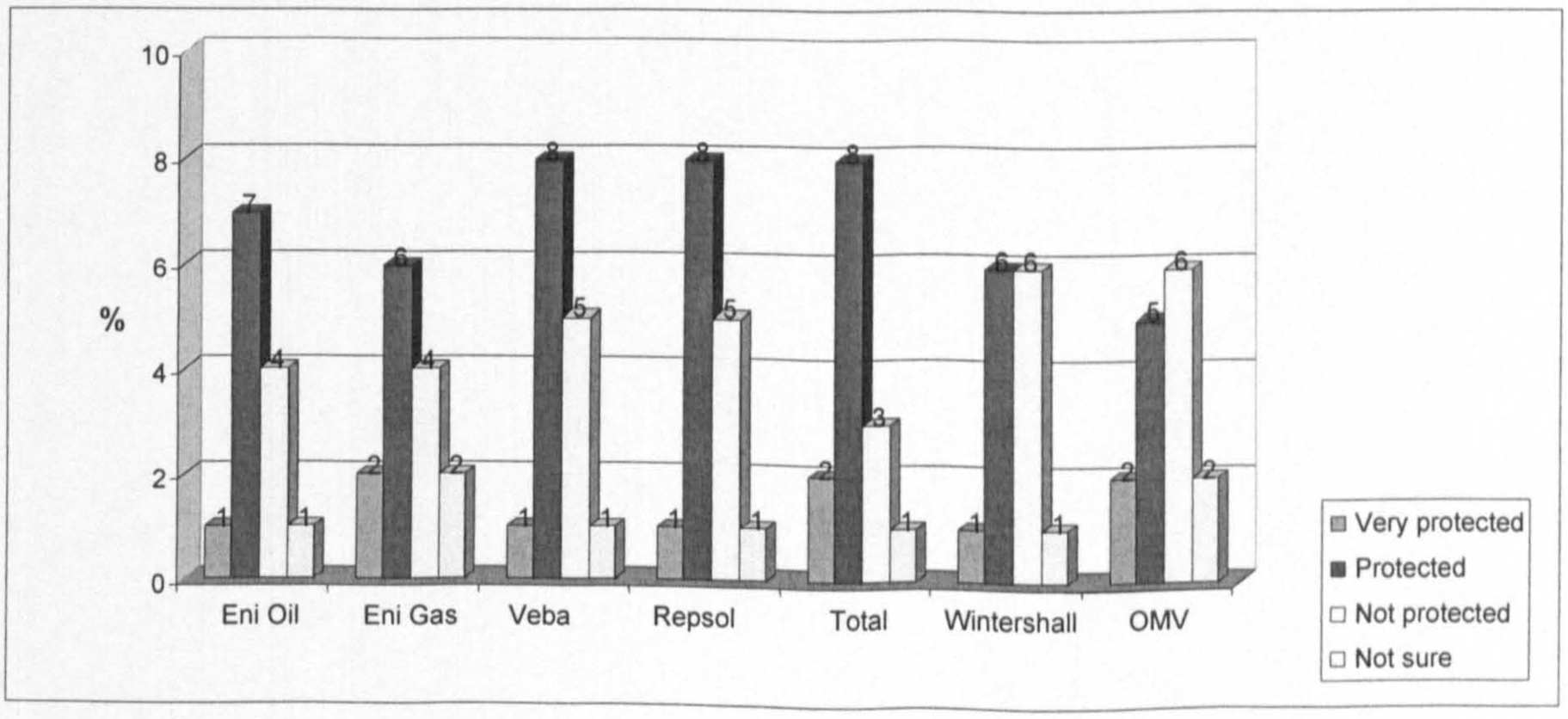
7.4.7 Knowledge protection

The findings relating to the protection of knowledge showed that nearly half of the local respondents (48 per cent) declared that their companies' resources of knowledge and information were protected, whereas almost 10 per cent indicated that they were very protected; around 33 per cent indicated that these resources of knowledge and information were not protected and anyone could gain access, while approximately 9 per cent of the total participants surveyed stated that they were not sure about the protection of knowledge and information resources owned by the foreign companies.

If Eni Oil is taken as an example for analysis, it can be seen that nearly 7 per cent of the total respondents who revealed that their company's resources of knowledge and information were protected were from this company, while only 1 per cent considered that they were very protected. However, about 4 per cent indicated that these knowledge and information resources were not protected and anyone could gain access, while only 1 per cent of the total participants from this company were not sure about the protection of knowledge and information resources owned by this foreign company.

As can be seen from Figure 7.17, companies' resources of knowledge and information were protected and the rate of their protection was higher than the other given options in all companies surveyed, except in OMV, where its respondents rated the protection of resources of knowledge and information in their company as not protected higher than the other given choices. Figure 7.17 presents the level of knowledge protection in each company.

Figure: 7. 17 Knowledge protection in each company



7.4.8 Knowledge creation process

As mentioned in Chapter Six, the majority of the participants (89 per cent) rated "shared experience" as the main method for knowledge creation in their companies, whereas "trainee practice" came in second, with 86 per cent of the total sample surveyed.

As can be seen from Table 7.10, almost 14 per cent of the total number of respondents who rated "shared experience" as the main mode for knowledge creation in their company were from Repsol, while around 13 per cent chose "trainee practice" from the same company. In Veba, approximately 13 per cent ranked "shared experience" and about 11 per cent "trainee practice", whereas in Eni Gas, nearly 11 per cent selected "shared experience", and almost 12 per cent "trainee practice". In addition, in the company Total, about 13 per cent chose "shared experience" and around 12 per cent rated "trainee practice", while in Wintershall, nearly 14 per cent of the respondents selected "shared experience", and the same percentage rated "trainee practice". Moreover, almost 13 per cent selected "shared experience" in OMV and the same figure "trainee practice". Finally, approximately 11 per cent of the total respondents rated "shared experience" as the main method for knowledge creation in their company were from Eni Oil, and the same number selected "trainee practice". Table 7.9 shows all the knowledge creation processes in each company, as indicated by the survey participants.

Table: 7. 9 Knowledge creation processes in each company

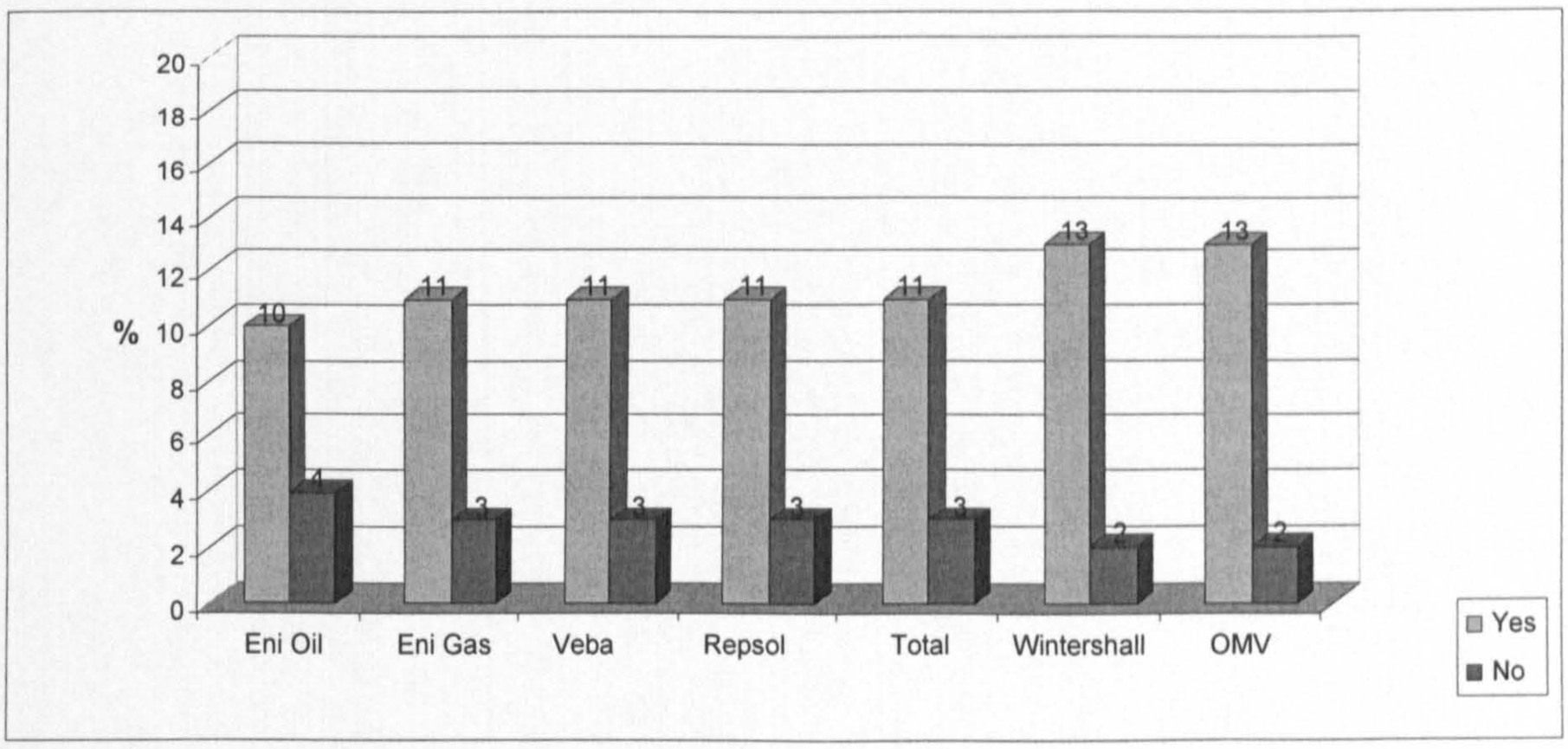
Knowledge creation process	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershall	OMV
Shared experience	11 %	11 %	13 %	14 %	13 %	14 %	13 %
Training practice	11 %	12 %	11 %	13 %	12 %	14 %	13 %
Formal meetings	9 %	12 %	10 %	9 %	11 %	11 %	10 %
Observation & Imitation	10 %	12 %	11 %	12 %	12 %	13 %	10 %
Brainstorming	10 %	11 %	9 %	10 %	9 %	9 %	9 %

7.4.9 Training courses

The findings of this survey revealed that almost 80 per cent of the total sample of local respondents surveyed joined a training course provided by their foreign partner, whereas around 20 per cent did not take any training course organised by their foreign company.

As can be seen from Figure 7.20, almost 10 per cent out of the total number attended were from Eni Oil, whereas about 4 per cent from the same company did not join. In addition, nearly 13 per cent out of the total respondents who joined a training course were from Wintershall, while only 2 per cent did not have a chance to participate. Moreover, about 11 per cent of the participants attended from Repsol, whereas approximately 3 per cent from the total number of the respondents who did not join a course were from the same company. Figure 7.18 shows the entire number of participants who joined a training course in each company.

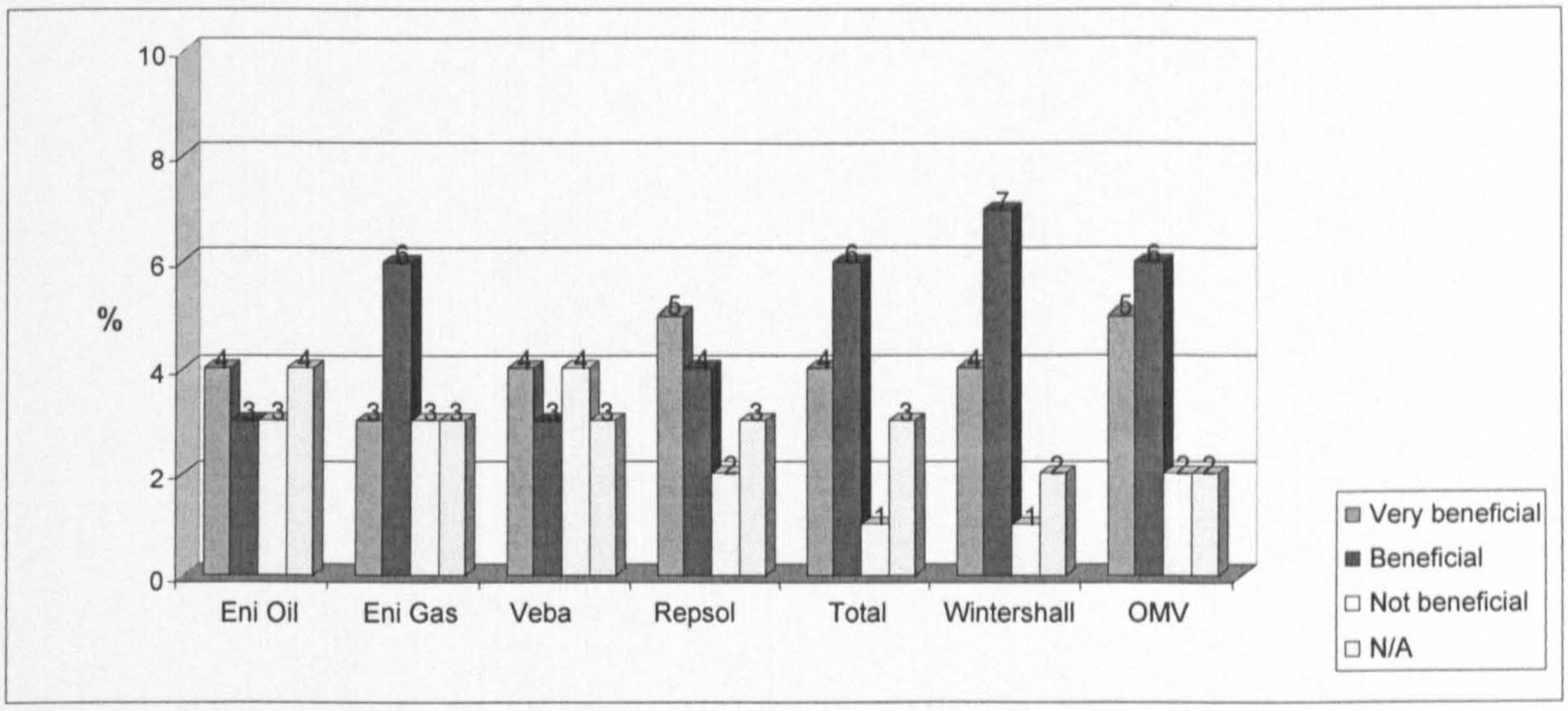
Figure: 7. 18 Training courses taken in each company



Furthermore, nearly 36 per cent of the respondents who confirmed that they had joined a training course indicated that the courses delivered were beneficial, compared with about 28 per cent who revealed that they were very beneficial. On the other hand, about 16 per cent of the respondents believed that these training courses were not beneficial

As can be seen from Figure 7.19, in the company Total, for instance, about 6 per cent out of the total respondents revealed that the training courses provided were beneficial, whereas almost 4 per cent claimed that these courses were very beneficial, approximately 3 per cent revealed that they were not beneficial, while only 1 per cent of the total respondents did not take a training course from this company. Figure 7.19 illustrates the benefits of training programmes in each company, as indicated by the respondents.

Figure: 7. 19 Benefits of training programmes

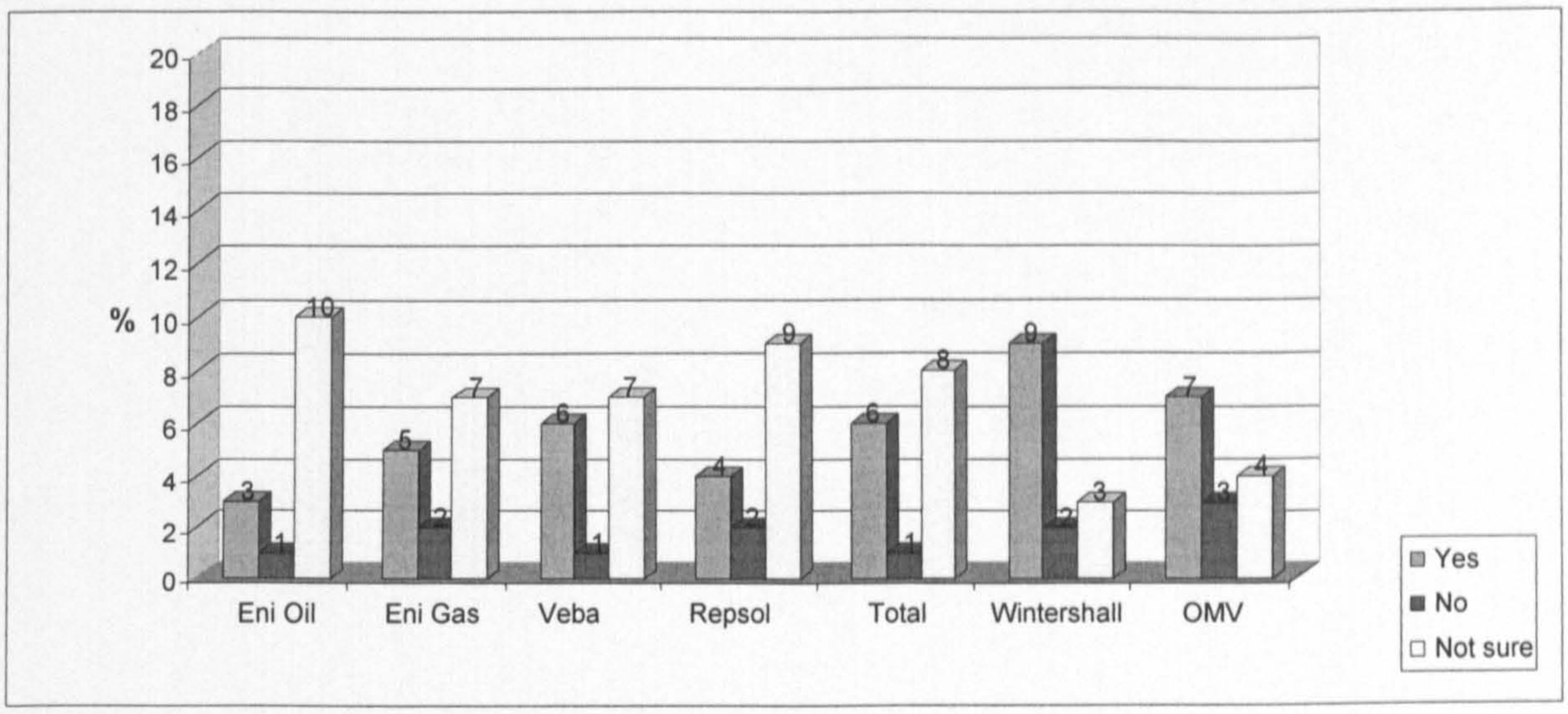


7.4.10 Knowledge management programmes

It was discovered from the survey's findings that less than half of the local participants (40 per cent) claimed that their foreign partner had a knowledge management programme, compared with around 12 per cent who believed that their foreign company did not have such a programme. However, approximately half of the respondents, 48 per cent, were not sure whether their foreign partners had a knowledge management programme or not.

If Wintershall is taken as an example for analysis, it can be seen from Figure 7.20 that nearly 9 per cent out of the total respondents who argued that their foreign partner had a knowledge management programme were from this company, whereas about 2 per cent believed that their foreign partner did not have such a programme. In addition, almost 3 per cent of the respondents from this company were not sure about the knowledge management programme of their company. Figure 7.20 presents the knowledge management programme of each company, as indicated by the participants surveyed.

Figure: 7. 20 Knowledge management programme of each company



7.4.11 Knowledge management activities

As indicated in Chapter Six, around 80 per cent of the participants revealed that "sharing the most valuable practice" was the main activity of knowledge management, whereas approximately 75 per cent believed that "conducting training programmes" was the key action of knowledge management. Nearly two thirds of the total respondents (66 per cent) acknowledged that the main activity of knowledge management was "setting up corporate libraries". Moreover, about 61 per cent considered that "building databases" was the essential activity of knowledge management. On the other hand, close to half of the participants (49 per cent) selected "building Intranets", and almost 45 per cent chose "leading cultural change" as a key activity of knowledge management in their companies.

If a Repsol is taken as an example for analysis, it can be noticed that almost 12 per cent out of the total participant who revealed that "sharing valuable practice" was the main activity of knowledge management were from this company, while nearly 11 per cent rated "conducting training programmes", and about 10 per cent selected "corporate libraries". In addition, approximately 8 per cent of the respondents from the same company indicated that "building databases" was the key activity of knowledge management, whereas almost 7 per cent ranked "building Intranets", and, finally, only 4 per cent of the participants of Repsol reported that "leading cultural change" was an essential element in knowledge management. Table 7.10 illustrates the activities of knowledge management in each company, as indicated by the respondents surveyed.

Table: 7. 10 Knowledge management activities

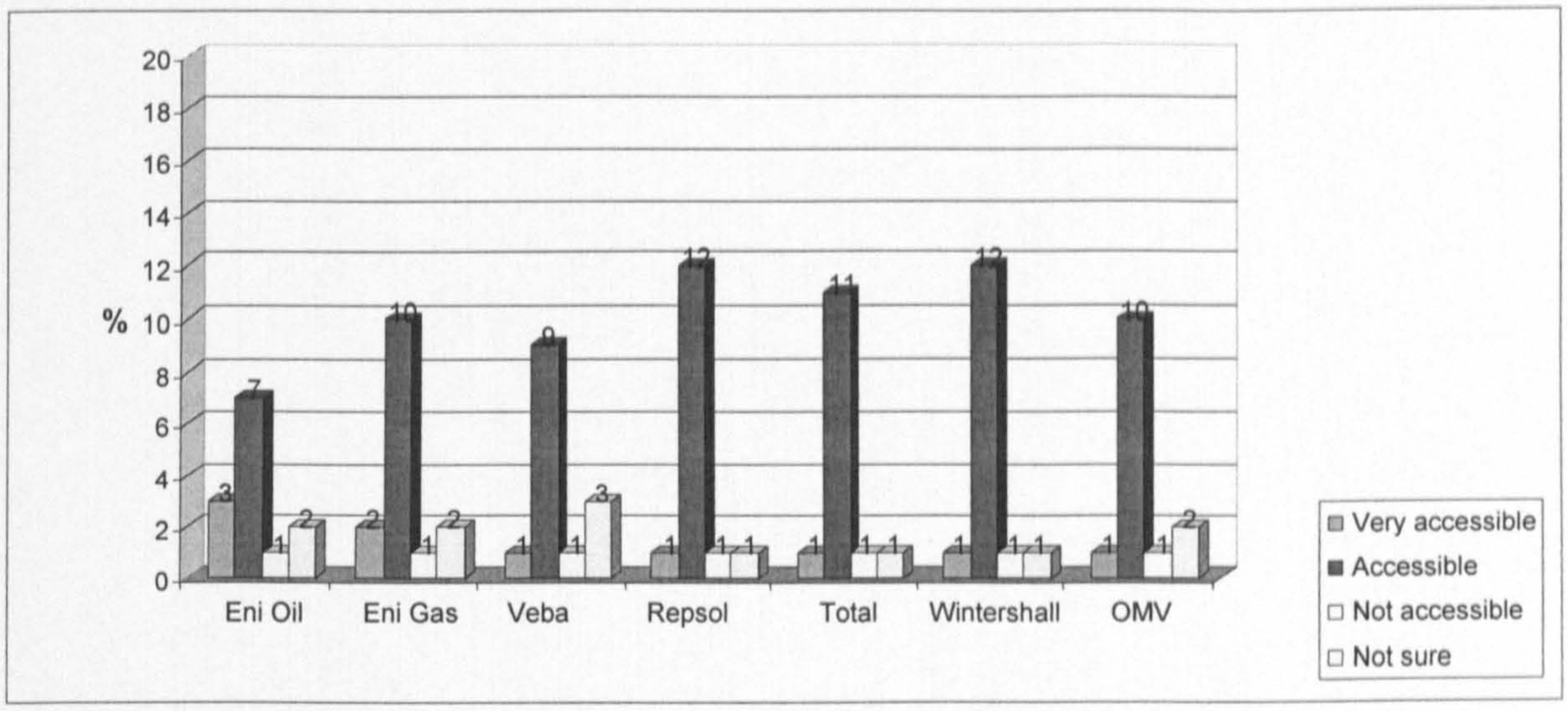
Knowledge management activity	Name of company						
	Eni Oil	Eni Gas	Veba	Repsol	Total	Wintershall	OMV
Building databases	9 %	10 %	7 %	8 %	9 %	10 %	8 %
Sharing valuable practice	11 %	11 %	11 %	12 %	12 %	11 %	12 %
Conducting training programmes	11 %	10 %	11 %	11 %	10 %	11 %	11 %
Leading cultural change	7 %	7 %	9 %	4 %	6 %	7 %	5 %
Corporate libraries	10 %	10 %	9 %	10 %	9 %	9 %	9 %
Building Intranets	6 %	5 %	5 %	7 %	8 %	8 %	10 %

7.4.12 Accessibility of knowledge management systems

There is reasonable accessibility to knowledge management systems for the local respondents in the companies surveyed. This was confirmed by nearly two thirds of participants (71 per cent), who believed that knowledge management systems were accessible, whereas almost 10 per cent confirmed that these systems were very accessible.

As can be seen from Figure 7.21, nearly 12 per cent of total participants who believed that knowledge management systems were accessible were from Wintershall, while only 1 per cent reported they were very accessible. Furthermore, almost 11 per cent of the total respondents who indicated that such systems were accessible were from Total, and only 1 per cent noted they were very accessible. Nearly 10 per cent of the total participants who claimed that knowledge management systems were accessible were from Eni Gas, and only 2 per cent from the same company mentioned that they were very accessible. Figure 7.21 presents the accessibility of knowledge management systems in each company, as indicated by the participants.

Figure: 7. 21 Accessibility of knowledge management systems



7.5 Summary

This chapter has focused mainly on the cross tabulation of the research results. It has looked in particular at the Libyan respondents in their companies, paying special attention to their age, sex, qualifications, employment positions and years of experience. It has been discovered that respondents who were from 30 to less than 40 years old constituted the highest percentage of participants. Furthermore, with regard to the cross tabulation of the age of respondents and their qualifications and sex, it was found that the holders of a Master's degree represented the highest percentage of participants in this survey; they constituted about 23 per cent of the total participants. Nearly 11 per cent of them were in the age group from 30 to less than 40 years old. In addition, regarding the sex of participants, this survey has shown that approximately 36 per cent of the male respondents were also aged from 30 to less than 40.

This chapter has also looked at the cross tabulation relating to the employment positions and years of experience of the local participants. It has discovered that the highest percentage of participants in this survey were operators, they represented around 34 per cent of the total respondents, and the participants from Wintershall and OMV constituted the highest percentage of operator respondents, with about 8 per cent from each company. In addition, participants who had three to five years of work experience participated more in this study, and the same companies (Wintershall and OMV) represented the highest category, with almost 7 per cent each of the total participants.

Open technology has been widely transferred. This was confirmed by about 76 per cent of the total respondents. Participants from Eni Oil and Eni Gas led the respondents holding this view, with around 12 per cent from each company. In addition, about 34 per cent of the respondents aged from 30 to less than 40 years old confirmed that open technology was transferred to their companies, while almost 22 per cent of the operators revealed that this type of technology was being transferred to their companies.

Furthermore, with regard to knowledge, this chapter has covered several areas relating to it, such as, its significance, types, protection, and creation, as well as knowledge management and knowledge management systems. It has revealed that explicit knowledge was the most popular type of knowledge transfer, and the highest percentage of respondents who confirmed this came from OMV, with about 13 per cent of the total number, which was around 84 per cent. In addition, approximately 39 per cent of the total participants who confirmed that this type of knowledge was being transferred were aged from 30 to 40 years old, whereas around 30 per cent of the respondents whose employment position was that of operator indicated that explicit knowledge was often transferred to their companies.

Meetings remain the most common channel for the transfer of explicit knowledge, about 91 per cent of the respondents indicated this. Respondents from Wintershall and Total remained the highest number of participants among the other companies who confirmed that this was so, with almost 14 per cent from each company. However, the face to face meeting was the most popular channel for tacit knowledge transfer, approximately 95 per cent of the respondents revealed this. Respondents from OMV, Wintershall, Total, and Repsol provided the highest percentage of participants among the other companies who confirmed this, with almost 14 per cent from each company.

Chapter Eight

Conclusion

8.1 Introduction

This chapter endeavours to collate and summarise all the materials collected for carrying out this research, and discusses some implications relating to technology and knowledge transfer in the Libyan oil industry. In addition, the limitations of this study are outlined. Finally, this chapter puts forward suggestions for further research in the area of technology and knowledge transfer.

8.2 Policy implications

8.2.1 Technology

There are several reasons for transferring technology to Libya. The vast majority of the foreign participants revealed that technology was always transferred to be used for oil and gas exploration and production. In addition, less than half of them pointed out that their companies brought technology just to be more competitive. However, this study discovered that local interests regarding technology were largely ignored by the foreign partners; for instance, a mere 14 per cent of the foreign participants indicated that their companies transferred technology just to train local individuals, and only 7 per cent reported that their companies brought technology just in order to develop the Libyan oil industry.

Local partners should ask for an effective transfer of technology. This can be achieved by laying down clear specifications in the contract as regards technology requirements. Thus, special rules governing technology transfer should be agreed by both parties, these rules

could be in effect for a certain duration and be automatically renewable from year to year until terminated by either party. This agreement should include a detailed description of methods, controls, raw materials and spare parts, as well as technical support and the training and development of locals.

Both closed technology and tacit knowledge have become very important assets in the rapid development of companies. However, this study found that neither closed technology nor tacit knowledge were widely transferred to the oil industry in Libya. As discussed in the last chapters, it was discovered that closed technology was scarcely transferred at all; only 4 per cent of the total survey participants confirmed its transference to the sector, and also only 3 per cent of them reported the transference of tacit knowledge to the industry. Therefore, local partners should instigate mechanisms that ensure the transfer of both significant types to its subsidiaries, as the success of technology and knowledge transfer requires a keen understanding of what knowledge needs to be shared and transferred. They should also encourage their personnel to concentrate on critical, unique, and relevant technology and knowledge that are of particular benefit to the company's objectives. In addition, local partners should issue certain rules and policies that allow local companies to receive complex technology and to acquire the tacit knowledge from their foreign partners, as well as encourage the local individuals to absorb the resources transferred.

Technology adds value as it becomes more accessible to individuals. This study has indicated that the level of accessibility of transferred technology was found to be reasonable by local individuals, as the foreign partners usually provided the technology that could help individuals to gain access and thus improve their knowledge. Databases, internal networks and documentation of the workflow processes were commonly accessible by the national workforce for the benefit of the company.

Furthermore, with regard to the selection of technology, it was discovered that other foreign companies working in Libya were usually consulted when the foreign partners needed to select and bring in technology. In addition, this study has indicated that national companies in the country were sometimes consulted, more that half of the foreign participants confirming this point. However, local partners were rarely consulted, only 11 per cent of the total number participating in the survey reported that their company consulted the local partner when they needed to transfer technology. Therefore, the local

partner should be informed and given a clear picture about the technology which their foreign partners intend to transfer so that they can add technology that can help in developing the oil industry in the country.

Moreover, this study described several sources of technology and it was found that equipment, which means all the machines, materials, tools etcetera needed for a purpose or for carrying out a particular activity, was regarded as the crucial source of technology, then came training, consultancy and manpower respectively as essential sources of technology provided by the foreign partners.

This study discovered that foreign partners typically tried to transfer expensive and reliable technology so that they could carry out their work without interruption and also avoid any maintenance issues or delay in operations which may occur during the discovery or production processes. This behaviour can help the oil industry in the country to improve and develop. However, this could certainly ensue with some involvement of the local personnel, who need to be motivated to learn and derive the maximum benefits from the technology transferred.

Foreign technology was usually transferred, but there was only provision of certain facilities. It was found that the foreign partners transferred design and construction techniques, management techniques, technical support, maintenance facilities, and research and development. However, it was discovered that the foreign partners' provision of research and development was minimal, and the links between foreign partners and the indigenous research and development centres was weak. Thus, only a small number of participants indicated that their companies had collaborated with the local research and development centres, and the main research centre they consulted when the need arose was the Petroleum Research Centre (PRC), which is the technical and social development arm of the National Oil Corporation of Libya (NOC). In addition, this study also found that local participation in research and development was very low, the majority of the participants indicating that their contribution in this area varied from no participation to very low involvement. Consequently, it is very important to establish inter-link research and development centres between foreign and local partners for the effective transfer of technology.

Regarding the provision of maintenance facilities by the foreign partners, the study discovered that these were services which were commonly transferred to the country, owing to the necessity of both partners for continuous work. It was also revealed that the local individuals participated highly in this area. Furthermore, management techniques were discovered to be usually transferred by the foreign partners to the local company, as commonly there is an article in the joint venture agreements which allow the local partner to take part in management. This fact clearly indicates the significance for both parties of transferring these techniques.

Furthermore, foreign technology transfer was found to be satisfactory in the areas of design and construction techniques, whereas local participation in design varied (7 per cent affirming there was no participation, 57 per cent low participation, and 34 high participation), while the local contribution to construction techniques remained generally high. In addition, with regard to the supervision of operations, this study discovered that local involvement in this area was found to be very high, the majority of the participants agreeing this was so.

The local workforce in the oil sector in Libya was examined from two main aspects: their educational background, and their abilities and willingness to learn. As a result, it was found that the educational background of the Libyan personnel receiving technology was generally satisfactory, while nearly half of the participants surveyed confirmed that they had the ability and willingness to learn and carry out the tasks and duties allocated. Both areas need to be enhanced and developed in order to allow individuals to receive easily the transferred technology for the benefit of the industry in general. In addition, local partners must prepare their workforce with the requisite skills that allow them not only to learn, but also to teach others in their companies so that nothing can become an impediment to technology and knowledge sharing and transfer. Good preparation can make a major difference to the nationals and, therefore, their performance at work.

In the long term, investment in human capital is very significant for the advancement of the oil sector in the country. This study discovered that the vast majority of the foreign partners' companies organised training programmes for local individuals and the local participation in these programmes was usually high. These training programmes usually took place either internally or externally (abroad or in Libya). It was also found that these

training courses were delivered by private companies arranged by the foreign partners, as indicated by the majority of the survey participants. However, despite the importance of training in enhancing local capabilities and mastering the imported technology, the study revealed that nearly one third of the respondents who participated in these courses considered that these programmes were not beneficial.

Managers and personnel of local partners alike should be trained to evaluate new ideas. To successfully produce new ideas, individuals needed to be trained in problem solving, including the skills of generating new ideas that may help in the management of any problems which may occur, or even forestall the occurrence of such problems. Therefore, companies should also give to personnel information on, and knowledge about, the business and its environment so that their ways of thinking will be appropriate and focussed towards the aim and objectives of the company. Moreover, both managers and personnel of local partners need to obtain up to date organizational skills, such as how to analyse organisational problems, how to motivate, and how to work successfully as a group.

8.2.2 Knowledge

Knowledge does not search for a single channel, but needs a number of channels to realize the expectations of individuals, using different means of learning. Both tacit and explicit knowledge require intensive meetings in order to be effectively transferred. This research discovered that meetings as such were considered as the main channel for transferring explicit knowledge, whereas the face to face meeting was regarded as an essential method for transferring tacit knowledge.

The company's databases and electronic forms were found to be crucial in obtaining explicit knowledge, according to the majority of the participants. Other explicit knowledge channels were also revealed to be important channels, such as: technical training programmes; conferences; seminars and workshops; printed materials and reports, which include some form of manuals, daily bulletins, newsletters, magazine, journals and other technical reports.

On the other hand, along with face to face meetings, the individual sharing of experience and interaction with other consulting groups were considered as very active channels for transferring tacit knowledge as these methods can create direct communication leads to generate useful new knowledge. Other important channels of tacit knowledge were considered to be specialised training courses, accidental meetings, and social activities.

This study discovered that explicit knowledge was an easy type to recognize and obtain, and it was usually acquired as a consequence of additional investigation. However, tacit knowledge is held within the individuals, it is the skill that adds wealth to the value and significance of the asset of knowledge; it is also acquired via dialogue, discussion and exchange of ideas. Therefore, its transfer is often blocked due to its nature.

Knowledge transfer should be encouraged in the companies so that effective and reliable knowledge can be obtained. It would thus be beneficial for the local partners to create a good system that could help to establish an efficient plan for dealing with the transferring of both explicit and tacit knowledge, laying special emphasis on the tacit type. This system should consider the available methods of transfer and create other strategies, techniques, and new channels that could acquire this kind of knowledge in an effective way.

This study has carefully examined the main barriers to knowledge transfer as companies face a number of knowledge sharing obstacles that must be vanquished in order to share knowledge more effectively, as well as to increase the ability to obtain new knowledge. It was found that the partner's cultural characteristics were the main barrier to knowledge sharing and transfer. Therefore, local partners should make sure that the culture of their companies is supportive of knowledge sharing and transfer and always open to discussion and dialogue, as shared assumptions and beliefs, such as those about the company's capabilities, ambitions, objectives, customers and even competitors, will add value and significance to new knowledge.

Furthermore, other barriers were identified by local individuals and these can be further hindrances to the transfer of knowledge. These barriers include areas such as organisational and communicational factors, as well as the unawareness of technology. These areas need to utilize scientific techniques in order to develop a co-ordinated and comprehensive plan to deal effectively and successfully with problems.

It was found that training courses could be crucial in the knowledge transfer process. Most of the participants agreed that training programmes produced new knowledge that could lead to an effective transfer and sharing among individuals. These courses also enhanced individuals' ability to learn and to use their knowledge with the help and support obtained from others, and, eventually, this new knowledge was shared in their company. Moreover, this study also found that meetings were essential for the sharing and transfer of knowledge. Local individuals should be encouraged to join meetings, as these can open a wide-ranging discussion regarding a specific topic, which can help in better learning and understanding.

Furthermore, the role of e-mail in knowledge sharing and transfer is also absolutely essential as it is a flexible and adaptive medium for the transfer of information and knowledge. Nearly three quarters of the survey respondents confirmed that e-mails were essential for knowledge sharing and transfer. Therefore, local partners should look for certain methods to ensure the effectiveness of e-mails in knowledge sharing and transfer; and the effective way knowledge is transferred in larger amounts is for the participants to come to the decision to publish e-mail content so it can be forwarded and shared with other individuals in their companies.

The study discovered that foreign personnel held a variety of views regarding their motivation for sharing and transferring knowledge. It was found that the majority of the respondents were motivated to share and transfer knowledge because they believed that if they shared and transferred, then others would share and transfer their knowledge with them as well. In addition, a large number of the participants shared and transferred knowledge because they felt that they were able to help others in the company. On the other hand, this study found that a small number of the respondents (11 per cent) indicated that they shared and transferred knowledge so that they could get rewards from their head office.

Companies should work for the supply of knowledge, and this happens through certain strategies that can motivate individuals to ensure excellence in the sharing and transfer of knowledge: creating an atmosphere that encourages the production of new knowledge; considering incentive pay for ideas generated by teams or individuals; allocating

employment duties that allow initiative and motivate individuals to work; and giving recognition to personnel who generate new information.

It has been identified that the creation of knowledge is a vital issue for companies. This research discovered that the main element that could assist in creating new knowledge was sharing experience, as the vast majority of the survey participants confirmed this point, and the best method for an effective sharing of experience was via interaction, as the interaction of staff members and the company partners contributed to each individual's personal knowledge base, as every interaction leads to learning and creating new knowledge. Other important methods for knowledge creation have been identified in this study: such as, formal meetings, trainee practice, brainstorming, observation and imitation.

In order to create knowledge effectively, new knowledge has to be developed continually. Therefore, companies must employ, develop, and attain outstanding managers who collect and build up valuable knowledge, as well as recruiting and encouraging dynamic, gifted individuals and raising their level of intellectual capabilities so that they can acquire new knowledge and share the knowledge they develop in an effective, efficient, and quick way.

It is clear that knowledge management plays a significant role in companies' development and innovation. However, this study found that the knowledge management programme was quite neglected by the foreign partners, while nearly half of the local participants were not sure whether their foreign partners had a knowledge management programme or not. Moreover, it was further discovered that almost two thirds of the local participants were also not sure whether they felt the manner of their foreign partners made it possible to acquire an effective knowledge management programme or not.

Furthermore, this study found that the majority of the participants believed knowledge management to be very significant because it represented the power of collective knowledge to enhance innovation and responsiveness. Via the accessibility of knowledge, individuals would be able to enhance their level of skills; this could lead to an improvement in the quality of innovation.

Strengthening organisational performance is also a very important reason for adopting a knowledge management programme in companies. Effective knowledge management

naturally requires an appropriate mixture of organisational, social and managerial programmes, as well as the use of suitable technology. Knowledge management gives a general idea of what is available in the company in order to understand in which areas knowledge is missing and to scientifically build the knowledge base in these areas. For a knowledge management programme to be successful, companies should evolve an understanding of how, and where, knowledge is created and developed in the companies.

Furthermore, knowledge management involves several activities; it was discovered that sharing the most valuable practice and conducting training programmes remained the key task of knowledge management. However, it was a surprise to find that leading cultural change was rated by less than half of the respondents as an important activity in knowledge management. It should be realised that knowledge management must provide a knowledge-driven culture that helps knowledge sharing to be encouraged and enhanced.

This study has also looked at the knowledge management system. It was discovered that this system was reasonably accessible, as two thirds of the research participants revealed this level of accessibility. In addition, with regard to the function and purpose of a knowledge management system, nearly half of the local participants indicated that it mainly focussed on creating, gathering, as well as organising, the company's knowledge. Knowledge management systems should be encouraged to be implemented in companies in an organized, integrated, and planned strategy in order to deal with problems that are likely to affect the competence and effectiveness of companies at all levels.

Arab countries' experiments with the transfer and acceptance of technology have neither achieved the preferred technological improvement nor yielded attractive profits on investments. Importing technology has not led to its acceptance and internalization in the host country, let alone to its flow and creation. The two major gaps accounting for this lack of success have been the lack of innovation and knowledge creation systems in Arab countries, and the absence of balanced policies that establish those vital values and institutional structures that support a knowledge society. These problems have been motivated by the incorrect belief that a knowledge society can be built via the introduction of scientific products without investing in the domestic production of knowledge, and via focusing on assistance with universities and research centres in highly developed countries for training Arab scientific cadres without making the local scientific traditions favourable

to knowledge production and acquisition in the area. (The Arab Human Development Report, 2003)

Knowledge in the Middle East and North Africa (MENA) faces several challenges. Aubert and Reiffers (2003, p. 1) assert that "the knowledge revolution presents MENA countries with challenges and opportunities. They need to take advantage of this source of growth and employment. To date, related investments in education, information infrastructure, research and development (R&D), and innovation have been insufficient or inappropriate in most MENA countries. Moreover, inadequate economic and institutional frameworks prevent these investments from yielding desired results."

"Training in Arab countries in general is driven by supply rather than demand and the focus is on quantity, not quality" (The Arab Human Development Report, 2003, p. 71). According to Aubert and Reiffers (2003) the Middle East and North Africa region's educational systems neglect training in accordance with labour market demand, the abilities required to perform well in the job market.

8.3 Limitations of the study

The questionnaires were distributed to respondents from different backgrounds in various administrative and technical departments, so the level of understanding of the questions may have differed, as individuals who worked in administrative posts may not have had a complete knowledge about the technical areas and vice versa, yet they both had to answer the same questions.

Some of the information requested in the questionnaires was considered to be confidential by some respondents, especially the foreigners, and they were unable to reveal certain information. In addition, for reasons of confidentiality, most of the foreign personnel were quite reluctant to be interviewed without prior permission. This lengthy procedure put an extra burden on the researcher to find relevant information that would substantiate the results.

8.4 Recommendations for further research

This research has focussed on technology and knowledge transfer via joint venture companies in the Libyan oil and gas industry. It did not consider cultural aspects as barriers, but these can play an important role in technology and knowledge transfer in any joint venture project; future research should be conducted on cultural influence in order to determine its impact on technology transfer in the oil industry in Libya. Research undertaken in this area would help in giving both local and foreign partners a better understanding of the transferred materials and greater confidence in their use.

This research was only targeted at the joint venture companies in the oil sector in Libya; therefore, it would seem a logical continuation to include some other international companies in the same industry. It might be the case that other companies may generate different results; hence, such a field deserves further investigation.

Tacit knowledge is usually valuable knowledge, because it brings and generates new ideas that can help in enhancing the individual's knowledge. It would be useful to conduct a further study regarding this type of knowledge, focussing on its main channels of transfer in the oil industry in Libya. Research carried out on this topic would help the local partners to formulate and improve their policies for acquiring this type of knowledge.

The study concentrated on the oil sector in Libya. It would be extremely interesting to find out how other companies in other sectors in the country, such as manufacturing, telecommunications, finance and agriculture, react to the technology and knowledge transferred from their foreign partners.

This research was targeted at the joint venture companies in the oil sector in Libya, therefore, it would seem a logical continuation to make a comparative study between Libya and other Arab and Middle Eastern countries. It might be the case that other countries in the region may generate different results and benefits regarding technology and knowledge transfer; hence, such a study deserves further investigation.

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Appendices

- **Questionnaire (1): designed for use of Libyan nationals.**
- **Questionnaire (2): designed for use of foreign personnel.**
- **Arabic translation of questionnaire (1).**

Questionnaire (1): designed for use of Libyan nationals

Questionnaire (1)

Technology and knowledge transfer: a case study of the Libyan oil and gas industry

The following questions are concerned with finding out more about technology and knowledge transfer via international joint ventures in the oil sector in Libya. I would be very grateful if you could take a few minutes to complete this questionnaire as soon as possible. Please tick each box which applies to you, and be assured that your replies will be treated in strict confidence.

Thank you very much for your kind assistance

Researcher:

Eltayeb M. A. Elgobbi

Section One: General Information

This section is intended to obtain some information about the Libyan personnel working with foreign partners, such as their ages, qualifications, sex, and employment positions, in order to get a clear idea about the research sample.

Question 1: What is your age? (Please tick appropriate box).

1. Less than 30 years ☐
2. 30 to less than 40 years ☐
3. 40 to less than 60 years ☐
4. 60 years or over ☐

Question 2: Please indicate whether you are:

1. Male ☐
2. Female ☐

Question 3: What type of qualification do you hold? (Please tick appropriate box).

1. PhD ☐
2. Master's Degree ☐
3. Postgraduate Diploma ☐
4. Higher National Diploma ☐
5. First Degree ☐
6. Intermediate Diploma ☐

Question 4: What is your employment position? (Please tick appropriate box).

1. Head of Dept. ☐
2. Administrator ☐
3. Technician ☐
4. Supervisor ☐
5. Operator ☐

Question 5: How long have you been working for this company? (Please tick appropriate box).

1. Less than one year ☐
2. From one to 3 years ☐
3. 3 to 5 years ☐
4. 5 to 10 years ☐
5. More than 10 years ☐

Section Two: Technology*

This section aims to collect data regarding technology. It tries to find out more about the significance of technology as well as its transfer to the Libyan oil industry.

*** Technology is viewed as "the means by which we apply our understanding of the natural world to the solution of practical problems. It is a combination of "hardware" (buildings, plant and equipment) and "software" (skills, knowledge and experience together with suitable organizational and institutional arrangements). Technology must be applied and maintained, which implies a demand for a further input of a suitable range of human resources and skills. It is this latter input that is at the root of the difficulty in transferring technologies between different environments" (Miles, 1995, p.3).**

Question 6: What type of technology is usually brought by your foreign partner? (Please tick appropriate box).

1. Open technology* ☐
2. Semi-open technology* ☐
3. Closed technology* ☐

*** Open technology means published technological theories such as scientific articles, conferences, technical training courses, and other types.**

*** Semi-open technology refers to patented technology where permissions are needed for the inventions to be seen after keeping some essential parts secret.**

*** Closed technology means the technologies which are unpublished and are highly protected by security rules and measures.**

Question 7: What is the main source of technology in your company? (Please rate from 1-4, where 1= most important, 2= quite important, 3= important, and 4= least important).

		Most important	Quite important	Important	Least important
1	**Equipment***				
2	**Training**				
3	**Consultancy**				
4	**Manpower**				

* **Equipment in general means all the machines, materials, tools etc needed for a purpose or to accomplish a particular task or activity.**

Question 8: What type of equipment is usually brought by your partner company? (Please tick appropriate box).

1. Very expensive equipment ☐
2. Expensive equipment ☐
3. Cheap equipment ☐
4. Very cheap equipment ☐
5. Not sure ☐

Question 9: How reliable is the equipment brought by your foreign partner? (Please tick appropriate box).

1. Very reliable equipment ☐
2. Reliable equipment ☐
3. Not reliable equipment ☐
4. Not sure ☐

Question 10: How sophisticated is the equipment brought by your foreign partner? (Please tick appropriate box).

1. Very sophisticated equipment ☐
2. Sophisticated equipment ☐
3. Not sophisticated equipment ☐
4. Not sure ☐

Question 11: How modern is the equipment brought by your foreign partner? (Please tick appropriate box).

1. Modern equipment ☐
2. Old equipment, but still usable ☐
3. Very old equipment ☐
4. Not sure ☐

Question 12: Who normally uses the equipment brought by your foreign partner? (Please tick appropriate box).

1. Foreign partner's personnel only ☐
2. Both (Libyan and foreign personnel) ☐
3. Not sure ☐

Question 13: How easily can the equipment brought by your partner company be fixed? (More than one option is acceptable).

1. Can easily be fixed in Libya with residential personnel ☐
2. Can be fixed in Libya by bringing in foreign personnel ☐
3. Can be fixed abroad ☐
4. Cannot be fixed ☐
5. Not sure ☐

Question 14: Why do you think your foreign partner brings technology? (More than one option is acceptable).

1. To be used for oil and gas exploration ☐
2. To be used for oil and gas production ☐
3. To be used for the training of Libyan personnel ☐
4. To help in developing the infrastructure of the Libyan oil sector ☐
5. To be more competitive ☐

Question 15: How would you consider the accessibility of technology brought by your partner company? (Please tick appropriate box).

1. Very accessible ☐
2. Accessible ☐
3. Not accessible ☐
4. Not sure ☐

Question 16: Does your partner company distinguish between the technology that should be centrally controlled and the technology that anyone should be free to use? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Question 17: How would you rank the benefits of technology transfer* for each of the following? (Please tick each item and category below).

For	Very important	Quite important	Not too important	Not at all important	Not sure
You					
Your Company					
Your Country					

*** Technology transfer is defined as "a channel for acquiring more than just 'ready-made' product designs, machinery and production know-how for expanding, improving or diversifying production in the short term though these elements have been recognized as essential. It has also been as a channel for acquiring deeper forms of know-how and expertise that will contribute to longer-term objectives about building up the firms' creative competences for generating their own paths of technical and organisational change" (Bell, 1997, p. 85).**

Question 18: When a technical fault arises, does your partner company let you get involved in solving that problem along with the foreign experts? (Please tick appropriate box).

1. Yes ☐ 2. No ☐

Section Three: Knowledge*

This section tries to acquire information about knowledge in your company including its types, creation, sharing, and transfer.

*** "Knowledge is a fluid mix of framed experience, values, contextual information, expert insight, and intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates in individual minds but is often embedded in organizational routines, processes, practices, systems, software, and norms" (Davenport & Prusak, 1998:5).**

Question 19: How would you rank the significance of knowledge in your company? (Please tick one of the options below).

1. Very important ☐
2. Less important ☐
3. Not at all important ☐

Question 20: Why do you think knowledge is required in your company? (More than one option is applicable).

1. To follow the latest innovation ☐
2. To gain competitive advantage ☐
3. To reduce costs ☐
4. To be shared with others in the company ☐
5. To be more reliable and adaptable to change ☐

Question 21: What type of knowledge does your foreign partner transfer? (Please tick appropriate box).

1. Tacit knowledge* ☐
2. Explicit knowledge* ☐
3. Both ☐

*** Tacit knowledge is not easily expressible, not visible, and is very difficult to share and communicate with others.**
*** Explicit knowledge is well articulated, described, and usually comes out in written reports. It is easily transferred and shared.**

Question 22: How would you rank the main channels for transferring explicit knowledge? (More than one option is acceptable).

1. The company's databases and electronic forms ☐
2. Meetings ☐
3. Technical training programmes ☐
4. Conferences ☐
5. Seminars and workshops ☐
6. Printed materials and reports ☐

Question 23: How would you rank the main channels for gaining tacit knowledge? (More than one option is acceptable).

1. Face to face meetings
2. Social activities ☐
3. Accidental meetings ☐
4. Specialised training courses ☐

5. Shared experience ☐
6. Interaction with consulting groups ☐

Question 24: By what means does the company convert explicit into explicit knowledge (combination mode*)? (Please rate from 1-4, where 1= Very high, 2= High, 3= Low, and 4= No).

		Very high	High	Low	Not sure
1	Meetings				
2	Documents				
3	Shared databases				
4	Reports and e-mail				
5	Company's newsletter				

* Combination mode means the process of combining different systems of explicit knowledge to form new explicit knowledge. For example, gathering data to produce a report that examines these data.

Question 25: By what means does the company convert tacit into explicit knowledge (externalization mode*)? (Please rate from 1-4, where 1= Very high, 2= High, 3= Low, and 4= No).

		Very high	High	Low	Not sure
1	Talks between individuals in the company				
2	Elicitation of ideas				
3	Application of methods and procedures				
4	The company's correspondence				

* Externalisation mode refers to the knowledge creation processes whereby tacit knowledge may be encoded into some forms of explicit knowledge.

Question 26: By what means does the company convert explicit into tacit knowledge (internalisation mode*)? (Please rate from 1-4, where 1= Very high, 2= High, 3= Low, and 4= No).

		Very high	High	Low	Not sure
1	Involving the company's individuals in carrying out many tasks in order to use their experience in the company.				
2	Providing several training courses in order to build up the individual's knowledge for the benefit of the company.				
3	Shared experience				

* Internalisation mode means the processes of getting access to explicit knowledge whereby it can be developed and becomes an essential factor of individuals' tacit knowledge .

Question 27: By what means does the company transfer tacit into tacit knowledge (Socialisation mode*)? (Please rate from 1-4, where 1= Very high, 2= High, 3= Low, and 4= No).

		Very high	High	Low	Not sure
1	Face to face meetings and sharing experiences				
2	Practice				
3	Observation				
4	Imitation				

*** Socialisation mode means the methods of sharing and transferring tacit knowledge to other individuals who encode the new knowledge in the form of new tacit knowledge.**

Question 28: Do you often receive your foreign partner's publications? (Please tick appropriate box).

1. Yes ☐ 2. No ☐

If No, please go to question 30.

Question 29: How often do you read your foreign partner's publications? (Please tick appropriate box).

1. Monthly ☐
2. Every 3 months ☐
3. Every 6 months ☐
4. Rarely ☐

Question 30: How does the knowledge creation process happen in your company? (More than one option is acceptable).

1. Shared experience ☐
2. Trainee practice ☐
3. Formal meetings ☐
4. Observations and imitations ☐
5. Brainstorming ☐

Question 31: Does your partner company issue an internal document that reports on how the company manages knowledge? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Question 32: Does your partner company distinguish between the knowledge that should be centrally controlled and the knowledge that anyone should be free to share? (Please tick appropriate box).

1. Yes ☐ 2. No ☐

Question 33: How would you rank the protection of knowledge and information resources owned by the foreign partner? (Please tick appropriate box).

1. Very protected ☐
2. Protected ☐
3. Not protected (anyone can gain access) ☐
4. Not sure ☐

Question 34: Why do you think that individuals are sometimes reluctant to transfer and share their knowledge? (More than one option is acceptable)

1. There is no motivation or recognition for sharing knowledge ☐
2. Individuals sometimes find it hard to know other employees would be interested in what they know ☐
3. Individuals are sometimes not sure of what they know ☐
4. Individuals are sometimes competitive and their knowledge increases their power and position ☐

Question 35: Does your partner company organise training programmes for the Libyan personnel? (Please tick appropriate box).

1. Yes ☐ 2. No ☐

Question 36: Where are these training courses usually held? (Please tick appropriate box).

1. Internally only (in Libya). ☐
2. Externally only (abroad). ☐
2. Internally and externally. ☐

Question 37: Who delivers these training courses? (More than one option is acceptable).

1. Foreign partner ☐
2. Libyan nationals ☐
3. Private companies arranged by the foreign partner ☐

Question 38: Have you ever taken part in a training course by your foreign partner? (Please tick appropriate box).

1. Yes ☐ 2. No ☐

If yes, please answer the next question

Question 39: Has/have the training course/s been beneficial? (Please tick appropriate box).

1. Very beneficial ☐
2. Beneficial ☐
3. Not beneficial ☐

Question 40: Please tick (√) the box that matches your view most closely.

- Individuals in my company only request knowledge when they really need it.
  1. Strongly agree ☐
  2. Agree ☐
  3. Disagree ☐
  4. Strongly disagree ☐
  5. Not sure ☐

- Knowledge sharing is widely recognized in my company.
  1. Strongly agree ☐
  2. Agree ☐
  3. Disagree ☐
  4. Strongly disagree ☐
  5. Not sure ☐

- Individuals need to give complete explanations when they request information and knowledge from the foreign partner.
  1. Strongly agree ☐
  2. Agree ☐
  3. Disagree ☐
  4. Strongly disagree ☐
  5. Not sure ☐

- Local personnel are restricted in searching for knowledge and information within their companies' applications and databases.
  1. Strongly agree ☐
  2. Agree ☐
  3. Disagree ☐
  4. Strongly disagree ☐
  5. Not sure ☐

Section Four: Knowledge Management*

This section intends to discover the knowledge management activities implemented in your company. It also gathers some materials regarding knowledge management systems applied by your foreign partner.

*** Knowledge management (KM) is viewed as "the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and develop new opportunities. It is a systematic process of underpinning, observation, instrumentation, and optimisation of the firm's knowledge economies. Its overall purpose is to maximise the enterprise's knowledge-related effectiveness and returns from its knowledge assets and to renew them constantly" (Jarrar, 2002, p 322).**

Question 41: Does your foreign partner have a knowledge management programme to ensure the maximum business benefit? Please tick one of the options below:

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Question 42: How would you rank the significance of knowledge management in your company? (Please indicate your preference 1-4, where 1= Very important, 2= Quite important, 3= Important, and 4= Not important).

		Very important	Quite important	Important	Not important
1	**KM works continuously to evaluate the company's internal theories in order to progress effectively.**				
2	**KM is the power of collective knowledge to enhance innovation and responsiveness.**				
3	**KM increases the company's knowledge-related effectiveness via its knowledge resources.**				
4	**KM strengthens organisational performance.**				

Question 43: How would you rank the key activities of knowledge management in your company? (More than one option is acceptable).

1. Building databases ☐
2. Sharing the most valuable practices ☐
3. Conducting training programmes ☐
4. Leading cultural change ☐
5. Setting up corporate libraries ☐
6. Building Intranets ☐

Question 44: Do you feel that the manner of your foreign partner makes it possible to acquire an effective knowledge management programme? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Question 45: What do you see as the main purpose of the Knowledge Management System* (KMS) in your company? (Please tick appropriate box):

1. It deals with setting up programmes which facilitate the existence and availability of KMS. ☐
2. It focuses on creating, gathering and organising the company's knowledge. ☐
3. It deals with knowledge in general. ☐

*** A knowledge management system involves cultural, organisational, and technical issues and mainly deals with knowledge and setting up programmes which facilitate the existence and availability of KMS. It concentrates on gathering, creating, organising, and disseminating an organisation's knowledge rather than its information and its data.**

Question 46: How would you rate the accessibility of Knowledge Management Systems provided by your foreign partner? (Please tick appropriate box).

1. Very accessible ☐
2. Accessible ☐
3. Not accessible ☐
4. Not sure ☐

Question 47: If you wish to make any further comments about technology and knowledge transfer in your company, please do so in the space provided below.

Thank you very much for your kind co-operation

Questionnaire (2): designed for use of foreign personnel

Questionnaire (2)

Technology and knowledge transfer: a case study of the Libyan oil and gas industry

The following questions are concerned with finding out more about technology and knowledge transfer via international joint ventures in the oil sector in Libya. I would be very grateful if you could take a few minutes to complete this questionnaire as soon as possible. Please tick each box which applies to you, and be assured that your replies will be treated in strict confidence.

Thank you very much for your kind assistance

Researcher:

Eltayeb M. A. Elgobbi

Section One: General information

This section aims to collect background information about the foreign companies involved in this survey.

Question1: In what type of investment has your company been involved with the Libyan local partner? (More than one option is acceptable).

1. Oil exploration ☐
2. Oil production ☐
3. Oilfields development ☐
4. Oil services ☐

Question 2: Is there any article in the joint venture agreement with the local partner that obligates your company to provide any of the following?

		Yes	No
1.	Training courses for Libyan personnel	☐	☐
2.	Educational courses for Libyan personnel	☐	☐
3.	Local participation in design and construction	☐	☐
4.	Local involvement in Research & Development	☐	☐
5.	Local participation in management	☐	☐

Question 3: Does your company have its own research and development* department? (Please tick appropriate box).

1. Yes ☐ 2. No ☐

If Yes, does your company have any relation with the Libyan oil research institutions (Please specify) _____

* Research and development is defined as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including the knowledge of man, culture and society, and the use of this stock knowledge to devise new applications" (Persaud *et al*, 2003, p. 1002).

Question 4: What is the level of local participation in completing projects in the following fields? (Please tick appropriate box).

No.	Local participation in:	High	Low	No Participation
1	Supervision of operations			
2	Construction			
3	Design			
4	Installation			
5	Maintenance			
6	Inspection			
7	Research and Development			

Section Two: Technology*

This section aims to collect data regarding technology. It tries to find out more about the significance of technology as well as its transfer to the Libyan oil industry.

* Technology is viewed as "the means by which we apply our understanding of the natural world to the solution of practical problems. It is a combination of "hardware" (buildings, plant and equipment) and "software" (skills, knowledge and experience together with suitable organizational and institutional arrangements). Technology must be applied and maintained, which implies a demand for a further input of suitable range of human resources and skills. It is this latter input that is at the root of the difficulty in transferring technologies between different environments" Miles, 1995, p.3).

Question 5: Which of the following elements of technology have been transferred by your company to the local partner? (More than one option is acceptable).

1. Design and construction techniques ☐
2. Provision of management techniques ☐
3. Provision of technical support ☐
4. Provision of maintenance facilities ☐
5. Provision of Research and Development ☐

Question 6: When you bring in technology, how has it been selected: (More than one option is acceptable).

1. By your company itself ☐
2. By consulting foreign companies ☐
3. By consulting national companies ☐
4. By consulting local partner ☐

Question 7: How did you obtain the equipment* brought by your company? (Please tick appropriate box).

1. Developed within the company ☐
2. Bought – in ☐
3. Both (developed and bought-in) ☐

* Equipment in general means all the machines, materials, tools etc needed for a purpose or to accomplish a particular task or activity.

Question 8: If you buy the equipment from other producers, do you make any modifications before it is transferred to Libya? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Question 9: If you modify the equipment, how great are the modifications? (Please tick appropriate box).

1. Minor ☐ 2. Modest ☐ 3. Significant ☐

Question 10: What do you think the main reasons are for the modifications of the equipment? (More than one option is acceptable).

1. Environmental problems ☐
2. Social and cultural problems ☐
3. To meet different technical specifications ☐
4. Amendments needed to account for a lack of skills available ☐
5. To improve maintenance ☐
6. Cost saving ☐

Question 11: When individuals finish solving problems, do they generally take the time to meet other individuals and analyze what went wrong and what could have been done better? (Please tick appropriate box)

1. Very often ☐
2. Often ☐
3. Sometimes ☐
4. Rarely ☐
5. Never ☐

Question 12: When a new opportunity arises, do you first try to retool your existing skills base including Libyan personnel, before you hire new individuals? (Please tick appropriate box)

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Section Three: Knowledge*

This section tries to acquire information about knowledge in your company, including its types, creation, sharing, and transfer.

* "Knowledge is a fluid mix of framed experience, values, contextual information, expert insight, and intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates in individual minds but is often embedded in organizational routines, processes, practices, systems, software, and norms" (Davenport & Prusak, 1998:5).

Question 13: Do you recognize knowledge as an essential part of your company's resources? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

Question 14: How willing to learn is the manpower of your local partner? (Please tick appropriate box).

1. Very willing to learn ☐
2. Willing to learn ☐
3. Not willing ☐
4. Not at all willing ☐
5. Not sure ☐

Question 15: What is the educational background of the Libyan personnel acquiring knowledge in your company? (Please tick appropriate box).

1. Excellent ☐
2. Good ☐
3. Satisfactory ☐
4. Poor ☐

Question 16: How good are the training courses provided by your company to train the Libyan personnel? (Please tick appropriate box).

5. Excellent ☐
6. Good ☐
7. Satisfactory ☐
8. Poor ☐

Question 17: In what language(s) are the training courses delivered? (Please tick appropriate box).

1. Arabic ☐ 2. English ☐ 3. Both (English and Arabic) ☐

Question 18: How would you describe the organised training programme? (Please choose 3 options only from the following).

1. The documentation of the training programme is clear and comprehensible ☐

2. The training programmes are designed to help the local personnel master the new technology ☐

3. During the training programmes all the technical details and most frequent problems of the technology have been well explained to the local personnel ☐

4. The training programs take into account the technical level of the local personnel ☐

5. The main elements of the training programmes are presented in a way the local personnel can easily understood and apply ☐

Question 19: Do you have just the right level of security for your sensitive information and knowledge? (Please tick appropriate box).

1. Yes, our information and knowledge are very securely protected ☐
2. Yes, our information and knowledge are securely protected ☐
3. No, we only protect the essential part of our information and knowledge ☐
4. No, everybody in the company can gain access to our information and knowledge ☐
5. I do not know ☐

Question 20: Have you established methods for individuals to share knowledge? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

If Yes, please answer the following question

Question 21: What are the main methods for individuals to share knowledge? (More than one option is acceptable).

1. Meetings ☐
2. Conferences ☐
3. Training courses ☐
4. Documents ☐
5. Reports and e-mail ☐

Question 22: Which part of your newly gained knowledge do you share? (Please tick appropriate box).

1. I share everything that I know/ have experienced ☐
2. I share what I think is important for the company ☐
3. I share what the head office asks me to share ☐
4. I do not share knowledge

Question 23: What motivates you to share your knowledge? (Please choose 3 options from the following).

1. The idea that if I share, others will share their knowledge with me as well ☐
2. Encouragement from the head office ☐
3. The feeling that I am able to help (others in) the company ☐
4. The power that knowledge provides, making me valuable to the company ☐
5. Knowing that the head office will actively use the knowledge I provide ☐
6. Because I get rewarded for sharing knowledge from my head office ☐

Question 24: Could you determine the main barriers to knowledge sharing and transfer? (More than one option is acceptable).

1. Partner's cultural characteristics ☐
2. Organisational factors (organisational climate, relationships, systems and structures of the company) ☐
3. Communicational factors e.g. language difficulties ☐
4. Unawareness of the advantages of technology ☐

Question 25: Which knowledge sharing facilities does the company provide? (More than one option is acceptable).

1. Face-to-face meetings during the assignment (including video/web conferences) ☐
2. Face-to-face debriefing after the assignment ☐
3. Electronic database for storing information ☐
4. E-mail ☐
5. Intranet ☐
6. Telephone (conferences) ☐

Question 26: Do the members of the senior management team in your company frequently talk about knowledge management* when reporting on the state of the company to the local partner? (Please tick appropriate box).

1. Yes ☐ 2. No ☐ 3. Not sure ☐

* Knowledge management is viewed as "the process of continually managing knowledge of all kinds to meet existing and emerging needs, to identify and exploit existing and acquired knowledge assets and develop new opportunities. It is a systematic process of underpinning, observation, instrumentation, and optimisation of the firm's knowledge economies. Its overall purpose is to maximise the enterprise's knowledge-related effectiveness and returns from its knowledge assets and to renew them constantly" (Jarrar, 2002, p 322).

Question 27: Please tick √ the box that matches your view most closely.

- I have been practising knowledge management for some time without calling it that. (Please tick appropriate box)

1. Strongly agree ☐
2. Agree ☐
3. Disagree ☐
4. Strongly disagree ☐
5. Not sure ☐

- My company looks for ways to remove barriers to knowledge sharing. (Please tick appropriate box).

1. Strongly agree ☐
2. Agree ☐
3. Disagree ☐
4. Strongly disagree ☐
5. Not sure ☐

Question 28: If you wish to make any further comments about technology and knowledge transfer in your company, please do so in the space provided below.

Thank you very much for your kind co-operation

An Arabic translation of questionnaire (1)

إستمارة الإستبيان

إنتقال التقنية و المعرفة عبر الشركات الدولية المشتركة: دراسة حالة خاصة بقطاع النفط و الغار بليبيا

تهتم الأسئلة التالية بالحصول على معلومات تتعلق بإنتقال التقنية و المعرفة عبر الشركات الدولية المشتركة بقطاع النفط و الغار بليبيا. آمل منكم التكرم بالإجابة على الأسئلة المتضمنة بالإستبيان بأسرع وقت ممكن و ذلك وفقاً وما يناسبك من ردود و تأكد بأن ردودكم ستعامل بسرية و خصوصية تامة.

شاكرين حسن تعاونكم و مساعدتكم

الباحث:
الطيب محمد علي القبي

القسم الأول : معلومات عامة:

يهدف هذا القسم للحصول على معلومات تتعلق بالعاملين الليبيين مع الشركات الأجنبية المشاركة, كالأعمار, الجنس, المؤهلات العلمية, مواقع العمل بالشركة وغيرها, وذلك من أجل حصول على فكرة وافية على عينة البحث.

س1: العمر:

1- أقل من 30 سنة ☐
2- من 30 إلى 40 سنة ☐
3- من 40 إلي 60 سنة ☐
4- 60 سنة فأكثر ☐

س2: الجنس:

1- ذكـــر
2- أنثي ☐

س3: المؤهل العلمي :

1- الإجازة الدقيقة (دكتوراه) ☐
2-الإجازة العالية (الماجستير) ☐
3- دبلوم دراسات عليا ☐
4- الشهادة الجامعية الأولى ☐
5- دبلوم عالي ☐
6- دبلوم متوسط ☐

س4: الموقع الوظيفي:

1- رئيس قسم ☐
2-إداري ☐
3- فني ☐
4- مشرف ☐
5- مشغل ☐

س5: الخبرة العملية:

1- أقل من سنة ☐
2- من سنة إلى 3 سنوات ☐
3 - من 3 إلى 5 سنوات ☐
4- من 5 إلى 10 سنوات ☐
5- اكثر من 10 سنوات ☐

القسم الثاني: التقنية*:

يهدف هذه القسم إلى جمع بيانات تتعلق بالتقنية المتوافرة بالشركة من اجل التعرف اكثر على أهمية التقنية بشكل عام ونقلها إلى الصناعة النفطية بليبيا بشكل خاص.

* يقصد بالتقنية هنا جميع الوسائل التي من خلالها يمكن تطبيق ما يمكن فهمه ومعرفته لحل مشكلة معنية, فالتقنية عبارة عن خليط بين الأشياء الملموسة (الآلآت, المعدات, المباني, المصانع وغيرها) والأشياء الغير الملموسة (المهارات, المعرفة, والخبره).

س6: ما نوعية التقنية التى يقوم الشريك الأجنبي في الغالب بإحضارها ؟ (من فضلك إختر أحد الخيارات أدناه).

1- التقنية المفتوحة* ☐
2- التقنية شبه المفتوحة * ☐
3- التقنية المقفلة (المغلقة) * ☐

* يقصد بالتقنية المفتوحة جميع النظريات التكنولوجية المصدرة (المنشورة), كالمقالات العلمية, المؤتمرات, الدروات التدريبية وغيرها.

* يقصد بالتقنية شبة المفتوحة الإمتيازات و الإختراعات الفنية المسجلة والتي غالباً ما تحتاج إلى إذن مسبق من المرخص للإطلاع عليها ومن حق المبتكر أو المخترع هنا الإحتفاظ ببعض من إجزاءها سرياً.

* يقصد بالتقنية المقفله التقنية لايمكن نشرها وتكون في الغالب محمية وبشكل جيد بواسطة مجموعة من اللوائح والمقاييس.

س7: ماهو المصدر الأساسي للتقنية بشركتكم؟(من فضلك رتب كل عنصر وفقاً للأرقام التالية: 1 = الأكثر أهمية , 2 = مهمة الى حد ما , 3 = مهمة , 4 = الأقل أهمية) .

		الأكثر أهمية	مهمة الى حد ما	مهمة	الأقل أهمية
1	المعدات*				
2	الدورات				
3	الإستشارات				
4	القوى العاملة				

* يقصد بالمعدات جميع الآلآت والمواد والأدوات التى يتم استخدامها لغرض معين أو لعمل مهمة أو نشاط محدد.

س8: هل المعدات التي يتم إحضارها بواسطة الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- معدات غالية جداً ☐
2- معدات غالية ☐
3- معدات رخيصة ☐
4- معدات رخيصة جدا ☐
5- لست متأكداً ☐

س9 : هل المعدات التي يتم إحضارها بواسطة الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- يمكن الإعتماد عليها بشكل كبير ☐
2- يمكن الإعتماد عليها ☐
3- لا يمكن الإعتماد عليها ☐
4- لست متأكداً ☐

س10: هل المعدات التي يتم إحضارها بواسطة الشريك الأجنبي؟(من فضلك إختر أحد الخيارات أدناه).

1- شديدة التعقيد ☐
2- معدات معقدة ☐
3- معدات غير معقدة ☐
4- لست متأكداً ☐

س11: هل المعدات التي يتم إحضارها بواسطة الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- معدات حديثة ☐
2- معدات قديمة ولكن مازالت تستخدم ☐
3- معدات قديمة جداً ☐
4- لست متأكداً ☐

س12: من في الغالب مايستخدم المعدات التي يتم إحضارها بواسطة الشريك الأجنبي ؟(من فضلك إختر أحد الخيارات أدناه).

1- أفراد الشريك الأجنبي فقط ☐
2- الإثنين (الأفراد الليبين والأجانب) ☐
3- لست متأكداً ☐

س13: هل المعدات التي يتم إحضارها بواسطة الشريك الأجنبي؟ (بالإمكان إختيار أكثر من خيار).

1- بالإمكان إصلاحها بليبيا وبواسطة أفراد مقيمين بليبيا ☐
2- بالإمكان إصلاحها بليبيا ولكن بواسطة أجانب من الخارج ☐
3- يتم إصلاحها بالخارج ☐
4- لايمكن إصلاحها ☐
5- لست متأكداً ☐

س14: لماذا تعتقد بأن الشريك الأجنبي يقوم بإحضار التقنية لليبيا؟ (بالإمكان إختيار أكثر من خيار).

1- لإمكانية إستخدامها في عمليات الإستكشاف عن النفط والغاز ☐
2- لإمكانية إستخدامها في عمليات إنتاج النفط والغاز ☐
3- لإمكانية إستخدامها في تدريب العاملين الليبيين. ☐
4- لإمكانية إستخدامها في تطوير البنى التحتية للقطاع النفطي بليبيا ☐

5- لإمكانية المنافسة ☐

س15: كيف يمكنك تقييم مدى إمكانية الوصول للتقنية المحضرة بواسطة الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- سهلة الوصول جداً ☐
2- سهلة الوصول. ☐
3- لايمكن الوصول إليها. ☐
4- لست متأكداً. ☐

س16: هل يميز الشريك الأجنبي بين التقنية المتحكم بها مركزياً والتقنية التي بإمكان أي شخص بالشركة استخدامها؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐ 3- لست ماكداً ☐

س17: كيف يمكنك أن تحدد الفوائد الخاصة بانتقال التقنية* لكل من الجهات التالية (من فضلك حدد وفقاً لكل عنصر و شريحة أدناه).

الجهة	مهمة جداً	مهمة	غير مهمة	غير مهمة اطلاقاً	لست متاكداً
أنت					
شركتك					
بلادك					

*** إنتقال التقنية هو القناة التي من خلالها يمكن الحصول على تصميم المنتجات جاهزة الإستعمال وكذلك الآلآت والخبرات ومهارات العمل للإنتاج وذلك من إجل توسيع وتحسين الإنتاج على المدى القصير.**

س18: عند حدوث أي عطل فني أو تقني هل يسمح لك الشريك الأجنبي بالتدخل لإصلاح العطل جنباً إلى جنب مع الخبراء الأجانب ؟(من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐

القسم الثالث: المعرفة*:-

يحاول هذا القسم الحصول على معلومات تتعلق بالمعرفة بشركتكم كا انواها, كيفية خلقها و انتقالها وكذلك مشاركتها مع الاخرين.

*** تنشأ المعرفة أساساً بعقل الفرد ويقصد بها الخليط المجمع من الخبره و المعلومات التي يمكن استخدامها من أجل الحصول على خبرة و معلومات جديدة.**

س19: كيف تقيم أهمية المعرفة بشركتكم؟ (من فضلك إختر أحد الخيارات أدناه).

1- مهمة جداً ☐
2- مهمة ☐
3- غير مهمة إطلاقاً ☐

س20: لماذا تعتقد بأن المعرفة ضرورية بشركتكم؟ (بالإمكان إختيار أكثر من خيار).

1- لمتابعة أخر الإ بتكارات ☐
2- للحصول على الميزة التنافسية ☐
3- لتخفيض التكاليف ☐
4- لمشاركتها مع الاخرين بالشركة ☐
5- لملائمة الشركة لإي تغيير ☐

س21: ما نوعية المعرفة التي يقوم شريككم الأجنبي بنقلها إليكم؟ (من فضلك إختر أحد الخيارات أدناه).

1- المعرفة الضمنية * ☐
2- المعرفة الصريحة* ☐
3- الإثنين ☐

*** المعرفة الضمنية هي المعرفة التي ليس من السهل التعبير عنها ورئيتها ومن الصعب جداً مشاركتها مع الاخرين.**

*** المعرفة الصريحة هي المعرفة التي من السهل جداً مشاركتها مع الاخرين و تكون في الغالب موضحة بشكل جيد وغالباً ما تكون في صورة تقارير ووثائق.**

س22: ما هي أهم قنوات إنتقال المعرفة الصريحة؟ (بالإمكان إختيار أكثر من خيار).

1- قواعد البيانات الخاصة بالشركة ☐
2- المقابلات. ☐
3- برامج التدريب الفني ☐
4- المؤتمرات. ☐
5- حلقات النقاش وورش العمل ☐
6- التقارير والمواد المطبوعة ☐

س23: ما هي أهم قنوات إنتقال المعرفة الضمنية ؟ (بالإمكان إختيار أكثر من خيار).

1- المقابلات وجهاً لوجه ☐
2- الأنشطة الإجتماعية ☐
3- المقابلات العرضية (بالمصادفة) ☐
4- الدورات التدريبية المتخصصة ☐
5- مشاركة الخبرة مع الاخرين ☐
6- التفاعل مع المجموعات الإستشارية ☐

س24: بأي طريقة من الطرق التالية تقوم شركتكم بتحويل المعرفة الصريحة إلى معرفة صريحة أخرى (نموذج الجمع أو الضم*)؟ (من فضلك رتب وفقاً للإتي: 1 = عالية جداً , 2 = عالية , 3 = منخفضة , 4 = لست متاكداً).

م	الطريقة	عالية جداً	عالية	منخفضة	لست متاكداً
1	المقابلات				
2	الوثائق				
3	مشاركة قاعدة البيانات				
4	التقارير والبريد الإلكتروني				
5	صحيفة أو نشرة الأخبار المطبوعة الخاصة بالشركة				

*** يقصد بنموذج الضم أو الجمع العملية التي بمقتضاها يتم توحيد الأنظمة المختلفة في المعرفة الصريحة من اجل تكوين معرفة صريحة جديدة فمثلا يتم جمع بيانات من أجل إعداد تقرير بطريقة جيده.**

س25: بأي طريقة من الطرق التالية تقوم شركتكم بتحويل المعرفة الضمنية الى معرفة صريحة (النموذج الخارجي*)؟ (من فضلك رتب وفقاً للإتي: 1 = عالية جداً , 2 = عالية , 3 = منخفضة , 4 = لست متاكداً).

م	الطريقة	عالية جداً	عالية	منخفضة	لست متاكداً
1	إجراء المحادثات بين الأفراد في الشركة				
2	مشاركة الأفكار				
3	تطبيق و ممارسة الطرق و الإجراءات				
4	المراسلات التي تجريها الشركة				

* يقصد بالنموذج الخارجي عمليات خلق المعرفة عندما يكون بالإمكان تحويل المعرفة الضمنية إلى أشكال من المعرفة الصريحة.

س26: بأي طريقة من الطرق التالية تقوم شركتكم بتحويل المعرفة الصريحة الى معرفة ضمنية (النموذج الداخلي*)؟ (من فضلك رتب وفقاً للإتي: 1 = عالية جداً , 2 = عالية , 3 = منخفضة , 4 = لست متاكداً).

م	الطريقة	عالية جداً	عالية	منخفضة	لست متاكداً
1	إشغال موظفي الشركة بتنفيذ مجموعة من المهام والواجبات بهدف إستخدام خبراتهم بالشركة				
2	تقديم العديد من الدورات التدريبية بهدف تنمية المعرفة الخاصة بالموظفين للإستفادة منها بالشركة				
3	الخبرة المشتركة (المشاركة في تبادل الخبرة)				

* يقصد بالنموذج الداخلي العمليات التي بمقتضاها يمكن الدخول إلى المعرفة الصريحة والتي بالإمكان تطويرها لتصبح عامل أساسي من المعرفة الضمنية للإفراد.

س27: بأي طريقة من الطرق التالية تقوم شركتكم بتحويل المعرفة الضمنية الى معرفة ضمنية أخرى (النموذج الإجتماعي*)؟ (من فضلك رتب وفقاً للإتي: 1 = عالية جداً , 2 = عالية , 3 = منخفضة , 4 = لست متاكداً).

م	الطريقة	عالية جداً	عالية	منخفضة	لست متاكداً
1	اجراء المقابلات وجهاً لوجه و تبادل الخبرات				
2	الممارسة				
3	الملاحظة و المراقبة				
4	التقليد في تنفيذ الأعمال و العمليات				

* يقصد بالنموذج الإجتماعي طرق مشاركة و إنتقال المعرفة الضمنية إلى أفراد اخرين اللذين يقومون بتحويلها إلى معرفة حديثة في شكل معرفة ضمنية جديدة.

س28 : هل تستلم بعض الإصدارات الخاصة بالشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعـم ☐ 2- لا ☐

إذا كانت الإجابة (بلا) من فضلك إذهب للسؤال (30).

س29: كم مره غالباً ما تقراء إصدارات الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- شهرياً ☐
2- كل 3 أشهر ☐
3- كل 6 أشهر ☐
4- نادراً ☐

س30: كيف تحدث عملية خلق المعرفة بالشركة؟ (بالإمكان إختيار أكثر من خيار).

1- الخبرة المشتركة ☐
2- ممارسة المتدربين ☐
3- المقابلات الغير رسمية ☐
4- الملاحظة والمراقبة ☐
5- العصف الذهني (التفكير المتعمق) ☐

س31: هل في الغالب ما يصدر الشريك الأجنبي وثيقة داخلية توضح كيفية إدارة ومشاركة المعرفة بالشركة؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐ 3- لست متأكداً ☐

س32: هل الشريك الأجنبي غالباً ما يميز بين المعرفة المتحكم فيها مركزياً والأخرى التي بإمكان اي شخص المشاركة فيها؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐

س33: كيف تقييم برامج الوقاية والحماية على المعرفة والمعلومات التي يملكها شريككم الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- محماة بطريقة محكمة ☐
2- محماة ☐
3- غير محماة (أي شخص بالشركة بإمكانة الدخول إليها) ☐
4- لست متأكداً ☐

س34: لماذا تعتقد بأن الأفراد بعض الأحيان عازفين عن نقل أو مشاركة معرفتهم ؟ (بالإمكان إختيار أكثر من خيار).

1- عدم وجود حوافز نضيراً للمشاركة بالمعرفة ☐
2- بعض الأفراد يجدونها صعبة لإقناع الأفراد الاخرين بالشركة بما يعرفون ☐
3- الأفراد اغلب الأحيان غير متأكدين مما يعرفون ☐
4- وجود التنافس بين الأفراد وبالتالي المعرفة التي لديهم تعزز مكانتهم بالعمل ☐

س35: هل تقوم الشركة الأجنبية المشاركة لكم بتنظيم برامج تدريبية للأفراد الليبيين؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐

س36: هل بإمكانك تحديد أين تقام هذه الدورات التدريبية؟ (من فضلك إختر أحد الخيارات أدناه).

1- داخلياً فقط (بليبيا) ☐
2- خارجياً فقط (بالخارج) ☐
3- داخلياً وخارجياً ☐

س37 من يقوم بالغالب بإعطاء هذه الدورات؟ (بالإمكان إختيار أكثر من خيار).

1- الشريك الأجنبي ☐
2- الشريك المحلي ☐
3- شركات خاصة بالتنسيق مع الشريك الأجنبي ☐

س38: هل سبق لك وأن شاركت بدوره تدريبية أعدت من قبل الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐

إذا كانت الإجابة بنعم فمن فضلك أجب على السؤال التالي.

س39: هل كانت الدورة التي أخذتها مفيذه ؟ (من فضلك إختر أحد الخيارات أدناه).

1- مفيذة جداً ☐
2- مفيذة ☐
3- غير مفيدة ☐

س40: من فضلك ضع علامة(√) مع ما يناسب رأيك.

- **العاملين بشركتكم غالباً ما يطلبون المعرفة عندما يكون هناك فقط حاجة ماسة اليها.**

1- أوافق بقوة ☐
2- أوافق ☐
3- لا أوافق ☐
4- لا أوافق بقوة ☐
5- لست متأكداً ☐

- **عملية مشاركة المعرفة متعارف عليها وبشكل كبير بشركتكم.**

1- أوافق بقوة ☐
2- أوافق ☐
3- لا أوافق ☐
4- لا أوافق بقوة ☐
5- لست متأكداً ☐

- **يقدم العاملين تفسيراً وافياً عند القيام بطلب المعرفة أو معلومات من الشريك الأجنبي.**

1- أوافق بقوة ☐
2- أوافق ☐
3- لا أوافق ☐
4- لا أوافق بقوة ☐
5- لست متأكداً ☐

- **العاملين الوطنيين مقيدين من البحث عن المعرفة أو معلومات من خلال قواعد البيانات و الوسائل المتاحة.**

1- أوافق بقوة ☐
2- أوافق ☐
3- لا أوافق ☐
4- لا أوافق بقوة ☐
5- لست متأكداً. ☐

القسم الرابع: إدارة المعرفة *:

يهدف هذا القسم للتعرف على الأنشطة الخاصة بإدارة المعرفة المطبقة بشركتكم, كما ويهدف ايضاً إلى تجميع بعض المعلومات المتعلقة بأنظمة إدارة المعرفة المطبقة من قبل الشريك الأجنبي.

*** يقصد بإدارة المعرفة العمليات المستمرة لإدارة المعرفة بجميع أنواعها بهدف مقابلة الاحتياجات الخارجية والظاهرة من اجل تحديد أصول المعرفة المطلوبة بهدف تطوير فرص معرفية جديدة, وهي ايضاً عملية تنظيمية تعد دعامة أساسية من اجل تقوية اقتصاديات الشركة المعرفية.**

س41: هل يملك شريككم الأجنبي برنامج لإدارة المعرفة بهدف ضمان الإستفادة القصوى من الأعمال؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐ 3- لست متأكداً ☐

س42: كيف يمكنك ترتيب أهمية إدارة المعرفة بشركتكم؟ (من فضلك حدد الأهمية وفقاً للإتي: 1 = مهمة جدًا , 2 = مهمة الى حد ما , 3 = مهمة , 4 = غير مهمة).

		مهمة جدًا	مهمة الى حد ما	مهمة	غير مهمة
1	تعمل بإستمرار على تقييم النظريات و اللوائح الداخلية للشركة للعمل بطريقة فعاله				
2	تعد القوة الأساسية للمعرفة الشاملة بهدف تقوية برامج الابتكار				
3	تزيد من كفاءة الشركة المعرفية وذلك من خلال المصادر المعرفية وتجديدها بشكل مستمر				
4	تقوية الأداء الوظيفي للشركة				

س43: ماهي الأنشطة الأساسية لإدارة المعرفة بشركتكم؟ (بالإمكان إختيار أكثر من خيار).

1- بناء قواعد البيانات. ☐
2- المشاركة في الأنشطة المهمة والفعالة ☐
3- اجراء البرامج التدريبية ☐
4- التغيير الثقافي ☐
5- بناء المكتبات المعرفية ☐
6- بناء الشبكات الإلكترونية المعرفية ☐

س44: هل تشعر بأن أسلوب الشريك الأجنبي يعمل على بناء برنامج فعال لإدارة المعرفة ؟ (من فضلك إختر أحد الخيارات أدناه).

1- نعم ☐ 2- لا ☐ 3- لست متأكداً ☐

س45: ما هو الهدف الأساسي لنظم الإدارة المعرفية* من وجهة نظرك؟ (من فضلك إختر أحد الخيارات أدناه).

1- العمل على إعداد مجموعة من البرامج لإمكانية حدوث وتوافر الإنشطة المعرفية ☐
2- التركيز على الخلق والإبداع , تجميع وتنظيم الأمور المعرفية بالشركة ☐
3- تتعامل مع المعرفة بصفة عامة ☐

*** تشمل نظم إدارة المعرفة القضايا الثقافية والتنظيمية والتقنية وتتعامل هذه النظم اساسا مع المعرفة و إعداد البرامج التي من شأنها توفيرها وحدوثها, كما تركز على تجميع, خلق وتنظيم المعرفة بالشركة.**

س46: كيف تقييم إمكانية الوصول إلى نظم إدارة المعرفة المعدة من قبل الشريك الأجنبي؟ (من فضلك إختر أحد الخيارات أدناه).

1- سهلة الوصول جدا ☐
2- سهله الوصول ☐
3- لايمكن الوصول إليها ☐
4- لست متأكدا ☐

س47: إذا أردت أن تضيف أي معلومات تتعلق بإنتقال التقنية والمعرفة إلى شركتكم, فمن فضلك أكتب ذلك في الفراغ المخصص أدناه:

شاكرين حسن تعاونكم