ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA

POTENTIAL OF MANUFACTURING SMES FOR INNOVATION IN SELECTED ESCWA COUNTRIES

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Preface

In the countries of the ESCWA region, no less than in many other countries, both developed and developing**,** manufacturing SMEs play an important role as contributors to national economic growth and providers of employment opportunities. In the developed countries of the OECD, governments have enacted legislation aimed at providing SMEs with access to credit, technical support, fiscal incentives and markets. In most developing countries, on the other hand, SMEs enjoy only limited support from government. However, they manage to thrive and prosper none the less, relying on their ability to innovate and find creative approaches to production and marekting. SMEs, of their very nature, tend to be innovative. According to Joseph Schumpeter, innovation and the innovative spirit constitute a major production factor for SMEs, on an equal footing with capital, labour and rent.

Manufacturing SMEs in the countries of the ESCWA region are facing serious challenges as a result of emerging regional and international developments and the recent dramatic increase in trade competition in domestic and international markets. Firms in that category stand at the threshold of a new era, as trends and events that will inevitably have a far-reaching impact on the quality of our lives appear in rapid succession. New technologies, most notably information technology, are being introduced in various aspects of manufacturing, bringing with them changes in production management and commercial practice. The structure of the international export market is being radically altered by the application of the provisions of the World Trade Organization (WTO) Agreement. Regional economic groupings are gaining power and are coming increasingly to influence the patterns of international trade flows (such as those among the countries of Europe and the Mediterranean basin), creating new prospects and provoking new fears. The potential for enhanced inter-Arab co-operation through the implementation of the Arab Free Trade Area is arousing fresh hopes. Change is becoming the rule rather than the exception, and many firms, particularly small and medium enterprises (SMEs) in the manufacturing sector, are having some difficulty adjusting to the new situation.

Creativity and innovation are crucial to SMEs' prospects of surviving these challenges. In the emerging context, competitiveness is contingent on a firm's ability to improve and modify its products, processes and mode of operation on an ongoing basis and to adapt to constantly changing market conditions. This requires a large measure of entrepreneurial spirit as well as creativity and flexibility. These are business traits that are becoming essential rather than simply advantageous, particularly in a period in the history of trade which is being referred to as the "creativity revolution".

If manufacturing SMEs in the region are to be able to compete under these new regional and international conditions, it is imperative for them to improve their products and enhance their performance by various means. They must be innovative in finding ways and tools that will help them respond to change, identify and exploit opportunities, create and develop new markets and adapt to new technologies and applications of those technologies.

This study analyses the innovational potential of manufacturing SMEs and the resultant policy implications in two countries of the ESCWA region, Egypt and Lebanon. The main emphasis is on non-technological innovation; however, technological innovation is dealt with in a separate volume. The study identifies factors internal to a business enterprise that stimulate or inhibit innovation. It attempts to show that SMEs have great potential as diffusers and exploiters of innovation and that as such, they play an important role in creating an enabling environment for economic growth and development. The study further shows that the competitive position of SMEs in traditional manufacturing sectors may be enhanced through the adoption of an innovation strategy.

The objective of this study is to help SMEs become aware of their inno-vational potential and learn from successful experiences of other manufacturing SMEs, and to help governments and donors become aware of areas in which SMEs are in need of support. Accordingly, the study targets a group consisting of managers of manufacturing SMEs, concerned government officials, donors and research workers in the field.

The findings of the study are based on the results of desk and field research work. It consists of five chapters.

Chapter I, "Introduction", presents the issue of innovation, the challenges facing SMEs, and the competitive advantages available to them as a result of changes in the international market and the shift towards knowledge-based economies.

Chapter II, entitled "Achieving enterprises and innovation", demonstrates that achieving SMEs are innovative enterprises. It describes the relative importance of manufacturing SMEs in the ESCWA region and analyses the correlation between achieving SMEs and innovation. The chapter outlines the various concepts of innovation as discussed in the literature survey, and it includes an analysis of the relationship between innovation and learning, with emphasis on the emerging importance of enterprises as learning organizations. It also analyses the role of innovation as a contributor to national growth, reporting the results of a number of field studies conducted in developed countries. The chapter ends with a reversed paradigm suggesting that innovative firms are effectively performing firms which are capable of creating an enabling economic environment and stimulating the recovery of a depressed economy, and that they tend to foster the advent of an achieving environment/society.

Chapter III, entitled "Management innovations through information technology", shows how the rapid development of information technology is enhancing SMEs' potential for innovation, and thus their competitive advantage, by affording opportunities for major improvements in business processes and management strategies. Issues relating to the re-engineering of SMEs through information technology are analysed, with reference to the fact that in industrialized countries, knowledge networking and knowledge management are increasingly becoming the building blocks of successful business process re-engineering. The chapter covers various types of information technology that can be adopted in support of SMEs' business process re-engineering through knowledge management. It concludes by emphasizing that special consideration must be given to local conditions and the work environment, particularly in developing countries, in selecting and adopting the most suitable and most cost-effective models from the range of available alternatives in the field of information technology.

Chapter IV, entitled "Results of innovation experiences from the field", reports the findings of field work undertaken in two ESCWA countries, Egypt and Lebanon, in the form of structured interviews with the owners of selected manufacturing enterprises.

Chapter V contains the study's conclusions and recommendations.

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ABBREVIATIONS AND EXPLANATORY NOTES

ESCWA	Economic and Social Commission for Western Asia
OECD	Organization for Economic Co-operation and Development
WTO	World Trade Organization
SMEs	Small and Medium Enterprises
ETC	Egyptian Knitting and Ready-Made Company
EITC	Egyptian International Trade Company
GMT	Global Marketing of Technology
MMTT	Modern Workshop for Manufacturing Tent Textiles
Natoil	Natural Oil Company
Indevco	Industrial Development Company
EDI	Electronic Data Interchange
PoS	Point of Sale
CAD/CAM	Computer-aided design/computer-aided manufacturing
GCC	Gulf Co-operation Council
MDE	More Diversified Economies
IT	Information Technology
GDSS	Group Decision Support System
DSS	Decision Support System
ERP	Enterprise Resource Planning
AI	Artificial Intelligence
MRP	Materials Requirements Planning
KBS	Knowledge-Based System
ES	Expert System
CBR	Case-based Reasoning
ASP	Application Service Provider

The following symbols have been used in the tables throughout the report:
Two dots (..) indicate that data are not available or not separately reported.
A dash (-) indicates that the amount is nil or negligible.
References to dollars ($) are to United States dollars, unless otherwise stated.

I. INTRODUCTION

In view of the constantly changing conditions of the international market and the stiff competition which firms and nations are having to face as a result, innovation is becoming an important instrument for coping with the evolving new international environment. Both for individual firms and for national economies, it is the key to competitive advantage and an important driving force for growth. In the emerging knowledge economy, innovation is assuming increased importance, creative thinking is coming to be recognized as the basis of innovation, and a major shift from the economics of goods to the economics of ideas is under way.

A. INNOVATION IN SMES - FACING THE CHALLENGES

ESCWA countries and firms are at a crossroads: either they adapt to the global changes that are occurring and integrate into the modern context, or they will become marginalized. They must learn to cope with the dramatic changes that are taking place in the global economy, particularly as regards the transition that any successful firm must make, from a privileged position in a local market to survival in a highly competitive environment, and from relative scale (economies of scale) to relative scope (economies of scope). SMEs in the countries of the region must grasp the fact that innovation confers a competitive edge over competing SMEs, both global and domestic, and is a major factor in a successful transition from a sheltered economy to a competitive economy.

1. *The beneficial aspects of the changing situation*

Manufacturing SMEs in ESCWA countries must learn to appreciate the bright side of globalization: the emerging global economy may benefit small and medium-sized producers in various ways, opening up significant growth opportunities that would otherwise not be available to them in their domestic markets.[1] Globalization offers them a chance of competing in the international market, and they can take useful advantage of the rapid pace of technological progress, especially in the field of information technology and its applications, and the market's response thereto.

Technology-related advances to date have yielded mainly smaller production runs, flexibility in production systems, an expanded range and variety of products and improved quality. Most notably, the rapid pace of development in information technology and its applications has created new business opportunities, particularly for small firms. The cost of information technology is now so low that it is easy for small companies to acquire sophisticated systems that perform as well as, or in some instances even better than, the computer systems used by their bigger competitors. The use of electronic data interchange (EDI) has substantially reduced ordering and invoicing costs, enabling retailers to maintain lower inventory levels. At the same time, the use of point of sale (PoS) data enables industrial firms to adopt flexible manufacturing systems, which also obviate the need to keep large stocks on hand.[2] The application of computer-aided design and computer-aided manufacturing (CAD/CAM) has improved SMEs' design capabilities and expedited their learning process. The use of the Internet has also enhanced learning and opened up new opportunities for outward expansion and growth. All these developments have expanded production potential and product range and variety, increased outward expansion opportunities, reduced manufacturing capital requirements and lowered cost and risk levels.[3]

As regards non-technological aspects, significant changes are occurring in the structure, sourcing, production and retail strategies of manufacturing industries in the developed countries: they are shifting away from the mass production of standardized goods, using narrowly skilled workers and unvarying high-volume technology, toward the production of specialized goods using more versatile labour and flexible intelligent machinery. Information technology and shifts in patterns of market demand are playing a

[1] OECD, *Globalization and Small and Medium Enterprises (SMEs), Vol. 1, Synthesis Report* (Paris, 1997).

[2] Bob Lowson, *Quick Response for Small and Medium-sized Enterprises - A Feasibility Study* (University of Wales, Cardiff/The Textile Institute, 1998).

[3] OECD, *Globalization and SMEs*.

substantial part in this transformation. Changes in demographic structure in the developed countries, with growing numbers of higher-income earners, have produced a more alert and sophisticated consumer, whose tastes favour more differentiated products. These developments have fragmented the mass market, forcing retailers to adopt new marketing strategies, consisting essentially of supplying a wider variety of higher-quality products to meet the needs of specific segements of the market. In this process, large retailers have had to adopt market practices similar to those of small retailers, with the result that producers have been compelled to shift away from mass supply and slowly changing product lines to short production runs and customized production.[4]

2. *Two concurrent trends*

Globalization and advances in technology, including information technology, have created two trends: one in the direction of the giant (global) corporation, and a second in the direction of greater fragmentation of the operations of large companies. The former trend is illustrated by the recent wave of takeovers and acquisitions on the part of large firms and the formation of strategic alliances between very large and powerful corporations, resulting in the emergence of global corporations.[5] The latter trend is illustrated by the parallel tendency for large firms to internationalize by cutting back their in-house operations and outsourcing globally. Many such firms are coming to consist of a proliferation of small and medium enterprises, with the co-ordination and integration of their operations being facilitated by the new information technology. As regards SMEs, globalization and advances in technology have opened up new opportunities for them to operate in areas that formerly required large-scale capacities.

B. ENHANCED COMPETIVE ADVANTAGE OF SMES

Competition is no longer possible on the basis of low cost alone; increasingly, the market requires quality and a fast, flexible response to demand. The key to success in this environment is innovation, and innovation is something that SMEs are particularly good at.

This remark holds good even for technology: some observers have seen contemporary technological change as the dawn of a new form of industrial organization, with SMEs assuming a leading role in promoting innovation.[6] A number of the determinants of comparative advantage for manufacturing enterprises, such as phase of the industrial cycle, available capital, scale of research and development (R and D), age of plant and equipment and manufacturing and marketing requirements, have all recently been changing in favour of SMEs. SMEs have become increasingly dynamic, to the point where they are now efficiently competing with industry giants in selected products; furthermore, information technology enables small firms to form consortiums by means of which they can have as much impact as big firms.

The success of SMEs is pushing large companies to adopt one of two alternative strategies: either adopting a new and more flexible structure, with information technology enabling various departments to act as though they were small, or else outsourcing areas that are not core competencies in their business.

On balance, the main advantages of SMEs with regard to innovation are associated with human behaviour: entrepreneurial dynamism, internal flexibility and responsiveness to changing circumstances.

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[4] Kurt Hoffman, "Technological and Organizational Change in the Global Textile-Clothing Industry - Implications for Industrial Policy in Developing Countries", in *Proceedings of the Expert Group Meeting on Prospects For Industrialization Policies in Developing Countries Taking into Account the Impact of Developments in the Fields of New and High Technologies, Vienna, 4-7 April 1989* (Vienna, UNIDO, 1989).

[5] Thomas Andersson, "Policy Design, Implementation and Evaluation – Rationale, Efficiency and Systemic Concerns", in *Forum on Public Policies for SMEs in Europe, Lisbon, 13-14 April 2000* (OECD, 2000).

[6] Amr Armanazi, "The Role, Impact, Potential and Competitive Behaviour of Small Enterprises in Product and Process Innovation", in *Proceedings of the Expert Group Meeting on Creation of Indigenous Entrepreneurship and Opportunities for Small- and Medium-Scale Industrial Investment*, *Damascus, 11-13 April 1993* (ESCWA, 1994).

Many recent studies have shown that SMEs are able to apply the same concepts and ideas as large firms in developing practical, economic products for the market.[7]

SMEs, however, often lack the time, financial resources and necessary technical skills to support an R and D or other effort adequate to achieve innovation. Large firms, for their part, notoriously tend to be handicapped in terms of the dynamism and flexibility required for innovation, and they frequently have potential problems associated with risk aversion, inertia and bureaucracy. On the other hand, they command abundant material resources in the form of capital, facilities and technology.[8]

Recently, some large firms have been experimenting with types of entrepreneurial structures that are similar to those of SMEs in an attempt to enhance their overall innovativeness. In so doing, these firms are seeking to change and adapt to the new environment and be flexible, exploiting both economies of scale and economies of scope. In other words, they are trying to mimic the behavior of SMEs by becoming more innovative and competitive, particularly in new ventures and high-risk operations.

One of the major phenomena of the new era is a shift toward knowledge-based economies, in which the ability to innovate, both at the level of individual firms and at the national level, determines a nation's ability to generate wealth. Many observers believe that a third great wave of historic change, after the agricultural and industrial revolutions, is currently under way, symbolized by the personal computer. Economic inputs have been divided into hardware, wetware and software.[9] "Producing new hardware is when we produce a tangible product such as shoes, producing new wetware is when we teach sombody how to be a dentist, and producing new software is when we develop a new design for a computer chip or a new procedure for processing electronic orders. Education makes wetware, innovation makes software."[10]

It is not clear where this new wave is likely to carry us. One thing is evident, however, and that is that change is inevitable. "Our challenge is to understand this new wave so we can ride it and not fight it."[11] In this context, innovation will serve as our surfboard.

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[7] Ibid.

[8] Ibid.

[9] Andy Neely and Jasper Hii, *Innovation and Business Performance: A Literature Review commissioned by GO-East* (The Judge Institute of Management Studies, University of Cambridge, 1998), section 2.1.

[10] Ibid.

[11] Ibid.

II. ACHIEVING SMES AND INNOVATION

The analysis in this chapter correlates achieving enterprises with innovative enterprises. In the process, various concepts and definitions of innovation are introduced, followed by an analysis of the relationship between innovation and learning and the role of innovation as a contributor to national growth. The analysis points to the conclusion that innovative firms are capable of creating an enabling economic environment, and that they tend to foster the advent of an achieving society.

Initially, it is important to define what we mean by SMEs and what role they play in the economic activities of the countries of the ESCWA region.

A. SMEs DEFINED

There is no single definition of MEs. In most of the OECD countries, for example, work force size is regarded as the main criterion. However, what is termed a small manufacturing enterprise may have up to 50 employees in Belgium and Greece, up to 100 in the United States, up to 200 in Canada, Italy and Spain, and up to 500 in Denmark, France, Germany and Ireland. In nearly all these countries, enterprises with fewer than 10 or fewer than 20 employees are regarded either as very small enterprises or micro-enterprises, or are excluded from official statistics.[12]

Similarly, in the ESCWA countries and elsewhere in the world, the definitions of a micro-, small, medium and large enterprise vary widely. In Yemen, for example, a small enterprise is one employing fewer than four workers, a medium-sized enterprise is one that employs between two and nine workers, and a large enterprise is one that has more than 10 employees. In Jordan, a small enterprise is one with between four and 10 employees and a medium-sized enterprise is one with between 10 and 25. Micro-businesses are those with up to four employees.[13] For the purposes of this study, SMEs are firms with between five and 250 employees.

According to OECD sources, SMEs are of considerable importance in the world economy.[14] They account for 25 to 35 per cent or more of all exports of manufactured products. The contribution of their exports to gross domestic product (GDP) is in the vicinity of 4 to 6 per cent for the OECD countries, and approximately 12 per cent in the case of Asian economies. Furthermore, approximately 1 per cent of SMEs are truly global, with multinational or intercontinental activities, or capable of operating wherever they find suitable conditions. SMEs in this category represent 30,000 to 40,000 manufacturing enterprises in the OECD countries. In addition, an estimated 5 to 10 per cent of all manufacturing SMEs are internationalized; there are between 150,000 and 300,000 firms in this category in the OECD countries. A further 10 to 20 per cent of all manufacturing SMEs, or between 300,000 and 600,000 firms in the OECD countries, rely on suppliers and/or customers in other countries for between 10 per cent and 40 per cent of their business, and are active in up to three foreign countries.[15]

B. SMEs IN THE ESCWA REGION

In the ESCWA member States, the manufacturing sector includes a few large, predominantly State-owned enterprises, most of which are concentrated in the Gulf Co-operation Council (GDD) countries, Egypt and the Syrian Arab Republic. These firms operate mainly in the area of oil derivatives, petrochemicals, natural gas, and metals (notably aluminum and iron and steel). The rest of the manufacturing sector consists of small and medium enterprises, mostly privately owned; these firms account for a significant part of the economic activity of that sector. They engage in a variety of manufacturing activities, especially labour-

[12] ESCWA, *Small and Medium Enterprises: Strategies, Policies and Support Institutions* (New York, United Nations, 1999), p. 7.

[13] Ibid.

[14] OECD, Globalization and SMEs, pp. 7-8.

[15] OECD, *Globalization and SMEs*, pp. 7-8.

intensive light industries of the traditional kind, such as food processing, textiles and clothing, wood products and furniture, chemicals, non-metallic mineral products, metal products, construction materials and plastic products.[16]

Although it is known that SMEs play an important role in manufacturing activities in countries of the ESCWA region and that they account for a significant share of the manufacturing sector, relevant statistical data on firms in this category, by size and economic activity, are not available for most ESCWA countries. However, official statistical information on small enterprises was obtained for selected ESCWA countries, and this may shed some light on the importance of manufacturing SMEs in the region as a whole.

The latest available data indicate that in Jordan, enterprises employing between five and 49 persons accounted for more than 40 per cent of manufacturing sector employment in 1995 (see table 1). In Lebanon, enterprises employing fewer than 50 persons accounted for more than 75 per cent of manufacturing sector employment in 1994, while in Bahrain, the corresponding figure was over 45 per cent in 1992. In the Syrian Arab Republic, enterprises employing fewer than 10 persons accounted for more than 90 per cent of manufacturing jobs in the private sector in 1993, while in Egypt, enterprises employing more than nine but fewer than 50 persons accounted for approximately 11 per cent of all jobs in that category in 1992-1993 (see table 1). In terms of output, the available data show that in Lebanon, SMEs accounted for 67 per cent of all manufacturing output, in the Syrian Arab Republic, they accounted for 84 per cent of private sector manufacturing, and in Bahrain, for 21 per cent (see table 1).

TABLE 1. CONTRIBUTION OF SMALL ENTERPRISES TO THE MANUFACTURING SECTOR IN SELECTED ESCWA COUNTRIES – SELECTED YEARS

Country	Year	Size of enterprise (No. of employees)	Contribution to employment (%)	Contribution to output (%)	Contribution to value added (%)
Bahrain	1992	<50	48	21	—
Egypt	1992-93	10 - 49	11	—	9
Jordan	1995	5 - 49	41	—	—
Lebanon	1994	<50	78	67	68
Syrian Arab Republic	1993	<10	91	84	88

Source: ESCWA, *Small and Medium Enterprises: Strategies, Policies and Support Institutions*.

Despite the important role that manufacturing SMEs have played in the economies of most ESCWA countries, they have been able to succeed in the past because in most cases, except in Lebanon, they have operated in a sheltered (though non-enabling) environment. Apart from the Government of Lebanon, most governments in the region, particularly in the MDE, have adopted protectionist policies, applying various import restrictions, such as high tariffs and import quotas, extending on occasion to total bans. In the GCC countries, domestic manufacturing enterprises have enjoyed only a small measure of protection (very low tariffs have been levied on certain products), but Governments have subsidized them in various ways: land, electricity, and water have been made available to them at nominal prices, they have been able to obtain subsidized loans and credit on generous terms, and they have generally been exempt from corporate income tax, and other taxes as well, subject to minimum firm size requirements (over $1,000,000 in Saudi Arabia).[17]

While it is true that these enterprises have been able to grow and flourish thanks in part to their insulation from market forces and/or Government intervention in the operation of the market, the policies that have brought this about have created markets for their products, sheltered them from foreign competition, and on occasion resulted in monopolistic practices and inefficiency. The elimination of outside

[16] For more details, see ESCWA, SMEs: Strategies, Policies and Support Institutions, p. 7.

[17] ESCWA, *Review of Industry in ESCWA Countries* (New York, United Nations, 2000).

competition has created disincentives: firms have had no need to innovate to develop new products, improve the quality of existing products, improve their production processes or export to other markets.[18]

The globalization of economic activities and the WTO Agreement are having a significant impact on the development and growth of manufacturing SMEs in the world economy, and enterprises in the ESCWA countries can no longer survive in a sheltered domestic market, with government subsidies for their exports. It is noteworthy that one of the main features of achieving SMEs in other regions is that they have been major innovators. Manufacturing SMEs in the region need to adapt to the new economic realities of the changing international environment and the resultant dramatic effects on their domestic markets. In order to survive, SMEs must be able to take advantage of the liberalization of markets, advances in technology, particularly information technology, applications of new technology, and increased production factor mobilization. They need to be innovative in a new era in which a pattern of cross-border enterprise activities is evolving, driven by international investment and trade on the one hand and strategic alliances for product development, production, sourcing and marketing on the other.[19] In a word, SMEs must develop their innovative capacities.

C. ACHIEVING ENTERPRISES AND INNOVATION

An achieving enterprise is one that is capable of enhancing its business performance and growth by continuously increasing its competitiveness. Field studies have shown that high-performing companies are usually characterized by, *inter alia*, unique technology or products, in-house design capability, mechanisms for meeting customer demand and an ongoing effort to charge maximally competitive prices. This points to an important fact: a firm's ability to innovate directly affects its competitiveness and performance. Not that business performance is the result of innovation exclusively; rather, it is the outcome of a number of other factors, including innovation. But it does appear that in the absence of innovation, a firm is unlikely to attain positive results.

Other field surveys have analysed differences between innovating and non-innovating firms, and have found that the former were able to improve their business performance in terms of penetrating new markets, increasing their market share and earning greater profits. Among innovative firms, differences in competitiveness may be partly due to differences in innovational capability and rate of innovation. The level of a manufacturing firm's innovational capability thus influences its competitiveness in the market.

However, most of these studies have also found that SMEs face many obstacles in their efforts to become more innovative. These include financial constraints, lack of specialized personnel, absence of a systematic flow of up-to-date information on market developments (both technological and non-technological) and lack of the time and human resources needed for the formulation of work plans and innovation strategies.

D. SOME RELEVANT CONCEPTS

Before introducing the concept of innovation, we must first clarify the differences among a number of related concepts. Invention is not the same thing as innovation, innovation and adaptation must be distinguished from imitation, and innovation may be either radical or incremental.

1. *Definition of Innovation*

Innovation, as defined in most of the literature surveyed in the context of this study, is essentially the successful commercial exploitation of new ideas. There is no theory of innovation as such, and only a few related concepts have been reported, defining various models designed to explain the innovation process and

[18] ESCWA, *Industrial Strategies and Policies in the ESCWA Region Within the Context of a Changing International and Regional Environment* (New York, United Nations, 1996).

[19] OECD, *Globalization and SMEs*.

analyse the levels at which innovation is undertaken (individual firm, national or regional) or measured. This may be partly because the concept of change is not yet fully understood.

Innovation has been analysed for a very long time, and the literature on innovation is extensive and varied. While many definitions have been proposed, depending on the focus and interests of different investigators, most definitions have emphasized innovation as it relates to products and technological processes. Our concern in this study, in contrast, is a general definition that will take a broader perspective, addressing non-technological as well technological innovation.

The Penguin Dictionary of Economics provides a useful starting-point for consideration of a definition. According to it, innovation is "Putting new products and services on to the market or new means for producing them. Innovation is preceded by research that may lead to an invention which is then developed for the market."[20]

(a) *Innovation as a multi-dimensional phenomenon*

According to Neely and Hii (1998), innovation is a multi-dimensional phenomenon that is complex and context-related, its main characteristic, essentially, being change. In simple terms, it is a process that involves the exploitation of new ideas. It is thus to be distinguished from invention, as the latter does not necessarily lead on to innovation.[21] The concepts are often confused. Invention is "… an idea, a sketch or a model for a new or improved device, product, process or system", whereas innovation is achieved only when an invention or new idea is commercially exploited, occurring at the time of the first commercial transaction of the new product, process, system, or device.[22] "Innovation occurs when a new or changed product is introduced to the market, or when a new or changed process is used in commercial production. The innovation process is the combination of activities (such as design, research, market investigation, process development, organizational restructuring, employee development and so on) which are necessary to develop and support an innovative product or production process."[23]

(b) *Imitation, adaptation, innovation*

Many studies differentiate between imitation, adaptation, and innovation. Syed Ahmed and Atif Kubursi[24] have shown that in technology, differences among the three concepts depend on the degree of substitution in production factors. Imitation consists in simply importing the technology embedded in a given technique or machine, taking as given the production factor ratios involved in the technique or in the use of the machine. Adaptation consists in importing technology judiciously, selecting production factor ratios and altering techniques or machinery to suit the local context. Innovation, in contrast, is the ability of an enterprise to develop its own new techniques or machines. Syed and Kubursi developed an innovation possibility curve showing that it was feasible to reduce the cost of technology transfer by reducing production costs, and that success in achieving cost reduction depended on the degree of adjustment through factor substitution and innovation. They concluded that the benefits of adjustment were, in general, an increasing function of substitution and innovation.

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[20] Graham Bannock, R.E. Baxter and Evan Davis, *The Penguin Dictionary of Economics*, fifth edition (London, 1992), p. 215.

[21] Neely and Hii, *Innovation and Business Performance*.

[22] Ibid.

[23] Confederation of British Industry, *CBI's 1999 Innovation Trends Survey*.

[24] Syed Ahmad and Atif Kubursi, "Imitation, Adaptation and Innovation: a Note on Typology and Consequences", *Industry and Development*, No. 26 (UNIDO, Vienna, 1989).

(c) *Incremental and radical innovation*

Other investigators have differentiated between radical and incremental innovation, indicating how great a change the innovation introduces.[25] Incremental innovations involve relatively small improvements to existing products, processes or procedures whose technical characteristics have been enhanced or upgraded; an example is the introduction of upgraded bit chips in electronics.

TABLE 2. EXAMPLES OF THE TWO TYPES OF INNOVATION

	Incremental	Radical
Product	Upgrading chips	Launch of compact disc player
Process	Upgrading quality inspection system	Product prototyping on computers
Organization	Implementation of quality circles	Teleconference meeting

Incremental innovations have been summed up as a little better, a little faster or a little cheaper. Radical innovation, on the other hand, occurs when newly marketed products whose functionality, technical construction, performance characteristics, design and use of materials and components are new or substantially changed. Examples might be the launching of a new vaccine or the microprocessor, i.e. "breakthrough" innovations based on fundamentally different technologies or approaches.

(d) *OECD definition*

Many definitions of innovation have been proposed, depending on the focus and interests of different investigators. However, most of these definitions have emphasized innovation as it relates to products and technological processes, disregarding social and organizational innovation, which are, in part, the concern of this study.

The definition proposed by the OECD study is rather different: according to it, "Innovation consists of all those scientific, technical, commercial and financial steps necessary for the successful development and marketing of new or improved manufactured products, the commercial use of new or improved processes or equipment or the introduction of a new approach to a social service. R&D is only one of these steps."[26]

It briefly summarizes innovation as including (i) the renewal and enlargement of the range of products and services and the associated markets, as well as the adoption of new methods of production, supply and distribution; and (ii) the introduction of changes in management, work organization, and the working conditions and skills of the work force.

(e) *Product, process, organizational innovation*

Product innovation involves new or improved products or services that have proved to be commercially successful. It implies the renewal and extension of the range of products and services and the related markets. Process innovation relates to the exploitation or development of a management, manufacturing or distribution process, or a new method of service. It entails the introduction of new methods of management, production, supply and distribution. Organizational innovation refers to the successful exploitation of new ideas, leading to more efficient management and use of human resources. It is concerned with the introduction of changes to management, work organization, and the working conditions and skills of the labour force.[27]

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[25] Andy Neel and Jasper Hii, *The Innovation Capacity of Firms - Report Commissioned by the Government office for the East of England* (The Judge Institute of Management Studies, University of Cambridge, 1999).

[26] Neely and Hii, *Innovation Capacity*.

[27] Neely and Hii, *Innovation and Business Performance*.

(f) *Diffusion of innovation*

An important aspect of innovation, one that is emphasized by most of the definitions found in our literature survey, is diffusion, which relates to the way innovation spreads in the market. It is clearly of great importance, since without it, innovation cannot have an economic impact and will not benefit the economy at large. Diffusion has an immediate impact on the operation of an economy by helping spread new products and services and new techniques to a wider environment, improving productivity and standards of living in the whole economy.[28]

An important aspect of the diffusion process is rate of diffusion, which is the number of adopters of any given innovation per unit of time. Rate of diffusion varies directly with the benefits innovation provides to users, and inversely with the costs it entails.[29] Thus, the larger the benefits and the lower the cost of an innovation, the greater the rate of diffusion, and conversely, the smaller the benefits and the greater the cost, the lower the rate.

(g) *Incidence of innovation*

A common misconception is that innovation occurs only in high-technology environments. In fact, innovation can occur in any type of industrial context, whether traditional or high-tech. However, since technology is increasingly becoming part of the product manufacturing and distribution process, product-related innovation may involve technological innovation and vice versa.

(h) *Regional innovation*

Recent research has attributed greater importance to the spatial aspects of innovation, particularly at the regional level. In this connection, regional innovation has been particularly emphasized, relating as it does to the firm's surrounding environment, which affects its innovative capacity and performance. Concepts such as "the innovative milieu" have recently come into common use, with reference to the type of high-performing regional or area nexus in which innovative activities take place. Many such regions have become widely known internationally, such as Silicon Valley and Route 128 in the United States, which promote collective learning and expand firms' innovative capacity. Here, innovation is a collective learning process, a product of networking and exchange among different agents.

(i) *European project – a holistic definition*

One notable definition that is worth stating here emerged from a report on European projects.[30] It was developed from firms' own views on innovation in SMEs as obtained through surveys (conducted in accordance with a grassroots or bottom-up approach) in a number of European countries (Austria, Germany, and the United Kingdom). As will be seen from the diagram below, the result is a holistic definition covering the process from invention to exploitation. It is learning-related at several different levels, and it is directly linked to enterprise performance and readiness to innovate. The general conclusion drawn from these surveys was that innovation consisted not only of invention and the exploitation of new products, but also of the application of new ideas and concepts; essential ingredients for successful innovation were the ability to learn and readiness to change.

According to the report on these European projects, innovation is the result of an interactive learning process based on learning systems, learning regions as learning economies, and learning enterprises as learning organizations.

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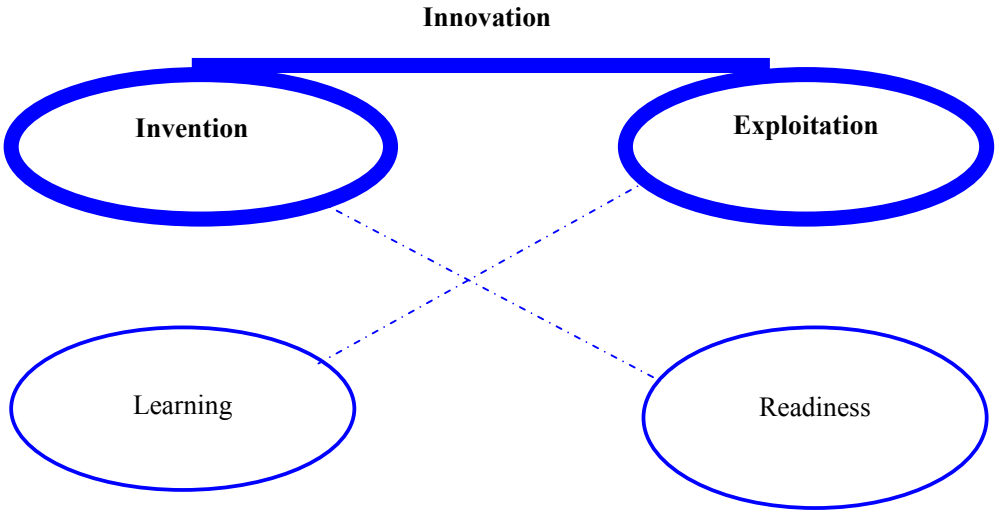
[28] Everett M. Rogers, *Diffusion of Innovations*, fourth edition (New York, The Free Press, 1995).

[29] Ibid.

[30] John Gordon, Ulrike Lederhass, Jürgen Schultze, Peter Schmitt-Egner and Rallph Schemmann, *Innovation in SMEs: Concepts, Experiences and Recommendations - Results from European Projects*, ADAPT Transnational Report (draft), n.p., n.d.

A *learning system* (or knowledge management system) is a complex of elements which are connected to each other within a common border. They possess flexible structures and the ability to adapt effectively to external change and to improve their learning and problem-solving capabilities continuously.

Learning regions (areas) as learning economies are characterized by the ability of a regional actor to use regional networks to attain enhanced action capabilities within the region and to utilize them as a learning system and a learning economy. "Region" in this sense could denote a country or an area or areas within a country.



Source: John Gordon, Ulrike Lederhass, Jürgen Schultze, Peter Schmitt-Egner and Ralph Schemmann, *Innovation in SMEs: Concepts, Experiences and Recommendations - Results from European Projects*, ADAPT Transnational Report (draft).

Learning enterprises as learning organizations are enterprises that are ready and able to organize their production, administration and distribution in a process of interactive learning or a learning system. According to this view, the long-term ability to remain competitive and create wealth and employment as inseparable goals can be achieved only by companies as learning organizations.

E. INNOVATION AND LEARNING

It is clear from the definition outlined above that learning is an important attribute of the innovation process, whether at the knowledge management level (learning systems), the economy level (learning regions) or the enterprise level (learning organizations).

Learning and innovation are interconnected; the latter may be regarded as the introduction into the economy of new knowledge or new combinations of old knowledge. Put in very simple terms, innovations are "learning results". Learning leads to new knowledge, and entrepreneurs of various kinds use that knowledge to formulate innovative ideas and projects.

There is growing evidence to suggest that a learning-region approach to economic development provides a dynamic basis for innovation and creativity, which are the hallmark of economic sustainability in the post-industrial economy.[31]

There are two types of learning: direct learning (a deliberately organized process, such as the learning that occurs in universities and research institutions), and indirect learning (an unintended by-product of normal economic activities such as procurement, production and marketing). Heavy investment in direct

[31] Birgitte Gregersen and Bjorn Johnson, "Learning Economies, Innovation Systems and European Integration," *Regional Studies*, 31, 5 (Cambridge, Carfax, 1997).

learning and the development of new ways of utilizing indirect learning are characteristics of the learning economy.

There is one characteristic that is common to all learning processes, namely that interactive learning is the dominant source of innovation. Innovation requires not only scientific and technological knowledge, but also organizational and managerial skills and capabilities.

1. *Learning Organizations (LOs)*

Learning is at the heart of a company's ability to adapt to a rapidly changing environment. It is the key to the ability to identify, in a timely manner, opportunities that others may not see, and to exploit those opportunities, rapidly and in full, ahead of competitors. It involves the transformation of data into knowledge and into economic value.[32]

It follows that survival in a dynamic environments entails the capacity to learn. "To remain viable in an environment characterized by uncertainty and change, organizations and individual alike depend upon an ability to learn."[33]

Peter Senge's vision of a learning organization is that it is one where people continually expand their capacity to create the results they want, where new and unrestrained patterns of thinking are nurtured, where collective ambition is set free, and where people are continually learning how to learn together.[34]

The concept of the learning organization is becoming increasingly relevant, given the increasing complexity and uncertainty of the organizational environment. Senge (1990) remarks that the pace at which organizations learn may in the future become the only source of a sustainable competitive advantage. According to him, the building of a learning organization requires five core disciplines:

(a) *Personal mastery* applies to individual learning. Organizations cannot learn until their members begin to learn. Personal mastery is the discipline of continually clarifying and deepening the individual's personal vision, focusing his or her energies, developing patience and seeing reality objectively.

(b) *Mental models*: a mental model is a framework for the cognitive processes of one's mind. In other words, it determines how one thinks and acts. Investigators have found that people can be taught to see the flaws in their mental models through "actionable knowledge" or "system archetypes". Mental models are deeply ingrained assumptions, generalizations or even pictures or images that influence how one understands the world and takes action. The discipline of working with mental models begin by turning the mirror inward, learning to unearth one's internal pictures of the world, bring them to the surface and hold them up to rigorous scrutiny.

(c) *Team learning* is the process of aligning and developing a team's ability to achieve the results its members desire. It builds on the discipline of developing shared vision. It also builds on personal mastery, for talented teams are made up of talented individuals. Team learning is vital because teams, not individuals, are the fundamental learning units in modern organizations. "Unless teams can learn, the organization cannot learn."[35]

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[32] J.G. March and J.P. Olsen, "The Uncertainty of the Past: Organizational Learning under Ambiguity," *European Journal of Political Research*, 3 (1975), 147-171; R.B. Shaw and D.N.T. Perkins, "Teaching organizations to learn: the power of productive failures," in *Organizational Architecture: Designs for Changing* Organizations (San Francisco, Jossey-Bass,1992).

[33] Amy Edmondson and Bertrand Moingeon, "From Organizational Learning to the Learning Organization," *Management* Learning 29, 1 (1998), 5-20.

[34] Peter M. Senge, *The Fifth Discipline - The Art and Practice of the Learning Organization* (New York, Currency Doubleday, 1990).

[35] Senge, *The Fifth Discipline*, p. 10.

(d) *Shared vision*: a shared vision begins with an individual vision, and an individual vision is something that one person holds as a truth. The shared vision of an organization must be made up of the individual visions of its members. What this means for the leader of the learning organization is that the organizational vision cannot be created by the leader; rather, that vision must be created through interaction with the individuals in the organization.

(e) *Systems thinking*: If the sources of modern problems are to be identified and solutions to them developed, linear and mechanistic thinking must give way to non-linear, organic thinking, more commonly referred to as "systems thinking", a way of thinking where the primacy of the whole is acknowledged. The defining characteristic of a system is that it cannot be understood as a function of its components considered in isolation. Systems thinking is a conceptual framework, a body of knowledge and tools that has been developed over the past fifty years to make large-scale patterns more clearly visible and to help people see how they can change things effectively and find the leverage points in a system with the least amount of effort.

According to Senge these skills can be developed only through a lifelong commitment. Moreover, it is not enough for one or two individuals to develop them; they must be widely distributed throughout the organization.

2. *Attracting the work force*

Today and in the future, the organizations that will truly excel will be the ones that discover how to tap people's commitment and capacity to learn at all levels in the organization.

Organizations have come increasingly to recognize that their human resources are at the heart of their competitive advantage. While most organizations have access to virtually the same information and technology, it is the people within those organizations and their interaction that make the real difference. The success of any organization, then, depends to a large extent upon its employees, the skills they possess, and how they are organized to operate. To build a culture of learning, however, organizations must initiate and nurture the learning process, provide the conditions needed for systematic people development, and provide guidelines designed to foster insight, motivation, real-world practice and accountability. Only an organization with a commitment to learning can attract and retain the talent it needs in order to thrive in a rapidly changing world.

3. *The kind of leadership needed to build learning organizations*

Senge argues that in an increasingly dynamic, interdependent, and unpredictable world, it is simply no longer possible for anyone to "figure it all out at the top". Traditional managers have always thought that they have to have all the answers for their organization. However, the managers of a learning organization know that it is their staff members who have the answers. The job of a manager in a learning organization is to be the teacher or coach who helps unleash the creative energy latent in each individual. Managing learning in organizations requires appropriate leadership that can be effective for eliminating barriers and constraints within organizations and breaking through the self-reinforcing loops of individual and organizational defenses.[36]

4. *Adaptive Learning Design*

The learning organization is a living, organic process, not a goal to be achieved once and for all. The learning organization is one that is fluid enough to change itself overnight in order to create and maintain a pathway to the organization's vision. This is accomplished largely through the channelling and development of knowledge among the organization's people. Within this context, the learning organization may be

[36] *Karen Ayas, Wil Foppen and Floris Maljers,* Exploring Organizational Learning: Observations on Resistance and Leadership*, n.p., n.d.*

described as a community which seeks continuously to develop and mine the knowledge of its individuals in such a way that those individuals work together to conceive, design, and bring forth the community's shared, desired future. Organizations, public and private, need to be more creative and to benefit strategically from enhancing their abilities to learn. These are organizations whose members recognize that knowledge, the knowledge possessed by their individuals and teams, is their most precious asset.

5. *Change in the learning organization*

In his last book, Senge writes that initiating and sustaining change is a difficult matter, and that the task of making change happen requires business people to begin by changing the way they think about organizations. In the past, successful efforts to bring about change have been rare, and not because of any lack of resources or intelligence. Indeed, past experience shows that many highly competent executives have failed to generate and sustain momentum for change. This suggests that something more universal may be at work here.

Deep change comes only through real personal growth—through learning and unlearning. Most of the people in an organization cannot make deep changes, because they are operating out of compliance, rather than out of commitment. Commitment comes about only when people determine that they are being asked to do something that they really care about. For that reason, the creation of compliance-oriented change will preclude the deeper processes that lead to commitment and prevent the emergence of self-generated change.

Every change process that has been sustained and spread started small. A change effort has to have some relevance to people. It has to matter. Usually, after an initial success, things tend to get harder, not easier. So, if we want to have effective leadership, if we want to have humane communities that can sustain significant change, we need to learn how to focus on these types of challenges.

F. INNOVATION AND GROWTH

Before proceeding to an analysis of innovation as a contributor to growth, it is important to present some clarification on the issue of measuring innovation. As is widely known, innovation is hard to measure, and as yet there is no simple and uncontroversial method of measuring it. The most common methods are marked by conceptual difficulties; in particular, innovation still tends to be perceived from a research and development standpoint.[37] Innovation is context-specific; different innovations attest to different levels of innovative intensity, and consequently it is difficult to compare data on innovation, as in the design of a stapler and that of a microprocessor, for example. However, best practice companies try to measure innovation performance by establishing performance objectives and indicators relating them to the several aspects of the innovation process.

Frameworks for the assessment of a firm's innovativeness have recently been introduced. These feature practical self-assessment methods, allowing enterprises to track innovation performance, identify the process that drives innovation and audit their innovative capacity. Performance assessment is a useful aid to achieving effective management of the innovation process, and since there is no single best way of assessing innovation performance, the latest thinking is that firms should rely on practical frameworks involving a wide range of measures.

One widely used technique for gathering information on innovation activities is the innovation survey, which has become a standard method in industry. Firms are surveyed on the inputs, outputs, and details of their innovative activities. Recently, greater emphasis has been placed on networking as the key element in enhancing a firm's innovative capacity, with innovation metrics focusing on knowledge flow measurement in terms of flow of technical personnel, links between institutions, industrial cluster formation and sources of firms' innovational behavior. In this process, surveys look for the sources of firms' knowledge and their expenditure on innovation, output, and sales of new or previously developed products.

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[37] Gordon *et al*., *Innovation in SMEs*, p. 36.

1. *Innovation as a contributor to national growth*

Most of the literature we surveyed on the subject of the contribution of innovation to national growth argued that achieving innovation was in part responsible for economic growth.[38] Growth is conceived here as national growth, and the contribution of innovation to development is evaluated in terms of its contribution to national income and employment. Scientific evidence either for or against a causal relationship between innovation and economic growth is limited and uncertain, but there is a wealth of anecdotal evidence, and the results of some field research suggests such a relationship.[39] In Italy, in particular, research has identified patterns of regional growth and innovation.[40] Small firms were found to have assumed a leading role in innovation during the 1970s; they were considered the most dynamic kind of industrial organizations, and the most successful in terms of performance and employment growth. Regions, such as the northeastern and central regions ("the third Italy"), which were characterized by a high incidence of small and medium manufacturing enterprises, attained remarkable levels of economic growth that were above the national average.[41] This was in contrast with the poor performance of the northwest region, where large traditional industries were strongly present.[42]

The relatively better performance of Italy's northeastern and central regions has been attributed in part to the high levels of innovation achieved by small enterprises. During the 1990s, changes in those regions' performance were observable, and these changes have been correlated with differences in their innovation profiles. Four main clusters emerged. One of these was designated the "Innovative traditional firms area". Most of the firms are medium-sized. This cluster was found to have higher productivity levels and innovation rates than the other clusters (areas), despite the fact that its proportion of high-technology firms is below the national average. Innovations in this cluster tend to be less technologically oriented and to take the form of product innovation, arising mainly from upgrading in the traditional sector, whose competitive advantage is based on market niches.

The results of several other field studies have tended to support the above analysis, confirming the association between innovation in SMEs and economic development or growth performance.[43] Most of these studies have found no straightforward cause-and-effect relationship between innovation and a firm's growth performance, but the fact remains that the most innovative firms also tend to be among the best-performing ones and the ones most likely to contribute to economic growth and the creation of employment opportunities in the regions where they are located.

One such study looked at the innovation process and SMEs in rural regions in England.[44] It found that during the period 1991-1995, the output of "strongly innovative" firms grew twice as fast as that of "moderately innovative" firms and four times that of "slightly innovative" firms. Similarly, the findings of the same study show that during the same period, employment with the strongly innovative firms displayed a median increase of eight jobs, compared to four jobs for the moderately innovative firms and none for firms with low levels of innovativeness. The study concluded that the manufacturing SMEs that were most likely to create jobs were those that were the most active in terms of innovation. Conversely, the fastest-growing manufacturing firms also tended to be those that were the most innovative in various aspects of their business.

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[38] Christos Kalantaridis and John Pheby, "Innovation and Competitiveness and Employment: the Experience of Manufacturing SMEs in Bedfordshire, UK", in *Competitiveness – Creating the Enterprise* (Centre of Europe, n.d.); Neely and Hii, *Innovation and Business Performance*; Gordon *et al*., *Innovation in SMEs*.

[39] Ibid.

[40] Neely and Hii, *Innovation and Business Performance*.

[41] Ibid.

[42] Ibid.

[43] David North and Davis Smallbone, "Innovative Activity in SMEs and Rural Econocmic Development: Some Evidence from England," *European Planning Studies*, 8, 1 (Abingdon, Carfax, 2000).

[44] Ibid.

Among the economic benefits of innovative activity on the part of SMEs is the fact that firms with highly innovative products are the ones most likely to engage in new market development, particularly as regards entering new non-local and export markets. The findings of the studies referred to above indicate that SMEs which were able to produce innovations—innovations that were new within a sector context as well as being new from the standpoint of the firm—were likely to generate substantial external revenue.[45] Indeed, innovative SMEs are more competitive, and the growth of innovative firms makes the local economy more competitive, generating external revenue from sales outside the region, creating jobs and helping to upgrade the skills level of the population.

2. *From achieving SMEs to an achieving environment/society - a reversed paradigm*

In principle, innovative firms are characterized by such good performance that they are capable eventually of creating an enabling economic environment and stimulating the recovery of a depressed economy. According to McClelland, the good performance of such firms may lead to a virtuous circle, with good performance feeding back to increased innovative capacity, leading, in turn, to more innovations and thus to increased competitiveness and therefore improved performance and so on.[46] The presence in an economy of a number of innovative, strongly performing firms will act as a seed for the creation of a virtuous circle at the macroeconomic level, each cycle expanding the performance capability of those firms and attracting new ones into the market.

As the numbers of strongly performing, innovative firms increase, a strongly performing economy is ultimately created, paving the way for the advent of an enabling environment for innovation and good performance. This explains how manufacturing SMEs in many developing countries have been able to survive and flourish in the absence of support from their governments. Innovative firms are thus capable of initiating a process of economic expansion and recovery, even without governmental support.

(a) *Entrepreneurship as an economic force*

Owing to the very nature of the entrepreneurial spirit, the level of entrepreneurship in an economy is an important factor affecting the rate at which that economy grows or recovers. It follows that in an economy, especially a depressed economy, the presence of indigenous industrial entrepreneurs, who are capable of taking the lead and stimulating a change in the environment, will help the economy to pull up, thanks to their desire to achieve not only profit but also success and triumph.

Many modern economists believe that the ultimate forces behind economic growth and development lie largely outside the economic system itself. This view has arisen in response to such questions as why important technical inventions should appear more frequently at one period in history than another, and why they should spread faster to one country than to another. Those who hold this view have concluded that the initial impetus to economic growth is not necessarily rational, as otherwise many historical phenomena would be difficult to explain in rational economic terms.

Attempts have been made to verify this proposition by showing that some of the forces which produce rapid economic development are rooted mainly in man's "fundamental motives and in the way he organizes his relationships to his fellow man."[47] McClelland (1961) notes Toynbee's thesis that it is a challenge arising in the environment, a "stimulus", that is responsible for the genesis of civilizations, and expands this concept by arguing that man's enlightened self-interest, in conjunction with an event in which pressure on the economic system is converted into activities as a result of self-interest, will result in greater productivity or wealth. The self-interest and the event alter the previously existing economic equilibrium in which some individuals were at an advantage while others were at a disadvantage, and this explains the resulting increase in productivity and economic activity. To understand what events could disturb the economic equilibrium,

[45] OECD, *Globalization and SMEs*.

[46] David C. McClelland, *The Achieving Society* (New York, The Free Press, 1961), p. 3.

[47] McClelland, *The Achieving Society*, p. 3.

this economist focuses on the four main forces that affect economic growth, namely capital accumulation, population growth, division of labour and entrepreneurship.

(b) *The strength to triumph*

Entrepreneurship is a key factor in economic development and growth. According to Joseph Schumpeter, the economy did not grow "naturally" but rather proceeded by a series of leaps, impelled by the activities of key men who wanted to promote new goods and new methods of production or to exploit a new source of materials or a new market.[48] To Schumpeter, the entrepreneur was not a man who was totally rational and profit-oriented, taking investment decisions on an entirely rational basis. The motivation of those key men was also the pleasure of creating the strength to triumph in competitive battles. In Schumpeter's view, then, the motivation to achieve was an important factor affecting economic development and the rate of economic growth.

(c) *Stimulating growth in a context of declining market demand*

The above analysis raises the important issue of whether investments are made only under conditions of expanding market demand. For example, what could make a producer of (say) infants' clothing build a new factory despite a declining market? The answer might be that he expects to produce infants' clothing of better quality, or that he will be able to charge lower prices because he has devised new and cheaper ways of producing infants' clothing, or that he intends to introduce infants' clothing of innovative design which he thinks will attract demand from other brands on the market.

The matter is not really quite so simple as that, but our concern here is to demonstrate that there may be key economic actors who do not appear to be exclusively rational in their business behaviour and who have the power to stimulate growth in a situation of declining market demand. Such an initial impetus, in conjunction with a spirit of innovation and a willingness to take risks, may stimulate economic expansion; the producer will build his factory despite the general decline in demand for infants' clothing, thereby increasing the overall level of sales and employment in his line and other lines as well, and the economy will begin to expand again.

(d) *Zeal for achievement*

It has been argued that the aspiration for profit has, in itself, done little to generate economic development in societies, but that the main contributing factor in such development is rather the zeal for achievement.[49] To achieve his desires, the entrepreneur has to innovate, and innovation generates economic growth.

[48] Joseph A. Schumpeter, *The Theory of Economic Development* (London, Transaction Publishers, 1983).

[49] McClelland, *The Achieving Society*.

III. MANAGEMENT INNOVATIONS IN SMES THROUGH INFORMATION TECHNOLOGY[50]

This chapter addresses issues related to the re-engineering of SMEs through information technology. It shows that in industrialized countries, knowledge networking and knowledge management are increasingly becoming the building blocks of successful business process re-engineering. The analysis in this chapter reviews the different types of information technologies that can be adopted in support of business process re-engineering and knowledge management. It concludes by indicating that special considerations have to be given to local conditions and the local work environment, particularly in developing countries, in order to select and adopt the best-suited and most cost-effective models among the various alternatives provided by information technologies.

A. INTRODUCTION

Small and medium-sized enterprises (SMEs) continue to play a vital role in economic development through the stimulation of competition, the development of new technologies and products and the creation of jobs (Oberski *et al*. 1999). According to the traditional view, large-scale production brings efficiency at the price of a certain rigidity, while smaller enterprises enjoy flexibility at the price of instability. However, technological and economic developments are opening up the possibility of a new type of structure, one that enables a firm to combine the advantages of both large-scale and small-scale operation. In this new organizational model, it is not the size of a company that matters so much as the quality of the business relationships between companies. The key production factor in this new model is no longer the individual company, but the binding links in a decentralized network of companies (Choueke and Armstrong 1999). In some cases, the network consists of vertical links tying small suppliers to large final assemblers. In other cases, the links are horizontal, binding together a number of more or less equally small companies. Regardless of whether their configuration is vertical or horizontal, these networks make continual innovation possible through a delicate balance of competition and co-operation, demands and support.

To succeed in the emerging global economy, managers of small and large businesses alike need to redefine how they interact with their customers, suppliers and competitors. To that end, organizational strategies and interaction with other stakeholders must be continuously reviewed and repositioned with a view to the enhancement of corporate functioning and the speedy flow of information and decision-making. In that connection, information technology (IT) offers a wide variety of supports and alternatives which are of crucial importance to dynamic firm management. In particular, the following management strategies are noteworthy:

(a) *Cost leadership strategy*. Becoming a low-cost producer of goods and services within an industry;

(b) *Differentiation strategy*. Developing ways of differentiating a firm's products and services from those of its competitors, or reducing the differentiation-related advantages of competitors. A differentiation strategy may require a firm to focus its products or services so as to gain an advantage in particular segments or niches of a market;

(c) *Innovation strategy*. Finding new ways of doing business. This may involve the development of unique products and services, or entry into specialized differentiated markets or market niches. It may also involve making radical changes to one or more of the firm's business processes, i.e. producing or distributing products and services in a new say, sometimes to the point of introducing fundamental structural alterations;

(d) *Growth strategies*. Significantly expanding a company's capacity to produce goods and services, expanding *into global markets*, *diversifying* into new products and services, or integrating into related products and services.

[50] This Chapter was prepared for ESCWA by Prof. Ali Reza Montazemi, Ph.D., Indiana University, Ameritech Fellow of Information Technology, School of Business and Economics.

(e) *Alliance strategies*. Establishing new business linkages and alliances with customers, suppliers, competitors, consultants and other companies. These linkages may include mergers, acquisitions, joint ventures, the formation of "virtual companies", or other marketing, manufacturing or distribution agreements between a business and its trading partners.

Firms may resort to any of the above alternatives or to a combination of them to enhance management strategies aimed at furthering competitiveness and growth.

One way in which information technology can be of strategic value is by contributing to major improvements in a company's business processes and management strategies. Investment in IT can help make a firm's operational processes substantially more efficient, and its managerial strategies and processes much more effective. Re-engineering and other improvements to business processes enable a company to cut its costs, improve its quality and customer service, and develop innovative products for new markets. Many manufacturing and distribution processes have been automated and significantly improved thanks to computer-aided design, engineering, production, enterprise resource management and Internet technologies.

B. RE-ENGINEERING SMES THROUGH INFORMATION TECHNOLOGY (IT)

As telecommunications break down barriers of time and place, distinctions between large and small companies are also breaking down. In many cases small, agile firms may compete effectively with industry giants, because information technology can make a consortium of small firms look, feel and act big, reaching for customers who were once beyond their grasp. Radical, rapid changes in IT are provoking large companies to adopt one of two alternative strategies: either using information technology themselves to respond rapidly to ever more demanding customers, or outsourcing areas which are not core competencies of their business.

The cost of information technology applications is now so low that it is easy for small companies to acquire sophisticated systems that perform as well as or even better than the larger systems used by their bigger competitors. In the information age, firms large and small need to redesign their managerial, organizational, operational and production-related processes, using information technology to achieve optimal resource management (Montazemi 1987, 1988). The following are some noteworthy examples:

1. Speed, but not at the expense of control. New products must be introduced ever more quickly. Time for order filling cycles must be cut dramatically; managers are exhorted to create organizations that can turn on a dime. However, taking time to reach the right decision has its advantages; where there is no margin for error, managers have to acquire the tools and skills that will enable them to make correct decisions. Skill and expertise—especially in dealing with unforeseen circumstances—are critical. The faster the pace, the greater the need to monitor business operations and clearly define and enforce the "rules of the road."

2. Empowerment is not anarchy. In large firms, managers may describe the term empowerment in terms of vague efforts to "push decision making down the line," or equate empowerment with "getting rid of (or bypassing) middle management." Most managers may fail to recognize that decision-making authority is tightly linked to a more complex set of organizational design features, including structure (e.g. how people are grouped into units and how those units co-ordinate their activities to develop and deliver products and services to customers) and incentives (e.g. performance evaluation methods, compensation, etc.). Many managers learn the hard way that isolated efforts to "empower" a particular employee or employee group can lead to disaster unless they are accompanied by a more comprehensive redefinition of authority and control throughout the organizational structure. Senior management must be more closely involved, not less, and organizational boundaries and value systems must be more clearly communicated, closely monitored, and consistently enforced.

3. Transforming an organization requires more than changing its structure. It is not enough simply to remove layers or redraw boxes on an organization chart. The resulting organizational confusion can help to shake up an entrenched organization and create the conditions for change early in the change process. But true change occurs deep within the organization as individuals and work teams redefine the way they work and the values that guide their decision-making and action.

These and other lessons from the field suggest that the task of building and sustaining an information-age organization requires managers to adopt a comprehensive approach to organizational change, one that addresses the need to rethink the nature of control and authority. Information technology should be adopted with a view to transforming business processes through new business models, increased collaboration and value-added services.

Another noteworthy trend that is being followed by both small and large firms is "*intellectual capital*" management, which has become a central theme in today's business literature and a commonly *cited "source of competitive advantage*" (*Harvard Management Update* 1999). A report released at the World Economic Forum in Davos, Switzerland showed that 97 per cent of the global CEOs surveyed stated that knowledge management was "absolutely critical to the success of their companies" (Yu 1999).

Knowledge management may be defined as a formal directed process of identifying knowledge possessed by individuals within a company which could *benefit others in the company*, then devising ways of making it easily available (*Harvard Management Update* 1999). There are two types of organizational knowledge: *product-specific knowledge* (explicit knowledge) and *skill-specific knowledge* (tacit knowledge) (See Nonaka and Takeuchi (1995) for a fuller discussion). Product-specific knowledge is well known and can be documented in many forms (e.g. user manuals). Skill-specific knowledge, on the other hand, is acquired by knowledge workers through experience. It is one thing, for example, to make available the best current thinking on reorganizing a client's purchasing process and the main benefits that are likely to result. It is another thing entirely to describe clearly when and how to bring up hard issues with managers, how to price a new product, and what benefits or arguments are likely to be relevant to a particular case. The former type of knowledge may be defined as *explicit knowledge* that can be readily communicated; the core concepts and ideas can be written down and then transmitted in discrete segments from one person to another. The latter type, which may be summed up in the term *tacit knowledge*, is transmitted—holistically, as a practice—in a very different way, usually through trial and error, apprenticeship and skilled coaching. The management of tacit knowledge thus requires a distinctive approach.

At present, most IT applications in support of knowledge management are designed for the explicit type of organizational knowledge. However, an increasingly valuable form of organizational knowledge is tacit knowledge, which can be supported and managed by means of "*group decision support systems*" (GDSSs) and "*knowledge-based systems*" (KBSs). In today's competitive environment, organizations increasingly need leverage on the know-how of their knowledge workers in order to prosper. This requires the establishment of an efficient knowledge network to enhance the transfer of knowledge and technological change throughout the organization, as discussed in the next two sections.

C. KNOWLEDGE NETWORK

Large enterprises have to rely on collaborative relationships among their knowledge workers to access, survey and exploit emerging technological opportunities (Powell 1998). Network-like relationships, within and between firms, are becoming increasingly common. In the automotive industries, for example, stand-alone suppliers of parts and components are frequently linked into a system of industrial partnerships (Lodge and Walton 1989). In many industries, bilateral co-operation and license agreements used for the acquisition of external technology are assuming ever-growing importance.

Traditional knowledge-management techniques cannot meet the increasing demands being placed on knowledge sharing in support of change in organizational processes, such as innovation and competition. In order to survive, SMEs need to develop knowledge networks that capture and store pertinent knowledge, innovations and new ideas. They also need to be able to distribute the stored knowledge to decision- makers on demand (Hogberg 1998). In this context, the term "*knowledge networking*" is used to signify the creation of links connecting a number of decision-makers, resources and relationships, in order to accumulate and use knowledge, primarily by means of knowledge creation and transfer processes, for creating value (Choueke and Armstrong 1998).

As shown in Figure I, a knowledge network makes it possible for valuable knowledge within the organization to be exchanged and advanced at the personal and group levels (knowledge work processes)

(Seufert *et al*. 1999). The structure and culture of the organization (facilitating conditions) constitute an enabling or inhibiting environment for the creation and transfer of knowledge. Knowledge activities—as well as information and communication tools—are the tool-set (knowledge network architecture) supporting social relationships (von Krogh *et al*. 1997).

A possible framework for a "knowledge network" would include the following components:

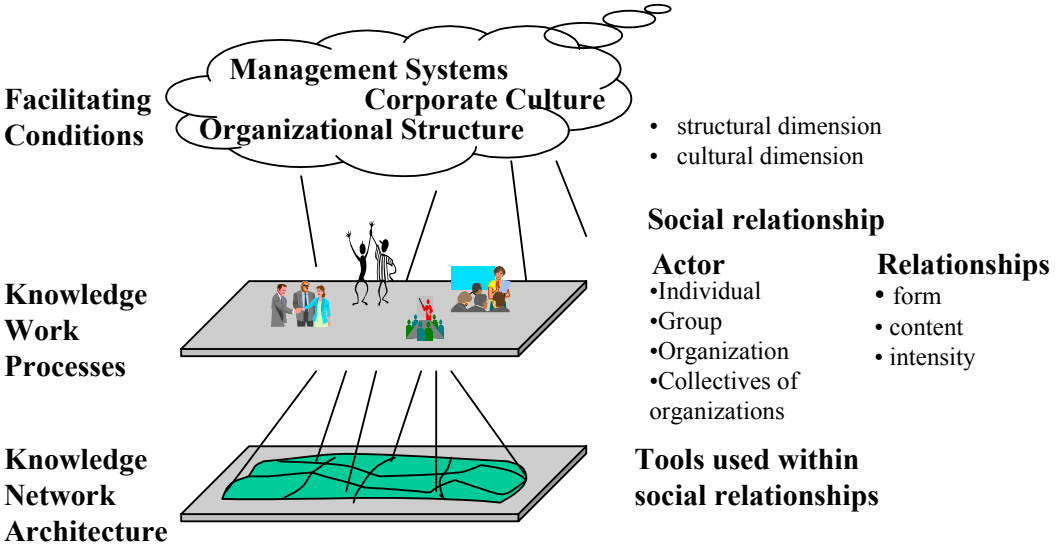
(a) Actors: individuals, groups, organizations;

(b) Relationships: relationships between actors, which can be categorized by form, content, intensity and the nature of the resources used by actors within their relationships;

(c) Institutional properties: including structural and cultural dimensions such as control mechanisms, standard operating procedures, norms, rules, communication patterns, etc.

Knowledge networking—even among competing firms—may yield great benefits. The openness and richness of networks will tend to foster a fertile environment for the creation of entirely new knowledge, while also accelerating the innovation rate. The task of managing a knowledge network is not a matter of controlling and directing flows of knowledge, it is a matter of creating accessibility (Augier *et al*. 1999).

Figure 1. Framework of a knowledge network – a micro perspective



D. KNOWLEDGE MANAGEMENT

Successful organizations must support creative individuals and/or provide context for them to create knowledge (Nonaka and Takeuchi 1995). Organizational knowledge creation, therefore, should be understood as a process that *"organizationally" amplifies the knowledge created by individuals* and crystallizes it as part of the knowledge network of the organization. This process takes place within an expanding "community of interaction" which crosses intra- and inter-organizational levels and boundaries. The genesis of ideas and the authentication of knowledge are part of a continuous process that ultimately brings knowledge to bear on decision-making—when the organizational environment is functioning optimally.

In real life, the process may fail to bring knowledge to bear, even when the required knowledge is somewhere in the organization. What matters, then, is the knowledge actually used at the decision-making point, not knowledge that is in the process of development or authentication, nor even knowledge that is

clearly apparent to particular individuals in the organization (Montazemi *et. al*. 1996). Knowledge derives from information as information derives from data. If *information is to become knowledge*, decision-makers must perform the following transformation (Davenport and Prusak 2000):

(a) Comparison: how does information about this situation compare to other situations we have known?

(b) Consequences: what implications does the information have for decisions and actions?

(c) Connections: how does this bit of knowledge relate to others?

(d) Conversation: what do other people think about this information?

There are four problems associated with relying on individuals as a knowledge repository for an organization, namely: (i) Knowledge embedded in individuals decays (Weldon and Bellinger 1997); (ii) individuals may not be motivated to share their knowledge (Engestrom *et al*. 1990; Stasser and Titus 1985); (iii) individuals may leave the organization and take their knowledge with them; and (iv) it is difficult for knowledge workers to reach a large number of people without some degradation in the communication.

The cost of coping with these problems becomes particularly significant for organizations that produce knowledge-intensive products (e.g. medical services, consulting firms or research and development units). In response to these concerns, *knowledge management* has become a central theme in today's business literature and a commonly cited source of competitive advantage. The consensus is that effective knowledge management requires the *re-engineering of organizational processes for an optimal flow of information and knowledge* within the organization with the support of information technology (Davenport 1993; Davenport and Prusak 2000). To this end, a variety of information technology applications such as enterprise resource planning (ERP), decision support systems (DSSs) and artificial intelligence (AI) have been adopted by organizations with a view to utilizing their knowledge resources more effectively.

Enterprise resource planning, which has been adopted in recent years by many large and medium-sized firms, is defined as a strategic business solution that integrates all business functions, including manufacturing, finance and distribution (Davenport 2000). ERP systems encompass traditional transaction-processing systems as well as model-based DSSs, such as data warehouse, supply chain optimization and planning and scheduling systems. Such integrated systems improve the management of information resources and enable decision-makers to access required information across the organization more effectively.

E. INFORMATION TECHNOLOGY IN SUPPORT OF EXPLICIT KNOWLEDGE

While small enterprises may move slowly into more integrated management methodologies using simple IT applications, larger firms in industrialized countries need more sophisticated systems. With the advance of enterprise-wide client-server computing comes a new challenge: how to control all major business processes with a single software architecture in real time. The integrated solution, known as enterprise resource planning (ERP), promises benefits ranging from increased efficiency to improved quality, productivity and profitability. ERP systems are software applications that afford a means of managing transactions in such a way as to permit the timely execution of decision support systems used to plan and manage resources across an enterprise (see Figure II). Materials requirements planning (MRP) and MRPII, used in manufacturing industries, may be regarded as forerunners of ERP systems (Sabbaghi and Montazemi, in press). ERP systems include applications for financial management, supply and distribution chains, and requirements planning for multiple sites. They facilitate well-managed resource planning in the face of rapidly changing constraints, such as materials availability, market readiness, plant capacities, personnel certification and business costs per location. Software vendors such as SAPAG, Baan, People Soft and Oracle provide a host of integrated ERP products.

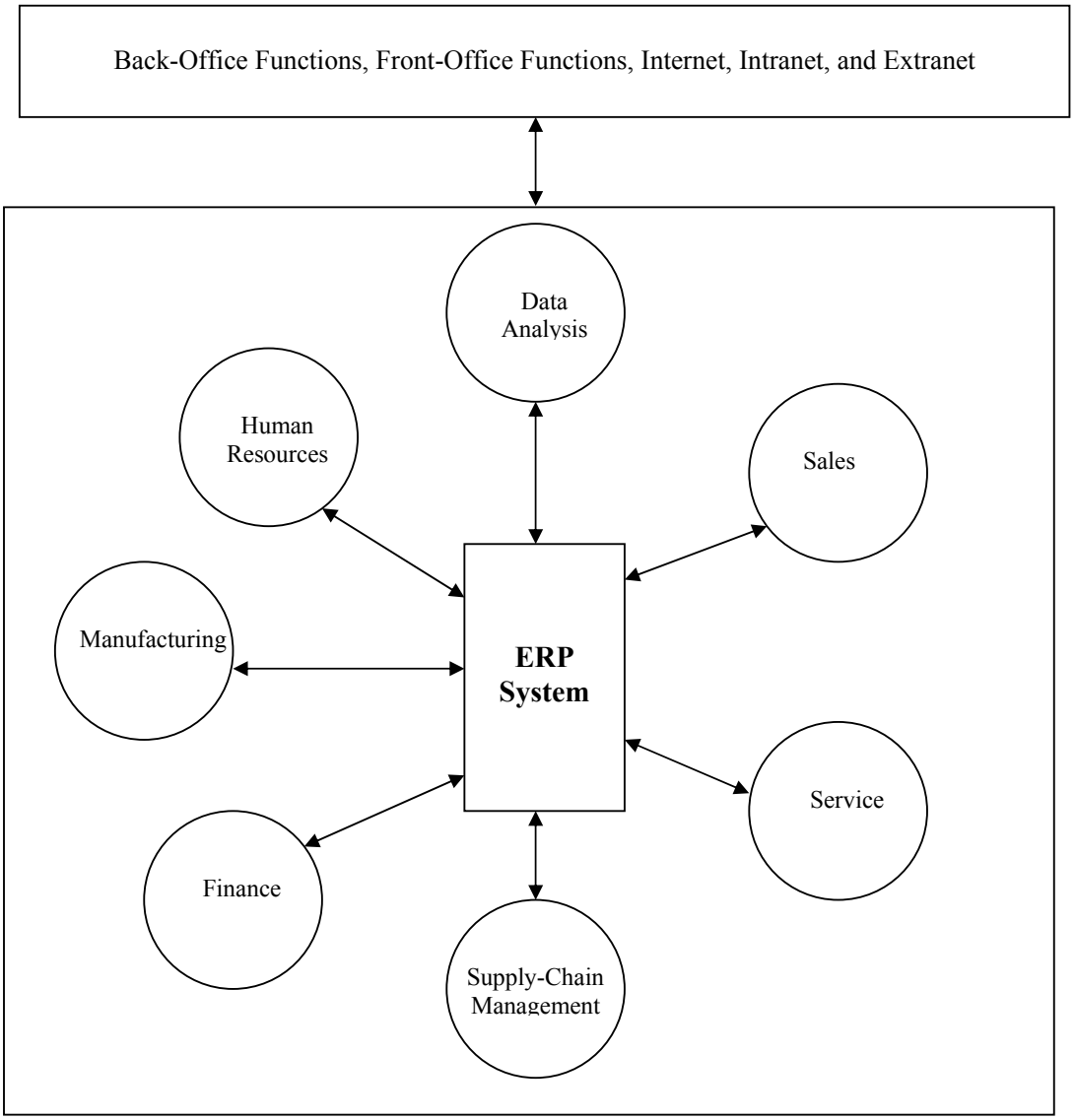
Successful implementation of an ERP system enables an organization to automate transaction systems and provide access to data across organizational boundaries. Although an ERP system primarily supports procedural knowledge, its implementation in an enterprise results in operational efficiency and improved

productivity. Furthermore, database and procedural knowledge captured in the ERP system can be used by decision support systems (DSSs).

Traditional definitions of decision support systems suggest that the purpose of a DSS is to support decision-makers in addressing unstructured or semi-structured decisions. Figure III depicts a variety of possible DSS structures (Holsapple and Whinston 1996). None the less, DSSs can be grouped in three categories: (a) model-based, (b) knowledge-based, and (c) hybrid (i.e. a combination of model-based and knowledge-based types).

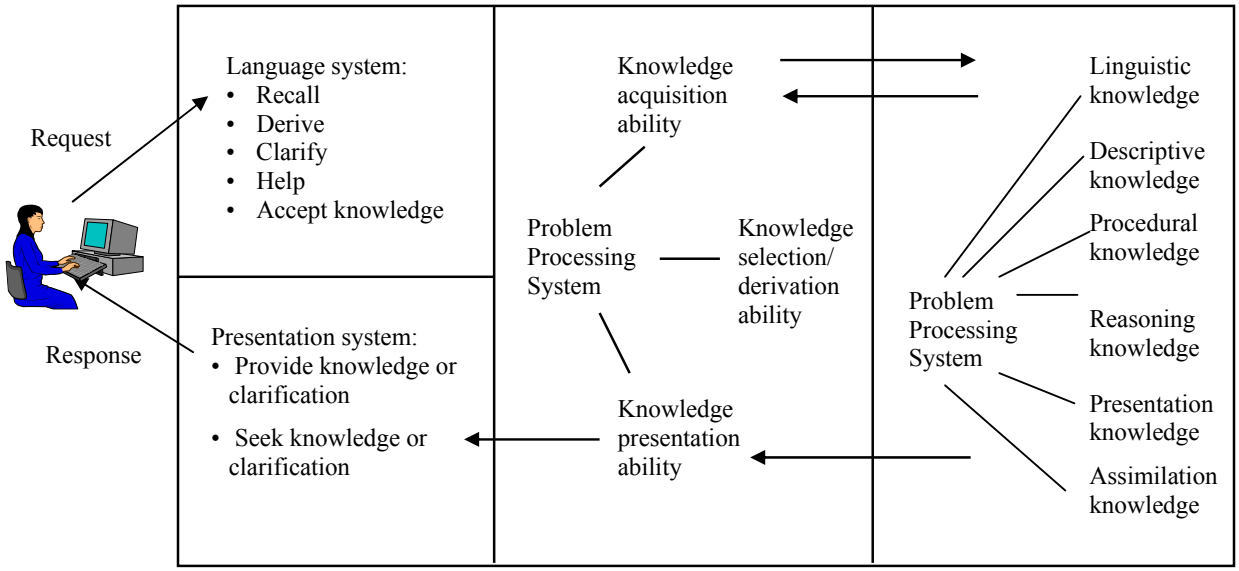
The model-based DSS structure makes use of qualitative models (i.e. operations research and management science techniques) to assist the decision-maker improve the effectiveness of his/her decision processes. For example, mathematical programming enables a decision-maker to seek an optimal solution to his/her decision problem under a variety of assumptions, and statistical techniques, such as cluster analysis, provide support for data-mining. A model-based DSS represents explicit knowledge in the decision-maker's possession about the structure of the decision problem. However, tacit knowledge is supported within the confines of a knowledge-based DSS (i.e. a knowledge-based system [KBS]).

Figure II. The basic components of an ERP system



Many of these advanced IT systems and applications may not be needed by small enterprises in developing countries, particularly where the outside environment and infrastructure may not be suitable in terms of the requisites of such systems. A firm in a developing country must thus be very careful in considering the possibility of adapting one of these systems that are used in more industrialized countries, even when the firm in question is thinking seriously of re-engineering its knowledge resources management. Every enterprise has to develop its own "customized" system, based on locally available resources and techniques, taking into consideration the internal characteristics of the firm and the prevailing conditions of the outside business environment.

Figure III. Generic Framework of Decision Support Systems (from Holsapple and Whinston 1996)



F. INFORMATION TECHNOLOGY IN SUPPORT OF TACIT KNOWLEDGE

In more industrialized countries, information technology has been a very effective tool in enhancing productivity at all levels of management and production processes. Many of the following examples may still be relatively advanced for SMEs in developing countries, yet they afford examples of "productivity tools", particularly at the senior management level. However, they must be customized to meet the actual needs of local firms.

Artificial intelligence (AI), for example, endeavours to make computers capable of displaying intelligent behaviour (Hayes-Roth and Jacobstein 1994) with a variety of techniques that are relevant for the development of KBSs (Minsky 2000). Expert systems and case-based reasoning systems have increasingly been used to capture and manage tacit knowledge in business. In addition, "*intelligent agent technology*" is increasingly being applied toward more functional human-computer interaction and more effective dissemination of information throughout the organization. Three types of techniques that are used in support of knowledge management are discussed below.

1. *Expert systems*

Expert systems (ESs) investigate methods and techniques for constructing man-machine systems with specialized problem-solving expertise (Hayes-Roth and Waterman 1983). Expert system methodology is based on the view that expertise consists of knowledge about a particular domain, an understanding of the problems specific to that domain, and skill in solving some of those problems. Expert system development methodologies assume that tacit knowledge can be elicited from experts in the form of a set of well-defined

decision rules (e.g. in the form of IF, THEN rules) that can be saved in the knowledge base of the ES. In addition, it is assumed that such decision rules are fairly stable (i.e. they do not change significantly over time).

A major challenge in the development of ESs is the knowledge acquisition process, i.e. understanding the heuristic experience ("rules of thumb") used by the human expert in solving specific problems. (See Boose (1986) for further details).

Many ESs have been developed to provide decision support in business. For example, America Express uses an ES called "Authorizer's Assistant" in support of credit record evaluation to protect against credit-card fraud. Westinghouse and Carnegie Mellon University have developed an ES called ISIS that schedules most-efficient use of Westinghouse's many job shops. The Ford Motor Company uses an ES called "Direct Labor Management System" to improve efficiency in all phases of the production process (Awad 1995).

In spite of its usefulness in support of tacit knowledge management, ESs have failed to address problems *requiring creativity* or aesthetic judgment (Aamodt and Plaza 1994; Kolodner 1991). Even common sense may fail to be included in such systems. This failure may be attributed to their "brittleness". The brittleness of ESs refers to their inability to provide a solution when the problem does not conform exactly to the rules in the knowledge base. This deficiency is due to the limited ability of ESs to acquire new knowledge and their inability to analyse incomplete knowledge (Sun 1992). Furthermore, the "knowledge" (i.e. expertise) of ESs is not readily available in usable form, and consequently they cannot provide adequate support in a dynamic decision environment. Thus ESs have tended to emphasize the automation of decision-making activities where the "decision-maker" plays a passive role. This in turn has led to their rejection where the role of *human judgment* is crucial.

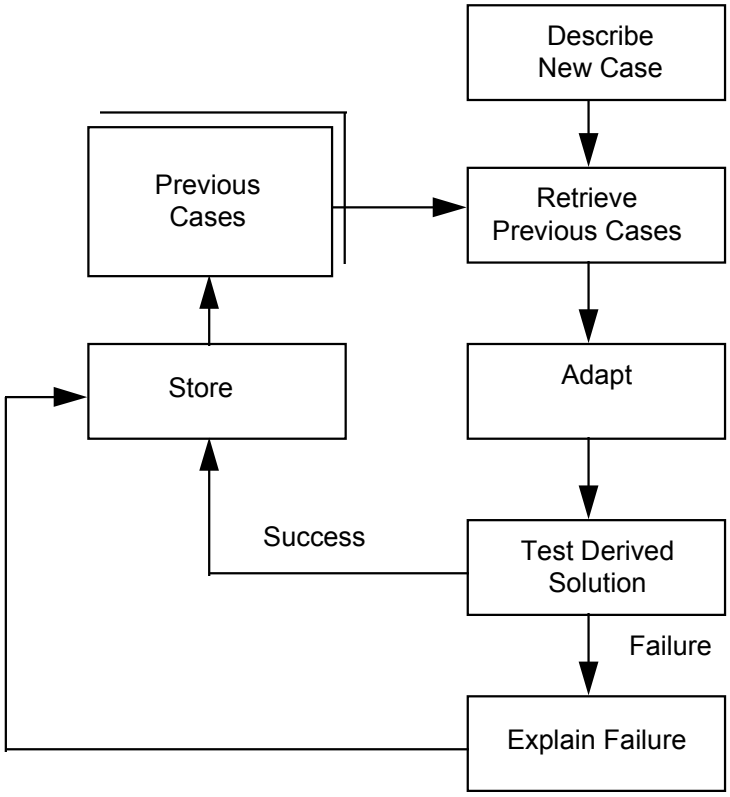
The deficiencies of rule-based systems have motivated the development of alternative decision-support methodologies. The result has been the case-based reasoning paradigm (Kolodner 1991; Leak 1996; Gupta and Montazemi 1997).

2. *Case-based reasoning systems*

"Case-based reasoning" (CBR) systems support "*reasoning*", based on accumulated experience, to solve decision problems, critique solutions and explain anomalous situations. The CBR paradigm is based on the premise that expertise comprises experience in solving new decision problems. Decision-makers rely on their earlier experience in similar situations; in designing a complex object (such as an automobile or an integrated circuit), for example, it is common practice among designers to refer to similar previous designs. A design developed in the past for different specifications is used as a base design and modified to incorporate the differences between the new and previous specifications. Changes are made to eliminate the flaws of the previous design. The design thus generated must be tested before it can be developed into a working prototype. Designing from first principles poses considerable difficulty, because it involves a large number of interrelated factors. A CBR system can be used as a DSS to access past designs so as to support the current design process (for some examples, see Tsatsoulis and Kashyap 1994).

A CBR system assists a decision-maker through the following process (see Figure IV): a previous case (previous cases) with some similarity to the new decision problem (new case) is (are) retrieved; the solution adopted for the previous case is mapped as a solution for the new case; the mapped solution is modified to account for the differences between the new case and the previous case. Then the revised adapted solution is evaluated against real or hypothetical situations (Gupta and Montazemi 1997; Montazemi and Gupta 1996). To aid in future decision making, feedback on the success or failure of the evaluated solution is obtained from the decision-maker (Montazemi and Gupta 1997). CBR thus makes it possible to capture and reuse tacit knowledge in the form of "case management".

Figure IV. Processes in a CBR System



CBR systems have been adopted successfully in support of complex decision problems within a variety of decision environments (Watson 1997). Present applications of CBR systems are generally used in support of specific task domains. However, they are not good at adjusting their retrieval processes to analyse the needs of other related but slightly different decision domains. For example, a diagnostic CBR system for the repair of AC motors is unable to assist a designer working on a new AC motor (Montazemi and Gupta 1996). Obviously, the fact that such systems are unable to share embedded knowledge among different types of knowledge workers reduces their value in the context of organizational knowledge management (Hayes-Roth 1997; Montazemi 1999; Plaza *et al*. 1997). One way of mitigating this problem is to use an adaptive CBR architecture that makes use of "intelligent agent" information systems to support the accessing of required information by different types of decision-makers.

3. *Intelligent agents (IAs)*

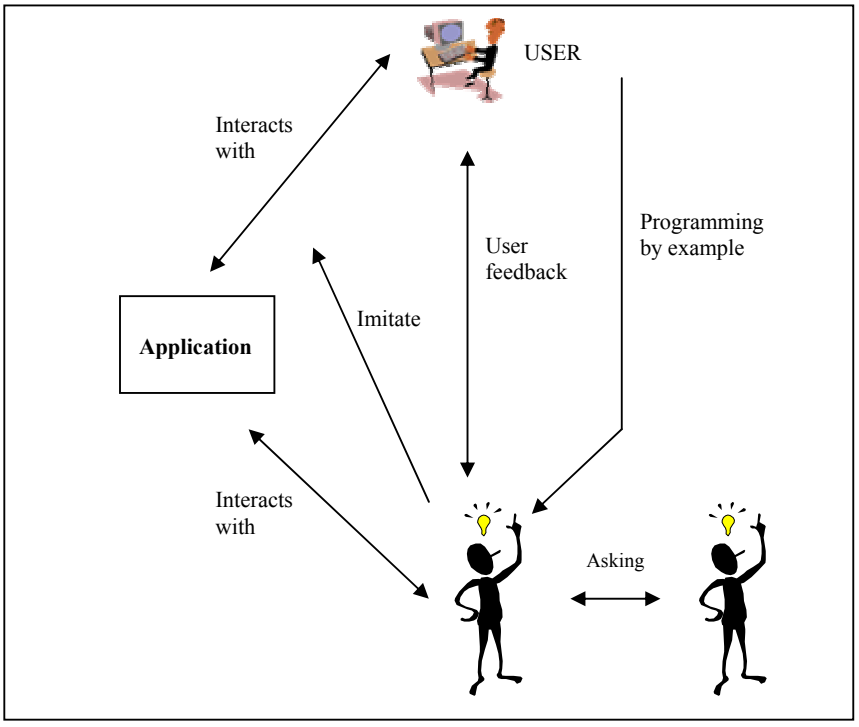
Interaction with a computerized system is a dialogue between the user and the system to accomplish the user's task. The complexity of the dialogue depends on the task domain and the mode of interaction (Montazemi and Sabbaghi 2000). An "intelligent agent" can reduce the complexity of the dialogue by helping the user to interact with the information system through an understanding of his/her goals (Lewis 1998; Pilkington 1992). Intelligent agents have been used in information retrieval systems to help users to retrieve relevant documents (Lewis 1998). The need for an IA for information retrieval systems arises from the fact that users may not know their information needs. In addition, users may not be able to use the system effectively because of unfamiliarity with the system and/or its content functions (Montazemi *et al*. 1996). For example, owing to the diversity of processes throughout an enterprise that are supported by an integrated ERP information system, it is difficult for a knowledge worker to access desired information relating to processes other than his/her own. Without an effective decision support system, the knowledge worker has to search through very large databases, a process that can result in information overload. An IA assists decision-makers with information search and retrieval.

Most computers currently respond only to what interface designers call "*direct manipulation*" (McRoy *et al*. 1999), i.e. nothing happens unless the end-user gives a command by means of a keyboard, mouse or touch screen. The computer is still merely a passive entity waiting to execute specific, highly detailed instructions; it provides little help with complex tasks or information searches that may take an indefinite time. The problem, then, is how to enable computers to identify the information requirements of individual decision-makers and provide assistance in support of knowledge-based tasks.

Techniques from the field of artificial intelligence, in particular the so-called IA, can be used to implement a complementary style of interaction, which has been referred to as "*indirect management*" (Kay 1990). Instead of user-initiated interaction via command and/or direct manipulation, there is a co-operative process in which human and "computer agent" initiate communication, monitor events and perform tasks (Figure V). Automation may consist of semi-autonomous processes set in motion by the end-user, or it may involve bypassing execution or evaluation stages which the end-user would otherwise have to perform (Lewis 1998; Montazemi and Gupta 1996). An agent that searches several databases for a favourable price is an example of a semi-autonomous process. This form of closed-loop automation is found in process industries, where operators establish a variety of set points for valves, breakers and proportional controllers. In order for automation of this sort to work satisfactorily, the user needs a relatively detailed mental model of the domain and what the automation is to do, so as to programme the computer (transparency). A high-quality display and methods for monitoring the system's performance (feedback) are also beneficial to the user (Lewis 1998; Montazemi *et al*. 1996; Montazemi and Gupta 1997).

Figure 5

The interface agent learns in four different ways: (1) it observes and imitates the user's behavior, (2) it adapts on the basis of user feedback, (3) it can be trained by the user by means of examples, and (4) it can ask for advice from other agents assisting other users (Maes 1994).



A computerized IA helps the user to define queries requiring the retrieval of relevant documents that satisfy his/her information needs (Montazemi and Gupta 1997). The effectiveness and efficiency of dialogue between the user and the system are improved, since the query can be accurately defined with fewer statements. Another advantage of the IA is the reduction in the cognitive effort required of the user, as a result of the change in the nature of the cognitive task from recall to recognition (Marchionini 1992). This change can further improve the effectiveness of the information system in terms of decision support (Montazemi et al. 1996; Montazemi and Gupta 1997).

These agents can perform tasks on behalf of the user to enhance the human-computer dialogue. An IA is considered to be adaptive when it uses knowledge and conditions in the environment to determine its actions. Two types of knowledge are needed to determine those actions: (a) domain knowledge, and (b) user knowledge. Domain knowledge is needed to perform actions in a particular domain, and user knowledge is needed to adapt those actions to differences between individual users. For example, in a context of CBR in support of ERP, the task of an adaptive agent in the retrieval of applicable cases would be to assist decision-makers in describing new cases by recommending relevant descriptors. And the task of an adaptive agent in the presentation of retrieved cases to the decision-maker would be to select the pertinent part of the previous cases and use that as a base for recommending a solution in support of the effort to solve the new problem (new case). Application of the adaptive interface IA to define a decision problem and recommend solutions has been shown to be useful for a single type of decision-makers (e.g. decision-makers required to diagnose and repair AC motors. See Montazemi and Gupta [1996]). The challenge now is to extend access to and the use of CBR systems by decision-makers with diverse needs and backgrounds.

As an example of how the above concepts are applied to a business process, let us consider a market-driven target-costing system for a computer manufacturer contemplating the introduction of a new computer system. Market requirements for the project are first identified through market research, conducted under the direction of the marketing executive using his/her past experience/knowledge. This initial step enables the manufacturer to establish a provisional target price for the new product. Product target cost is then determined by subtracting target profit from the target price. The calculation of target profit is a function of capital cost, which can be computed on the basis of concepts drawn from the field of finance, but is ordinarily determined in the light of the chief financial officer's past experience and judgement. At this time, the manufacturer embarks on the task of determining target costs and cost drivers for various parts/activities. Alternative designs/processes are investigated to minimize costs while preserving quality. If, after review by management, the project is found to be feasible, the manufacturer proceeds with detailed design and production plans and sets a final price for the product. The project is tracked continually to improve product quality and reduce costs.

The above process entails the sharing of knowledge about (a) customer requirements, (b) the profit requirement having regard to the risk involved, and (c) the feasibility of the project in terms of cost. Such knowledge is skill-specific for the most part. For example, the chief financial officer uses his/her knowledge to establish a target profit that will generate an adequate return for the risk the company is taking in embarking on the project. The design and production engineers use their knowledge and experience to design and manufacture the product in a manner consistent with the mission and objectives of the company. This process becomes maximally efficient when the knowledge workers involved can benefit from each other's knowledge with regard to different parts of the puzzle (i.e. market-driven target costing). A research challenge is to develop knowledge-based systems that will store knowledge and enable knowledge workers to retrieve the knowledge pertinent to their decision problems through IA systems.

G. CONCLUDING REMARKS

Effective management of a firm's knowledge resources is one of its most important assets, inasmuch as those resources are the source of innovation and enhanced productivity. Firms in more industrialized countries have realized this fact and have been adopting different systems and models, based on information technology in most cases, in an effort to harness the potential of tacit knowledge within the firm.

A major reason for this surge toward more effective management of firms' organizational knowledge has been the recent shift from natural resources to intellectual assets as the foundation of industrialized economies (Thurow 1999). Executives have been compelled to examine the knowledge underlying their business and to consider how that knowledge is used. In addition, thanks to the falling cost and improving performance of hardware and software technologies, it is increasingly feasible to capture and share organizational knowledge. To be useful in today's dynamic business environment, an enterprise model must not merely represent a static version of "how we do things around here"; it must also include the capacity to adapt systematically and rapidly. Like the process of piloting a jet fighter, a true manage-by-wire system relies both on an accurate information model and on the organization's ability to learn (Haeckel and Nolan 1999).

Information technology risks are becoming increasingly entangled with business risks, requiring senior management (e.g. CEOs) to become involved in IT planning and decision-making. Furthermore, identification and assessment of the available technology has come to be an important base for the successful implementation of information technology systems in any organization. This issue is especially important to SMEs, since their limited financial resources restrict their capacity to maintain in-house access to a full range of the necessary professional expertise, and since they cannot afford to absorb technology by the trial-and-error method (Montazemi 1988). In this situation, outsourcing can be a viable means of dealing with the selection and implementation of information technology systems. Many firms outsource, that is, turn over all or parts of their information system operations to outside contractors known as system integrators. In addition, many companies are outsourcing software procurement and support to application service providers (ASPs), which provide and support business applications and other software, via Internet and intranet, to all the company's employee workstations. Successful outsourcing plans and contracts depend on managers who are knowledgeable about their internal business processes, as well as about issues affecting the management of information technology systems (Bryson and Ngwenyama 2000).

To compete effectively in the global market, SMEs in both developing and developed countries must invest in the education of their managers, so as to enable them to keep up with the managerial aspect of information technology in support of innovation and competition.

SMEs in developing countries have to be well aware of these developments in the more industrialized countries; however, they have to be careful in adapting these systems to their local environment. What is more important for SMEs in developing countries is to learn the lessons outlined above, that is, to appreciate their "knowledge resources" and to re-engineer their managerial and operational processes so as to harness all knowledge resources within the firm more effectively, using to that end suitable information technology applications, where available, in so far as possible.

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IV. RESULTS OF INNOVATION EXPERIENCES FROM THE FIELD

A. INTRODUCTION

This part of the study is based on structured interviews conducted with general managers/owners of selected manufacturing enterprises. Its aim is to draw lessons from successful cases of innovation in selected countries of the ESCWA region, namely Lebanon and Egypt. Lebanon was selected because it has a relatively free economy, with a substantial part of the production of its industrial enterprises going to the export market, a situation which offers strong incentives for innovation. Egypt, for its part, was selected because of its relatively large economy, with the concomitant probability of numerous examples of innovation. Moreover, Egypt has been progressively adopting more liberalized policies since early in the 1990s, particularly after the signing of the WTO Agreement in 1994, so that the private sector now accounts for a larger share of the country's manufacturing and other economic activities.

1. *The economic environment in which enterprises operate*

The economic conditions and setting in which the selected enterprises have been operating in Egypt and Lebanon have greatly affected their performance and their tendency to innovate.

In Egypt, prior to the early 1990s, industrial activities were basically inward-looking and dominated by the public sector. Economic protection inhibited the development of a spirit of entrepreneurship, entrepreneurial skills and the growth of an innovative environment in the industrial sector. Private-sector activities remained quite limited, despite the open-door policy proclaimed by the Government in the mid-1970s. The industrial sector, particularly the import-substitution industries, remained heavily protected through a policy of high tariff rates and non-tariff barriers, amounting to a total ban on the importing of some types of industrial products. Egyptian industries had little experience of exporting, relying as they did on a relatively large domestic market of more than 50 million captive consumers.

In the early 1990s, the Government introduced a new industrial policy, initiating a structural adjustment programme aimed at promoting private-sector economic activity and exports. The new policy was successful, stimulating a significant expansion in the private sector, but most manufacturers tended not to be innovative, basically because they were lacking in entrepreneurship and did not possess entrepreneurial skills. Such factors as the Government's continued protectionist policy constrained the business environment, and the emergence of monopolistic practices in the market was also not conducive to innovation. Enterprises were producing for a large, guaranteed domestic market, and they were not forced to innovate because they could copy new products and processes from the international market. Lack of competition from imported foreign products, monopolistic practices and supply-push market conditions prevented the country from developing an innovative manufacturing sector and a culture of innovation among producers.

The WTO Agreement was signed in December 1995. Egypt has had to begin complying progressively with the terms of that agreement, with the result that competition from foreign imports has gradually increased. The liberalization of foreign trade is forcing manufacturing enterprises to change the way they operate and become more innovative. In the course of the interviews that were conducted with owners and managers of Egyptian manufacturing SMEs, it was noticeable that a number of them had begun to reconsider the way they ran their businesses, and many of them had already re-engineered their enterprises in anticipation of prospective changes in the domestic market.

As regards Lebanon, in December 2000 the Government announced a plan for new industrial policies to promote the reactivation of the manufacturing sector. This unprecedented step, if implemented, will help eliminate many of the obstacles that have inhibited industrial investment and expansion in the country. For this purpose, the Government is planning to introduce policy measures aimed at addressing many of the serious problems afflicting the manufacturing sector and introducing promotional measures offering industrialists incentives to expand their activities, particularly their export activities.

Hitherto, manufacturing industries in Lebanon have been operating under difficult conditions, owing mainly to the continuing effects of civil war and strife, and to the absence of a Lebanese industrial policy. This has marginalized industrial activities, especially new investment.

Traditionally, Lebanon has long enjoyed an open and private-sector-oriented economy, with private activities dominating most economic sectors, particularly in industry. This has been a contributing factor in the development of an entrepreneurial spirit and entrepreneurial skills in the country, and the ultimate result has been a relatively innovative environment. The civil war and strife that raged during the period 1975-1990 significantly affected the performance of manufacturing enterprises, forcing industrialists to operate at 50 per cent of production capacity. Despite the hardships of the war, most Lebanese exporters were able to direct their exports towards markets outside the region, particularly Europe and the United States. Thanks in part to the entrepreneurial skills and innovative spirit characteristic of Lebanese businessmen, most industrialists were able to survive the challenges of that difficult period.

After the civil war had come to an end and the rule of law had been re-established, Lebanese manufacturers found themselves facing fresh difficulties in the form of progressively higher production costs, deteriorating conditions in the domestic economy, especially since 1996, and political instability in the region. This situation has dramatically affected the incidence of innovation and reduced growth in industrial investment.

Under these conditions, many industrialists have begun to reconsider the way they operate their businesses in response to the challenges of the domestic situation and changing international markets. Many of those industrialists have already re-engineered their enterprises to adapt to new market requirements.

It is to be hoped that the Government's new industrial policy will help those enterprises adjust to the new economic order, both domestically and internationally.

(a) *Methodology*

As mentioned earlier, for the purposes of this study, innovation refers to non-technological innovation in process, product and product development, industrial organization and management, marketing, packaging, industrial services, industrial community services, industrial facilities and other areas.

In the course of this study, information was collected through structured interviews with officers of a number of manufacturing SMEs. Only enterprises that were found to have demonstrated innovation in specific instances were selected for the study. In all, 17 examples from Egypt and eight from Lebanon are considered.

Although the study is concerned with instances of innovation on the part of SMEs, which are defined as companies employing between five and 250 persons, some of the examples from Egypt involve enterprises that are currently larger than this, with more than 250 employees. However, the innovation experiences considered here date from a time when they were still within the SMEs size range. They have since grown larger, mainly as a result of the innovation or cumulative innovations they have introduced. These companies are the following:

(i) National Arts Development Industries of Mashrabeya (NADIM);
(ii) The Egyptian Knitting and Ready Made Company (ETC);
(iii) SEKEM;
(iv) The Egyptian Agricultural and Food Products Company – Vitrac;
(v) El-Rashid El-Mizan Confectionery;
(vi) Indevco.

One Lebanese company, Kindou, currently has approximately 100 employees of its own, while the small workshops to which it subcontracts its sewing and trimming operations employ approximately 170 persons in all.

In the case of one Egyptian company, Bella Donna, the innovations have increased productivity to such an extent that the staff has been cut from 500 to 270 employees, reducing production costs and improving the earnings and efficiency of the enterprise.

As will be seen, the innovative manufacturing SMEs in Egypt and Lebanon identified in this study are exporting enterprises. This choice was based on the assumption that the firms in question had successfully coped with the challenges of a competitive market. Whereas Egyptian producers long enjoyed a protected market, many Lebanese firms have produced, directly or indirectly, for the export market.

In the course of the interviews, company officers were asked about the internal situation of their firms with respect to innovation, while external conditions, such as the economic environment and the existence (or absence) of governmental supporting (or inhibiting) policies and measures, if mentioned at all, were referred to only as part of the economic background to the innovation under consideration.

(b) *Limitations of the approach adopted*

This part of the study is not meant to be all-inclusive; rather, it is restricted to a randomly selected number of manufacturing enterprises with a view to offering instructive examples of innovation-related knowledge and learning experiences to other manufacturing SMEs in the region. There may be many other innovative enterprises in both Egypt and Lebanon that are not mentioned in this study.

While most of the companies selected enjoy high reputations in their respective sectors, the fact remains that, in general, the examples of innovation considered here were born of the skills and abilities of the general managers of the enterprises in question, who were also, in most instances, the owners of those enterprises.

B. FINDINGS OF FIELD WORK ON INNOVATION EXPERIENCES

In most of the cases considered in the survey, the innovations reported were incremental innovations, introduced mainly in the form of improvements to an already existing product, process, management/marketing strategy or the like, rather than a reduction in production cost and price. In some instances, the changes introduced were new to the region, the country or the industry. A very small number of the enterprises covered by the survey had introduced an altogether new innovation. The survey did not include cases where enterprises had introduced changes that were new only to the company but were already well established in the marketplace.

As a general observation, although most of the enterprises had introduced their innovations in response to challenges encountered in the market as a result of changing conditions, there were quite a few that had initiated change in an attempt to create market demand. Furthermore, despite the fact that there was a limited degree of innovative activity among most of the manufacturing SMEs covered, several enterprises were found to be "habitual" innovators, producing a constant stream of innovations. Enterprises that had introduced only a single innovation over a relatively long period of time were few and far between.

Some of the enterprises surveyed stated that they applied a proactive strategy in identifying market opportunities, knowledge generated within the firm being supported by suggestions from suppliers, buyers and customers. Most of them, however, relied largely on knowledge originating within the firm.

Few of the enterprises stated that in implementing change they sought support from external sources such as universities, private consultants, industrial associations, foreign partners/experts, potential collaborators, other businesses in the sector, etc. In the case of the acquisition of new machinery, most companies reported that suppliers were supportive in helping them acquire new skills and providing training.

In the course of the interviews, several enterprises highlighted the main obstacles inhibiting innovation. One major obstacle cited by most enterprises was lack of financial resources and an absence of adequate financial planning. Another major obstacle was difficulty in finding the necessary skilled workers, qualified technical staff and persons with the requisite technical knowledge. For an information technology

company such as Com.Com, the major factor was difficulty in finding skilled and creative programmers in Egypt. For the Bchamoun Industrial Park, it was a shortage of qualified technical personnel in Lebanon who could help in applying new ideas involving new technology and the local scarcity of technical knowledge and research and development facilities.

Cultural factors were also mentioned by several enterprises as obstacles inhibiting innovation. The participative approach to management applied by ETC was a new culture to the company, and its introduction has encountered resistance on the part of some of its middle managers. Most workers could not grasp that the manager was genuinely seeking new ideas from them and not only giving orders. Companies such as Les Conserves Chtaura complained of the lack of determination of the company's workers, most of whom did not appreciate the innovation's effect on the enterprise. La Lainière Nationale suffered from the old-fashioned mentality of some of its middle managers and their inability to adapt to change.

Other obstacles were cited, including lack of communication among different departments in a company, which is a managerial problem that inhibits innovation. Reluctance on the part of the owner to accept the risks involved in introducing change and lack of time were two other inhibiting factors that were noted by several enterprises.

1. *The nature of innovation*

The enterprises covered by this study were found to have introduced different kinds of innovations with varying degrees of impact on the operation of the firm. One common form of innovation was the simple, direct introduction of a product or process, such as Vitrac's new packaging for marmalade in glass containers, El-Rashidi's wide selection of new varieties of halawa, Ghaffar's wooden furniture sold in kits to be assembled by the consumer, and Horreia's introduction of an improved quality of hard candy in different flavours and attractive packaging. However, more complex cases of cumulative innovations were also reported, some of them radical, as in the case of SEKEM and Natoil. The former company has not only introduced many innovations in various areas of manufacturing, but has also added a social development dimension to its business.

(a) *Bonding business to development*

SEKEM is a vital, distinctive company that has been innovative in all aspects, including product, process, marketing and others. But its really unique contribution has been in human resource development, by establishing a culture of a collective approach to management, transforming itself into a "learning organization" and bonding business to development. SEKEM's sustainable approach of comprehensive social, economic and cultural development "illustrates how mankind can find its way back to fundamentals, in balance with nature, via technology which serves rather than exploits."[51]

Another company that has bonded business to development, though to a lesser extent, is the Egyptian Knitting and Ready Made Company (ETC). Management has created a working environment of committed employees by adopting a policy of collective decision-making and management. It is trying to develop a culture that is learning-oriented and technically aggressive. To achieve this objective, management has introduced incentive systems to attract and retain highly skilled employees while addressing issues related to their welfare and well-being.

(b) *Combining business with a cultural message*

A number of enterprises in Egypt have built the success of their businesses on the development of heritage and traditional industries. They consider that they have a mission to spread knowledge and appreciation of Egypt's history and civilization, and they aspire to preserve and develop a tradition without compromising authenticity. While these enterprises have been operating as craft industries, they have attained a level of excellence and innovativeness that has enabled some of them to capture markets worldwide. Azza and Randa Fahmi's Al-Ain Company is one example.

[51] SEKEM, *SEKEM - Company Guide* (Cairo, n.d.), p. 19.

The Al-Ain Company has turned jewellery making from a craft into an artistic message of culture, tradition, and history. The company's heritage lanterns (*fanous*) are produced in a high-quality, attractive design aimed at recreating their functionality as traditional and aesthetically acceptable lighting devices which have long been absent from the Egyptian market, despite their important place in the country's heritage.

Al-Memarian is the first and so far the only company in Egypt to introduce monumental historical models created on-site. Behind each model lies a historical and cultural story from Egyptian history.

El-Pharaana Metal Engraving has introduced the concept of engraving inscriptions from Egypt's Pharaonic and Islamic heritage on gold and silver, adding an artistic and historical dimension to a special product.

(c) *Exploiting information technology to promote knowledge*

Com.Com Egypt has been innovative in launching a campaign to promote Egyptian sites and other tourist attractions by developing a software program called *Age of the Pharaohs*, which is an interactive software guide containing detailed coverage of Ancient Egyptian history and a complete interactive guide for tourist facilities in Egypt. The Lebanese company Timezero, for its part, has been able to facilitate the teaching of the new science curriculum to students by developing an attractive and easy method on a software application.

(d) *Discovering a "gold mine" for desert cultivation*

Natoil, the Egyptian Natural Oil Company, is promoting cultivation of the desert in Egypt with the "magical" jojoba plant, which yields synergistic benefits in the form of jojoba oil, chemically a liquid wax. Jojoba oil has a unique structure that facilitates the manufacture and development of a variety of products in a number of fields. The company has developed new applications for processing jojoba oil into medicinal products and pesticides, and has licensed a pharmaceutical company to produce three useful remedies.

(e) *Turning a craft into an industry*

NADIM has developed the production of traditional wooden furniture with mother-of-pearl inlays and *mashrabeya* from a craft into a modern industry, reintroducing the style for modern usage. It has revived the traditional artistic form of woodwork by producing pieces that are not merely ornamental items or souvenirs, but are designed for functional use.

(f) *Competing in the local market, against heavy odds*

As an innovative strategy in children's clothing, Kindou has targeted the middle and upper segments of the Lebanese market. Through price differentiation, it competes with imported European products in the local market. The company's policy was first to reach critical mass in production volume by operating on a low profit, high turnover basis. It has outsourced its sewing and trimming operations and has developed just-in-time production, an effective costing system and CAD/CAM applications. It has linked retailing to production through IT. The company has also introduced its own retail distribution network through franchising.

(g) *Adopting a "quick response" strategy*

La Lainière Nationale is a supplier of textile fabric inputs to local manufacturers producing mainly for the export market. To keep its machines operating at full capacity, the company has adopted a "quick response" strategy in production, by changing its mode of operation to keep up to date with fashion trends in Europe and to meet the needs of Lebanese exporters of ready-made garments. It has acquired circular knitting machines, and it has installed a large dyeing machine and a finishing machine. The company's technicians are trained in Europe.

(h) *Innovative concepts in industrial organization*

Bella Donna/Roadal has introduced innovative marketing techniques and industrial organization. Production has been separated from marketing, and old machinery has been replaced by new state-of-the-art machinery, with the result that the company's work force has been reduced from 500 to 270, while production has increased. International costing methods have been adopted, and competitive prices have been achieved. Bella Donna produces branded products under the franchise name Rodier. The company has become affiliated with a foreign partner, and it has acquired knowledge relating to operation, production and marketing techniques.

(i) *Turning a market crisis into business opportunities*

The Scouts Shop Establishment, originally a manufacturing enterprise producing scouts' uniforms for the local market, introduced a series of cumulative innovations in the exploitation of opportunities in both local and export markets during the critical period of civil strife in Lebanon. The Scouts Shop successfully compensated for the drastic decline in domestic demand for scouts' uniforms by responding to a growing market shortage of ready-made clothes in northern Lebanon. With deteriorating security and economic conditions in the home country, the Scouts Shop successfully accessed markets in Kuwait and the United Arab Emirates, thanks in part to the manager's established contacts in both countries, and in part to the fact that it was exporting the right product, namely clothing. The Scouts Shop grew gradually but steadily, holding its own against Asian products and exporting trousers to Europe.

(j) *Targeting the institutional consumer*

Les Conserves Chtaura is a well-established Lebanese food products manufacturing enterprise which is building its success on cumulative innovations in its products and marketing techniques. The enterprise has recently been trying to create a market within the Western community by directing greater efforts to improving its product quality and marketing techniques. The company is currently targeting institutional consumers through its new "Chtaura Chef" line of ready-to-eat products, which is still in its trial phase. The Scouts Shop, too, has identified a niche market in the Gulf countries, consisting of institutional consumers of custom clothing; it is targeting public and private institutions such as hospitals, Ministries of Defence, charitable institutions, schools and the like. Similarly, Al Maamarian has found a market for its niche product, model monuments, in institutions such as national and foreign museums, schools, Egyptian and foreign embassies and the like.

(k) *Benefiting from experience in industrial technology transfer*

The Bchamoun Industrial Park, the first of its kind in Lebanon, accommodates small and medium-sized manufacturing facilities and workshops, offering them an opportunity of owning affordable premises that are appropriate to their needs. The Park acts as an incubator for industries that are just getting started, and the Park's management helps industrialists to promote their businesses and provides them with new technologies transferred in from abroad. It also supplies them with technologies, and the patents on them, for new inventions to be manufactured in the Park, such as turnkey rotational molding. In addition, it provides, through its banks, financing for the purchase of space in the Park, and it also makes long-term financing available.

2. *The energizer*

Almost all the enterprises covered by the survey were family businesses, and in every case the business operation was powered by an energizer, the entrepreneur. This person was either the owner or the partner who was the managing director or the chairman of the board of directors.

In both countries, entrepreneurs were found to share a number of characteristics: they are individuals of vision and purpose, personally ambitious, and with some nationalistic aspirations. They thrive on challenge and are dynamic and hard-working; a few of them are also benevolent and humanitarian. All of

them are passionately devoted to their businesses. They are progressive and not complacent, they strive for excellence, and they are determined and unyielding. Several of these entrepreneurs are creative by nature and have started their own businesses, while others are carrying on a family tradition.

(a) *Individuals of vision and purpose*

Most entrepreneurs in both countries are individuals of vision, and a number of them are pursuing a personal mission. They are progressive and not complacent, and they live for the future. One of them is Hilmi Abuleish of SEKEM. He is a former Egyptian expatriate who returned to his home country with the original idea of doing business in such a way as to bond the development of the business with the welfare of the community. He has introduced a number of radical concepts in production methods, integrating agriculture with industry and pioneering sustainable production techniques. He has revolutionized working conditions and management-labor relations at the company, creating a learning environment and aspiring to change the mentality of the enterprise and the surrounding community through associated NGOs, schools, a training centre and an academy, and through interactive learning and cultural and social activities.

Nabil El-Mougy of Natoil is a former Egyptian expatriate who is environmentally aware and has worked hard for many years to realize a project that he believes is a "gold mine" for Egypt. He encourages farmers and agricultural investors to cultivate the jojoba plant in the Egyptian desert, and then he in turn buys the crop from them to produce jojoba oil. El-Mougy embarked on this endeavor after learning that jojoba oil, like petroleum, was a product with a unique structure that was suitable for the manufacture of a variety of chemicals. He is convinced that jojoba cultivation will lead to a radical change in the country's economy.

Azza Fahmi, of the Al-Ain Company, is concerned above all to strengthen and preserve a tradition and to heighten awareness of a beautiful heritage through the production of small, handmade, aesthetically attractive jewellery. She feels responsible for the promotion of this cultural heritage, which she believes she can pass on to others without compromising its authenticity.

Roy Badaro, of Kindou, produces children's wear for the Lebanese domestic market; the clothing is made to the company's own designs and carries its brand name. Badaro has developed a growth programme for his company, with clear-cut targets. He has done this because he is acutely aware that conditions in international, regional and domestic markets are changing radically as a result of globalization and the WTO Agreement, and as a result of the rapid pace of technological change, particularly in the area of information technology and IT applications. In his future plans, Badaro has taken the limitations of the domestic market into consideration, and is hoping to co-operate with regional and, if possible, European partners in pioneering a regional brand for children's wear piloted by Kindou, with an eye to, eventually, the global market.

(b) *Strive for excellence*

Most of the entrepreneurs are characterized by the pursuit of excellence in their businesses. In the case of Al-Memerian, the intensive and extensive research undertaken for each model, as well as the intricate, detailed work involved, demonstrates this desire to excel. Randa Fahmi, one of the Al-Ain partners, who is known for her oriental lanterns (*fanous*), went to the trouble of undertaking documentary research, roaming around museums and old houses, travelling to other countries, completing a challenging traditional apprenticeship and acquiring the skills needed for the realization of her designs. Heba El-Shafei, of the Egyptian International Trade Company, transformed herself from a housewife to a self-made businesswoman, solely because of her dedication to the goal of producing a unique product of high quality, excellent finish and sophisticated taste.

(c) *Up-to-date information and zeal for continuous learning*

Most of the owners of enterprises interviewed in the course of this study possessed extensive knowledge of their trades and kept up to date in their business fields by various means, including affiliation with relevant international professional associations and the Internet. For example, Al-Jamal, of the Bchamoun Industrial Park, has established an affiliation with a technology transfer company that is helping the Park's industrial firms to bring in new technology that meets their needs. Some of the owners whom we interviewed, such as Suleiman Khattar of La Lainière Nationale, are members of specialized groups organized expressly to obtain information on international trends in the field. Bhaa Raafat of ETC, for his part, subscribes to professional magazines such as *Learning Organizations*. They are also constantly on the lookout for information that will spark inspiration for a new idea or the development of an existing one, as in the case of Al-Jamal and Randa Fahmi of Al-Ain. Most of the entrepreneurs interviewed participate in international fairs and conferences, while others even attend training workshops to revitalize their abilities by learning about new business concepts, as Attef Idriss of Les Conserves Chtaura frequently does. One entrepreneur, Azza Fahmi of Al-Ain, went back to college to take special courses.

3. *Impact of innovation on other firms*

Only a few of the companies covered reported, to varying degrees, on the effect their company's innovations had had on other SMEs. Those companies were SEKEM, the Al-Ain Company (Azza and Randa Fahmi), Natoil Egypt, Timezero, La Lainière Nationale, Horreia 2000 and Al-Pharaana. It appears that most of the innovations have had little effect on other enterprises, and the spread or diffusion of innovations through market or non-market channels seems to have been quite limited. This fact is of some importance for our analysis, since without diffusion an innovation has no economic value: having no economic impact, it can have no immediate effect on the well-being of an economy. The importance of the diffusion of innovation lies in the fact that it affords a means of realizing the full benefit of innovations, and thus is crucial to the attainment of higher productivity and higher standards of living for the economy as a whole. A fuller understanding of the factors promoting or inhibiting the diffusion of innovation in the countries of the region must await further studies.

Of the few enterprises that responded to the question on the diffusion of their innovation, one, the Bchamoun Industrial Park, explained that a project such as an industrial park was difficult to establish, as it required a very large capital investment and financing that most industrialists could not afford, particularly under the unfavorable economic and political conditions prevailing in the country (Lebanon) and the region.

Another company, SEKEM, has generated interest in organic farming and in the cultivation and manufacture of organic products, as well as market demand for its products. The company has also succeeded in interesting some developing countries in its comprehensive approach to business development. Similarly, Natoil has created awareness of the jojoba plant and its oil, and has encouraged farmers to cultivate desert land as a means of generating income.

Azza and Randa Fahmi have forced other local workshops to improve the quality and design of their products in order to be competitive. There is now a domestic market for well-designed, well-made heritage jewelry and traditional lanterns.

Getting a new idea adopted (or diffused) by other enterprises is not an easy task, even when its advantages are obvious. In his book on the diffusion of innovation, Rogers[52] lists several factors that may affect such diffusion. One major factor may be the innovation itself, as the rate at which the innovation spreads (its rate of diffusion) is different for different products. Innovations that are seen by potential adopters or other SMEs as ranking high in terms of relative advantage, compatibility and visibility and are not excessively complex, are adopted more quickly than other innovations. The relative advantage of an innovation refers mainly to the degree of improvement it brings to users and to its relative cost. Its compatibility is the extent to which it meets the needs of other SMEs, and is seen as complying with existing norms and values of the community or social system. The complexity of an innovation refers to its difficulty or ease of comprehension and application. The simpler a new idea is, the more readily it can be understood

[52] Everett M. Rogers, *Diffusion of Innovations*, fourth edition (New York, The Free Press, 1995).

and used, and the more quickly it is likely to be adopted. Lastly, the visibility of an innovation means the extent to which the results of its introduction are readily perceived by other SMEs.

Another major reason listed by Rogers is the process of communication of innovations or new ideas that exists in the community; this is a factor that influences the extent to which innovations or new ideas are diffused and transmitted to SMEs that are potential adopters. Interactions within the community often exert a multiplier effect on the spread of innovations, whereas the absence of such interactions may impede the process. The tendency of the relevant institutions to co-ordinate their activities and interact with other economic actors, and the extent to which enterprises, particularly competing enterprises, are prepared to share their expertise and co-operate in a common competitive strategy are important determinants of the nature and effectiveness of such community interaction.

New ideas are communicated through specific channels among the members of a particular community. The communication process essentially involves the flow or exchange of information or knowledge about the innovation between the innovator and the adopter. The nature of this information-exchange relationship determines the extent to which the innovation is diffused to potential adopters. At the receiving end, the nature of the existing enterprise population (potential adopters) and its tendency to adopt new ideas relatively quickly or slowly also influence the diffusion process. In other words, the structure of the existing enterprise population, as broken down into early adopters, late adopters and laggards, greatly influences the diffusion process. Research has shown that, in general, enterprises that belong to the same category share various features: late adopters, for example, tend to be of low social status, make little use of mass media channels and learn about most innovations from peers through interpersonal channels.[53]

The innovation diffusion process is also determined by the nature of a community or social system, its values, norms and beliefs, the decision-making process and so on, which may facilitate or inhibit change. The norms in question may be those of the nation, a religious community, a local area (village, town or city) or a commercial firm.

4. *Lessons diffusible to other SMEs*

(a) *Marketing*

Innovation depends to a large extent on marketing, as it helps enterprises to identify markets and customers and understand their nature and needs. Marketing helps firms to receive exposure to market changes and trends and to new ideas. Most of the innovating firms covered in this survey innovated in the area of marketing, and almost all of them treated it as important, albeit to varying degrees and in various ways.

Launching a sound, aggressive overall marketing strategy involving various aspects of marketing techniques has helped several firms to succeed against the odds in overcoming daunting challenges in domestic and international markets. Bella Donna and Vitrac, for example, have been able to capture competitive export markets, while GMT, itself a marketing firm, has achieved an initial success in accessing the competitive European market by aggressively marketing innovations in ICT solutions, applications, services and systems that had been produced by its associate companies. It is also good marketing strategy that has helped a firm such as Horreia 2000 to produce for the extremely competitive domestic market, and has helped Kindou to grow in a tightening domestic market.

Adopting a scientific approach in acquiring market information for innovation. Seeking expert advice and resorting to specialized sources of information, putting together a marketing team, obtaining good market information and undertaking market research are techniques that have helped several firms, such as Conserves Chtaura, repeatedly to capture new markets and become a "habitual" innovator and a creator of new demand. The firm has developed the Med Gourmet line and various new health products, including an array of dips and dressings for the European consumer, targeting a very competitive and sophisticated market that is also very restrictive, particularly as regards food products. Although the managers of most of the firms

[53] Rogers, *Diffusion of Innovations*.

surveyed were aware that the ability to generate innovations rests on the accumulation of knowledge, only a few of them mentioned links with knowledge institutions and firms, such as educational establishments (Al-Ain, Conserves Chtaura), universities (Conserves Chtaura, Natoil), consulting firms (Conserves Chtaura, Bella Donna), or other support institutions such as EXPOLINK (Bella Donna, GMT, Horreia 2000).

Keeping up to date on market developments, and continuous exposure to new ideas and market trends. This has helped firms learn more about market conditions and enabled them to meet expressed needs, acquire a better understanding of consumers' tastes and lifestyles, adapt to their preferences and respond quickly to changing market conditions and new trends. In their efforts along these lines, most enterprises rely on both internal and external sources of information, including notably the company's own market-watchers, good relations with suppliers and customers, professional meetings, conferences and exhibitions. Most of these firms participate regularly in national and international fairs and exhibitions, subscribe to international specialized periodicals, join specialized international associations and attend specialized international conferences. They also use the Internet in their search for information, and many of them have created their own Web sites. This strategy has also helped firms secure exposure for their products in national and global markets.

Adopting a specialized strategy, identifying and focusing on segmented niche markets or products in domestic and/or foreign markets is a major strategic marketing instrument adopted by most of the enterprises surveyed, one that has contributed to their success in identifying and capturing market gaps. Competition in niche markets is limited, and an enterprise may obtain a non-price competitive advantage. Accordingly, enterprises tend to focus on a market or product niche that requires some form of technical expertise, and concentrate their efforts on maintaining or expanding their market shares.

Some companies have achieved leadership positions in specialized market niches: Kindou in high-quality children's fashions for the Lebanese market, SEKEM in health products, Horreia 2000 in hard candy and Vitrac in marmalade. Others have successfully adopted a combined product-market specialization strategy. A few of them have been quite innovative, creating new markets for their niche products after long and intensive market research. Natoil, for example, has created a market for jojoba oil processing applications, Al-Ain a market for traditional lanterns and jewellery for intellectual Arab women, and Conserves Chtaura a market for ready-to-eat catering packages. These enterprises, particularly the first two, have faced little or (in the case of Natoil) no competition in the highly specialized niche markets that they have created.

Product differentiation is another major marketing tool that almost all the enterprises have adopted, addressing, in essence, buyers' preferences for similar substitute products. In most cases, the enterprises have responded to changing market conditions by adapting their products to customers' tastes and needs and producing customized products for fragmented market segments. With differentiated products, individual enterprises have gained a measure of freedom in setting their prices relative to those of their competitors; this is an advantage that they would not enjoy if they were producing undifferentiated, standard, low-quality products. By differentiating their products, the Lebanese enterprises have been able to cope with high production costs, while the Egyptian firms have been able to hold their own against stiff competition in the domestic market.

Some of the companies have used design as a means of product differentiation, as Bella Donna and Kindou have done with fashion clothing, as Al-Ain has done with lanterns, and as the Egyptian International Trade Company has done with embroidered textile products for household use. Others have concentrated on the physical quality of their products, including HAG Wooden Furniture with its customized furniture kits at affordable prices, Horreia 2000 with its higher-quality products and its packaged hard candy, Vitrac with its glass pots of marmalade, El-Rashidi with its halawa snacks and its quality packaging, Kindou with its auxiliary services, including door-to-door delivery to its customers all over the world, and La Lainière Nationale with its quick-response approach in the textile and clothing supply chain. Most enterprises reported that they conformed to international standards, especially if they exported their products. In some cases, product differentiation took the form of advertising and sales promotion efforts intended to win the loyalty of potential buyers. Several enterprises have used a combination of two or more of the above approaches to product differentiation.

Branding is a key marketing tool for enterprises at all stages in the supply chain. Horreia 2000 has established a commercial name, Kindou and SEKEM have developed their own branded products, Bella Donna and ETC have sought branded partners. By these various means, the companies in question have added value to their products and have been able to access difficult markets and attract sophisticated consumers. As the consumer continues to search for "value", a brand name is a form of product differentiation which tends to convey a message of quality. Thus a brand name may guarantee a market, exert greater appeal, and even attract higher prices.

Adopting appropriate new technology and keeping up to date on equipment with a view to improving a firm's innovative capacity. Almost all the innovations reported involved the installation of new technology and, in many cases, the automation of production. In essence, appropriate new technology (not necessarily the latest technology) will help manufacturing enterprises achieve the targeted physical qualities of their products, and, in most instances, improve their innovation capacity. El-Rashidi, for example, took a machine that had originally been designed for producing paint, made some modifications, and transformed it into a machine for making halawa. This has opened up opportunities for further innovations that have helped the company expand its range of halawa products. Horreia 2000 installed new technology that has helped the enterprise transform itself from a low-quality production and packaging company producing standard hard candies into an upmarket operation producing a wide range of high-quality, differentiated, impressively packaged hard candies at competitive prices.

(b) *Management*

Innovation or change, by definition, requires the establishment of a new system, which in turn demands new management, and success in implementing change is correlated with success in developing a suitable management approach. Most of the enterprises covered in the survey showed awareness of the benefits of enhancing the quality of management in general, and a few of them associated those benefits with innovation. The management of innovations introduced by these enterprises concerned mainly the areas of organizational structure, organizational management and human resource development.

(c) *Industrial organization*

Adopting a new strategy and introducing new technology entails, in many instances, changes in the organizational structure of the enterprise, as in the case of Bella Donna. This company has carried out a substantial organizational restructuring in pursuing its new marketing strategy targeting the sophisticated European consumer of high-fashion styles. This has entailed separating production from marketing and turning them into two separate business entities, replacing all the old machinery with new, state-of-the-art machinery, significantly reducing staff, adopting international costing methods, selecting a foreign branded partner and applying franchising as a sales distribution method.

Promoting the generation of new ideas and innovation requires management to adopt a participative approach to consultation and decision-making, with greater flexibility and the granting of a measure of autonomy, as appropriate and in varying degrees, to the several organizational spheres. Innovative firms such as Indevco, SEKEM, ETC, El-Rashidi, Timezero and others have recognized the important role of individual staff members and the group spirit in contributing new ideas and enhancing the firm's innovative capacity. This entails the promotion of mutual respect, the elimination of "intimidation functions" within the enterprise and the creation of a flatter management structure. Some firms, such as Indevco and SEKEM, have created autonomous projects and subsidiaries for that purpose, while Timezero and Com.Com have adopted a teamwork approach to management. El-Rashidi has deployed a bottom-up approach to planning, giving the company's various departments and their managers space to come up with innovative ideas. A participative approach and flexibility in management are also helpful in producing more motivated and committed employees who are more loyal to the group, and hence more innovative.

(d) *Management of human resource development*

Creating an innovative enterprise by attracting the right skills into the work force, enhancing employees' capabilities through a human resource development scheme, developing competent employees within the organization and retaining them through an incentive and reward scheme. Most of the enterprises covered in the survey did not link human resource development with innovation, but a few, such as SEKEM, Indevco and, to a lesser extent, ETC were quite advanced in that respect, having successfully adopted a comprehensive human resource development strategy. Those companies believe that market opportunities may be available, the necessary technology obtainable, plant, equipment and land accessible, but the factor that matters most and is crucial to a company's success and innovativeness is the people who work for it.

Indevco has instituted a Human Resource Department with the task of establishing policies and procedures for staff recruitment, developing workers' capabilities and skills and then assigning them to teams working on new projects. The enterprise recognizes the human element as its most important asset. SEKEM, for its part, has introduced its human resource development strategy as part of an overall culture bonding business to development, including human resource development. The enterprise has established continuous on-the-job training for its workers and has recently established an associated polytechnic institute for development of the human resources both of the enterprise and of the neighbouring village community.

ETC's human resource development program aims at creating a learning environment and transforming the enterprise into a learning organization. The company organizes lectures and small seminars on management, personal development and technical issues and provides on-the-job training programmes for the workers. It has published its own training manual for the clothing industry. The company is also building a library with relevant up-to-date documents and magazines for its employees, and it encourages them to attend courses, including English courses, after working hours by offering to pay their fees, with a view to helping them upgrade their capabilities and gain access to knowledge from foreign sources.

Fostering innovation by creating and developing incentive programs and rewards, which a few of the enterprises covered in the survey said that they had introduced in various forms. These consisted mainly of incentive schemes and performance/profit-related pay, non-monetary benefits, bonus schemes and, in the case of ETC, a share ownership scheme. None of the enterprises, however, reported having an innovation incentive scheme as such. Creative efforts need to be recognized, even if they do not lead to innovation, and innovative performance by company staff should be rewarded through an innovation incentive scheme.

(e) *Information technology*

Applying information technology improves a firm's innovation potential, making its operational processes substantially more efficient and its managerial and marketing strategies and processes much more effective. This was observed in most cases of innovations reported by the enterprises covered in the survey, although the complexity of the applications involved was variable. One enterprise that was found to be relatively advanced in terms of being IT-oriented was Kindou. That enterprise has installed an IT system for the complete cycle of manufacturing, outsourcing, marketing, distribution, stock-taking and customer feedback. The company has applied a CAD/CAM (computer-aided design and manufacturing) system and installed computer links with its franchised shops running its in-house-developed software, thereby obtaining a complete on-line data system for efficient stock movement monitoring at all points of sale as well as a means of reaching better management decisions. Kindou was among the first to adopt a person-to-person marketing strategy by introducing its Fidelity Card, by means of which it can estimate the potential of every customer. It has a Web site, and it offers door-to-door delivery all over the world.

V. CONCLUSIONS AND RECOMMENDATIONS

It is clear from the above analysis that increased involvement by SMEs in innovational capacity-building may enhance their competitiveness. However, firms will differ in terms of their innovational potential, and that difference will be reflected in their levels of innovation. Differences in competitiveness between firms may be due in part to differences in their innovational capacity and incidence of innovation. Different firms follow different paths in terms of product and process innovation levels. High-performing, innovative enterprises are characterized by, *inter alia*, unique technology or products, in-house design capabilities, mechanisms for meeting customer demand and an ongoing effort to charge maximally competitive prices.

Innovation in SMEs is associated with economic development or growth performance. Innovative firms display good performance and are capable eventually of creating an enabling economic environment and stimulating the recovery of a depressed economy.

There are no hard-and-fast rules about innovation or innovative initiatives. Innovation need not consist of a radically new product or a technological breakthrough. Innovation may be incremental, i.e. an improvement to an existing product, as in the cases of Timezero and Com.Com., or a product development, as in the case of Randa Fahmi. Innovation may take the form of a novel approach to a production process or a marketing strategy, as in the case of El-Rashidi El-Mizan, or it may involve an organizational change, as in the case of Bella Donna, or the introduction of new conditions for human resource management, as in the cases of SEKEM, ETC and Indevco.

Essentially, the main characteristic of innovation is change. It is fundamentally a cumulative process of learning, searching and exploring. It involves a combination of new and old ideas and knowledge which results in new or improved products, techniques, processes and forms of organization and new markets.

SMEs in countries of the ESCWA region must be aware that organizational barriers to innovativeness are to be found both in formal structures and in the informal group dynamics that influence individual action.

If SMEs in countries of the ESCWA region are to survive and prosper in this age, they need to assess their innovative capacities and take strategic action to improve their innovative skills.

(a) *Fostering an innovative culture*

Culture plays a key role in the development of a firm's capacity to innovate. It influences the way a firm operates and the relationships among its employees. Innovation requires a mentality characterized by initiative, a sense of creativity and dynamic organizational capabilities, one that is open to new ideas and other cultures and promotes a learning environment. If innovational capacity is to be developed, innovators must be tied to the company's shared values and goals. Values that support innovational capacity must be woven into the fabric of the corporate culture.

(b) *Developing learning SMEs*

In this knowledge-based age, SMEs must construct themselves as learning organizations and become increasingly knowledge-based by developing a culture of learning that provides conditions conducive to systematic, across-the-board work force development. Innovation is related to learning, in the sense that it is an outcome of learning. A prerequisite for competition in the new era of the knowledge economy is an organization that fosters a learning environment. If manufacturing SMEs in the countries of the region are to survive and remain viable in a dynamic international and regional environment characterized by uncertainty and rapid change, they must possess learning capacity. This means that employees must become learning individuals, as it is they who are the key to a firm's competitive advantage, it is they who make the real difference.

(c) *Human resources – an asset*

Local SMEs should be aware of the importance of their employees. In many situations, managing people so as to bring out the best in them will significantly enhance business performance. Anyone and everyone can be an innovator. It is a misconception to suppose that only a small minority of people can be genuine innovators. In fact, in most companies there are many people who possess the qualities usually attributed to innovators but who never have an opportunity of putting their abilities to work. In many cases this is likely to be because they are stifled by the way the company is managed, perhaps with a cramping bureaucracy or a restrictive centralized decision-making structure. Given the conditioning that results from the way most companies are managed, unfortunately, individuals tend to allow their innovative traits to atrophy.

Local SMEs should realize that true innovators are not solitary individuals working in isolation. In practice, many people participate in the innovative act. Companies, inevitably, rely on both specialization and co-ordination, with the result that innovation is fundamentally collective in nature. Corporate innovation is rarely attributable solely to the vision and courage of a single individual striking out alone along an uncharted path.

Local SMEs need to adopt a more participative approach to management and provide attractive rewards and incentives in order to recruit and retain innovative employees.

(d) *The role of management*

Successful innovation is correlated with the nature of change management. Management includes the ability to integrate market opportunities with technological capabilities, creative problem-solving skills, tacit knowledge sharing and experimentation. The competence of a firm is often attributable to its engineering, design, research and marketing resources and assets; the role of management consists in combining those resources with market opportunities to generate innovations.

The manager's job is to shape the goals, incentives, values and conditions that lead others to innovate. The manager who can maintain an environment in which others can allow their innate creative abilities free play is central to his/her company's vitality and competitive vigour. A manager must have sufficient self-confidence and strength to be able to tolerate the ambiguity and risk associated with new undertakings and work with innovators.

To encourage innovation, companies must value and reward conscientious, creative efforts, even when they do not end in innovation. This is one of a number of basic values that must pervade a company seeking to foster innovativeness. Members of management must be willing to tolerate uncertainty and ambiguity; they must value open communication, even if it results in controlled conflict. There must be a widespread willingness to challenge conventional wisdom, and managers must be supportive but thorough in assessing ideas and opportunities.

One major source on which a firm may draw in its efforts to achieve innovativeness and enhanced productivity is effective management of its knowledge resources. In the industrialized countries, a variety of systems and models, based on information technology for the most part, have been developed to harness the potential of tacit knowledge. SMEs in the countries of the region must be aware of these developments; however, they should be cautious in adapting these systems to their own local environments.

(e) *Networking and co-operative relationships*

SMEs in the countries of the region should develop industrial networks and encourage co-operative relationships among economic actors. Those relationships might assume different forms, but their development is of crucial importance for the countries in question, since most economic actors have a history of operating relatively independently. Innovation is a product of networking, and the milieu in which an enterprise operates is an important factor in its innovational capacity. It may either enhance that capacity by promoting collective learning and reducing uncertainty, or it may inhibit it by doing the reverse.

Local SMEs must realize that networking initiatives are essential to the ability to innovate, functioning as they do as a vehicle for importing external knowledge. Such a vehicle is crucial for many sources of innovation that do not reside exclusively within an individual firm. These networking initiatives are frequently informal, and an innovative firm will turn both informal and formal networks to advantage.

(f) *Technical support institutions*

Local SMEs are likely to benefit from externalities originating in their immediate environment. Technical support is immensely valuable to SMEs, but may be costly to provide on an individual basis. Governments should therefore help out by establishing bodies that provide SMEs with subsidized services or resources. In addition, private firms should contribute by creating support pools to help finance such endeavours. They should also seek to strengthen links among the support institutions in the region, including universities, training and research institutions, laboratories and business support agencies.

(g) *Government support*

The role of Governments in the ESCWA region is to create an innovation-friendly environment that helps SMEs to remain successful, and to encourage the establishment of new ones in their respective countries. In view of the new competitive conditions resulting from globalization, Governments must develop new policies that foster innovation and promote the innovational capacity-building of manufacturing SMEs.

Governments in the region need to develop a comprehensive approach to the promotion of an environment conducive to innovation, and to the task of assisting SMEs in developing their potential innovational capacity. Governments need to devise national innovational strategies and establish bodies to implement those strategies. The main function of such bodies would be to enhance SME's innovational capacity-building by offering relevant services that are currently lacking, such as industrial parks, training, applied research, technical assistance, dissemination of information, data bases, quality control, technology transfer, management systems and so on. National innovation bodies might be created in partnership with representatives of the private sector, such as producers' associations, educational centres, local banks and the like.

Governments need to conduct national field studies to learn more about the innovation activities of SMEs in their respective countries and to assess their innovational potential. They need to determine the factors that are inhibiting or promoting innovation, identify the kinds of support needed by SMEs for their innovation activities, and find ways and means of contributing to the building of firms' innovational capacity and the creation of an innovation-friendly environment in their countries.

(h) *Regional co-operation in innovation activities*

Governments in the region need to co-operate in their efforts to enhance SMEs' capacity for innovation and promote an innovation-friendly environment. This could be achieved through the establishment of a regional coordinating body for innovation that would initially serve to promote exchanges of information and experience among national innovation bodies, and perhaps, at a later stage, facilitate co-operative support activities for innovation.

(i) *Further studies on the diffusion of innovation required*

The international community, including ESCWA, should help Governments by undertaking further activities on the issue of innovation in the region. Those activities might include further regional studies on the diffusion of innovation, the analysis of factors tending to inhibit the spread of new ideas and innovations in the countries of the ESCWA region, and the preparation of policy recommendations designed to foster the diffusion of innovations.

Annex I

INNOVATION EXPERIENCES FROM THE ESCWA REGION – SELECTED CASE STUDIES

A. EGYPT

THE AL-AIN COMPANY (Azza Fahmi)

1. *Nature of innovation*

Innovation in design and product development: The manufacture of high-quality jewellery, every item consisting of a blend of silver and gold and with a unique design. Azza Fahmi is a creative, highly cultivated jewellery designer and entrepreneur. In 1978 she embarked on the design and manufacture of high-quality ethnic jewellery featuring gold and silver blended in a way that combines a decorative modern style with intellectual and traditional touches. Her jewellery has come to be known as "elite jewellery".

2. *Introduction to innovation*

Azza's ethnic artifact jewellery combines culture with art and authenticity with beauty. It features beautiful Arabic calligraphic inscriptions consisting of quotations from the Arab poets, proverbs and other folklore items. Azza has transformed jewellery-making from a craft into an artistic message of culture, tradition and history. Her jewellery caters to all ages and tastes, and it is intended to be worn by men, women and, more recently, teenagers.

3. *Historical background: challenges addressed by innovation*

Eight years after graduating from the Faculty of Fine Arts in Egypt, Azza Fahmi discovered her interest in ethnic jewellery, and she has pursued her passion for the design and manufacture of ethnic jewellery ever since.

In order to perfect her skills, Azza decided to become an apprentice in the establishment of a master jeweller in the Khan El Khalili, which is the epicentre of the jeweller's craft in downtown Cairo. In the course of two years there, she learned the various techniques of soldering, smoothing and finishing silver and gold, the ability to distinguish precious and semi-precious stones from fake ones and the value and characteristics of each stone. She also learned about the culture and mentality of workers in the craft and acquired an understanding of their psychological, environmental and social background. The experience was very useful to her when her own business started to expand many years later.

Azza started with a very small budget and on a very small scale: her initial capital enabled her to manufacture five pieces of jewellery. However, the jewellery was an immediate success, and her capital multiplied fivefold in a very short period of time. This gave her an incentive to continue and eventually expand her business.

One of the most difficult challenges she had to face was that 25 years ago, jewellery-making was a predominantly male profession; it was not socially, culturally or traditionally acceptable for a woman to engage in it. During her apprenticeship, Azza faced many difficulties and considerable resistance while trying to learn the ins and outs of the craft. Subsequently, her greatest achievement was to attract skilled male workers to her workshop. But Azza is a natural leader with good managerial skills, and she was able to handle the culturally delicate situation of being the employer of a number of her male ex-seniors in the trade.

Having won the respect and trust of her male colleagues, Azza's next major challenge was to revolutionize the tradition of the craft in the matter of the gender issue. Owing to the rough manual work involved in jewellery-making and the use of materials harmful to the skin, the craft has traditionally been monopolized by men. Women were allowed to help with only the simplest tasks, those requiring no skill at all. They were not given the chance to do more because they were traditionally considered to be weak, limited and generally incapable.

But Azza believed in her own ability and the capabilities of other women. She was adamant that women should be able to engage in jewellery-making, regardless of the hard work and perseverance the effort would require of her and her workshop. She began recruiting adolescent girls and women as apprentices to be trained by her senior skilled male workers. The outcome was a great success: three years later, the girls were producing complete pieces of jewellery by themselves. Today, Azza enjoys a strong lifelong bond with all her employees, both men and women. This has been a crucial element in her success.

Azza has now gone on to approach this issue from a humanitarian standpoint by recruiting handicapped girls and women as apprentices. In the course of our interview, she emphasized that her domestic and international success to date had had a positive impact on her thinking and had helped her appreciate the importance of the social and humanitarian dimension of her business.

4. *Objective of innovation*

Azza's goal is to continue to grow in order to strengthen and preserve a tradition and to foster greater awareness of a beautiful heritage through a small, handmade, aesthetically attractive product worn by Egyptians and persons of other nationalities, both men and women. She feels she bears a great responsibility for the maintenance of a cultural heritage which she believes she can pass on to others by means of simple modifications that do not compromise its authenticity.

5. *Process*

After two years of apprenticeship, Azza held her first solo exhibition in Cairo, inviting intellectuals, journalists and friends. All the pieces were sold. As she began to establish herself in the field, she poured all her energy into her business. However, she found time to visit museums in search of a better knowledge of her country's heritage, and this led her to the production of designs and creations that required higher technical skills for their realization than her workshop master, Hag Sayed, could provide. "My mind seemed to be working too fast for my hands and his techniques to follow," she said. By mere chance she won a scholarship to study jewellery-making at one of the most prestigious institutions in the field, the City of London Polytechnic in the United Kingdom. Azza's experience and education gave her confidence and expertise. Upon her return to Cairo, she opened her own workshop and hired one assistant. They became a team of two, then a team of four, and now they are a team of fifty.

Azza takes pains with her designs and collections, and is constantly improving the quality of her products. Each year she produces a new collection, inspired from a variety of themes, depending on trends in culture and fashion. She perfects these new designs through meticulous research and study on the new subject. The theme of her most recent collection is Sufism, which she selected in the hope of encouraging European and American customers to learn more about it. Her unique products are always in great demand, both domestically and world-wide, and this shows her strenth as an entrepreneur.

Azza travels widely in her own country, visiting remote areas and deserts, as well as outside Egypt, in search of inspiration for new designs and themes that will enrich her jewellery with genuine ethnic motifs. She participates in various international jewellery fairs, thereby exposing her products to different cultures, broadening her intellectual scope and networking.

6. *Success of innovation*

Azza now owns Egypt's largest jewellery empire, and she is a member of the World Gold Council. Her creations are known world-wide, and they are in constant demand. Her workshop employs 50 persons, including a sales manager, a production manager, production engineers and administrative staff.

7. *Impact of innovation on other firms*

Azza's superb, refined jewellery has forced other Egyptian jewellery makers to improve the quality and design of their products in order to be competitive. Jewellery, though a craft industry, accounts for a

relatively large percentage of consumer spending in Egypt (and in other countries of the region). Consequently, improved product design and quality are significant assets in the industry's effort to maintain, and eventually expand, its share of the domestic market and perhaps the export market as well. It is noteworthy, however, that there is now a domestic market for well-designed heritage jewelry of good quality.

Two years ago, Azza began to provide local jewellers with technical assistance. She has also embarked on awareness-generating projects such as the Gold Conference in Dubai, in an effort to facilitate networking in Europe for other companies. She also continues to provide professional advisory services and assistance. In addition, she is currently planning to write a book on ethnic jewellery in Egypt, and will make her collection available to researchers or academics in that field.

8. *Internal factors inhibiting innovation*

The main problem is one of management. Azza runs what is effectively a one-woman operation: he is the designer, the public relations officer, the comptroller and so on. Another problem is the lack of space in her workshops and the dispersal of the work to a number of different workshops. She hopes this problem will soon be solved, as she is planning to merge all her workshops into a single facility located in one of the industrial districts just outside Cairo. Other problems and challenges that Azza faces on a daily basis include high turnover among her women workers, many of whom leave their jobs upon marriage or upon becoming pregnant, and the scarcity of skilled, dedicated workers in the field.

9. *Lessons diffusible to other SMEs*

(a) Creation of a new niche market in jewellery for intellectual Arab women;

(b) Use of existing international technical and intellectual forums to promote her products;

(c) Success as a woman entrepreneur, running what is almost a one-woman operation in which she is the designer, the general manager, the public relations and marketing officer, the comptroller, etc.

THE AL-AIN COMPANY (Randa Fahmi)

1. *Nature of innovation*

Innovation in product development and design: Production of traditional heritage lanterns (*fanous*) in high-quality, attractive designs, made of brass or silver, usable as functional lighting devices.

2. *Introduction to innovation*

During the sixteenth and seventeenth centuries, the antique type of lantern known as a *fanous* was the most important lighting device used by ordinary people in Egypt. Randa Fahmi is a woman of vision who realized that those lanterns, which were no longer seen among the traditional items available in contemporary Egyptian markets, could be her passport to the field of heritage products. Good entrepreneur that she is, she introduced replicas of these antique-style lanterns, and today she has succeeded in establishing her name and enjoys a good reputation as a producer of them.

3. *Historical background: challenges addressed by innovation*

Randa Fahmi, a fine arts college graduate, had always aspired to do business in an area related to her heritage and tradition. She was in the habit of frequenting museums, and liked to visit the old part of Cairo, where there are a number of metalworking shops. After observing various metalworkers, she realized that most of them were skilled at their craft but were producing traditional metal products that were poorly designed, unattractive and of low quality.

One of her excursions took her to the Geographic Association Museum, which exhibits various items and products of everyday use from the sixteenth and seventeenth centuries, such as jewellery, dresses, pots and the like. Among other things, Randa was astonished by the various designs of traditional lanterns displayed at the GAM. These lanterns had been nearly forgotten, and were seldom seen among the traditional products available in the contemporary Egyptian market.

Her biggest challenge was to find skilled metalworkers who were familiar with the old technique used to produce these traditional lanterns, as she herself had no experience with traditional or contemporary metalwork. In addition, she encountered great resistance from the traditional metalworkers at the shops in the Old City when she tried to explain how she wanted the lanterns made. They all responded that the work required was too complicated and difficult, and thus would be uneconomical. Randa's resources were limited, and replicas of traditional lanterns were a novelty for the market and far too expensive.

Another problem that Randa had to face was lack of knowledge of good techniques in producing designs of the kind she wanted, which would involve many hours of handwork and considerable expertise. She had many designs and ideas, but she faced difficulties in realizing them because she herself did not possess the necessary skills, and none of the metalworking shops in Cairo could do the work for her.

4. *Objective of innovation*

Randa's main goal was to create a domestic and eventually an export market for traditional antique-style lanterns in high-quality, unique designs, produced in commercial quantities, that could be used as functional lighting devices, thereby maintaining part of the heritage of old Egypt.

5. *Process of introducing innovation*

Randa studied lanterns of some 60 different designs at the Geographic Association Museum. After a long and tiring search, she finally found a workshop that was willing to produce the lanterns in accordance with her directions. She insisted on the use of the old metalworking techniques for each of the several designs, and they had to be of superior quality. She worked closely with the metalworkers daily for a year, until she was able to learn the craft and master the production herself. She then held an exhibition at the

French Cultural Centre in Cairo, at which all her replica lanterns were sold. This gave her an indication that there was substantial market demand for a well-designed, finely produced, functional heritage product.

The success of the exhibition prompted Randa to establish her own workshop, starting with five traditional metalworkers. She decided to invest time and energy in these workers, training them in the old metalworking techniques and the whole production process. As her business grew, she had the skilled workers in the shop teach the techniques to new entrants, and in this way the art was passed on.

During the first three years, each worker made approximately two small lanterns or one large one per week, so that the company produced an average of 10 small lanterns per week, or 500 per year. As domestic and foreign demand for her lanterns increased, Randa realized that she had to raise her yearly output to a level such that she could meet the demand, yet without exceeding that level, as otherwise she would have to deal with a costly overproduction scenario. She solved the problem by setting up a production system under which one new workshop with a labour force of 10 was opened at a time, for an incremental increase of 1000 lanterns yearly.

By the early 1980s, after three years of hard and successful work, Randa was famous for her silver *fanous* lanterns, with their attractive designs and motifs. However her creative drive and innovative ability did not stop at that: she expanded her product range, applying new techniques to manufacture a variety of small items and mirrors which were very well received in the market.

Randa traveled extensively for research purposes, and attended the London Polytechnic to learn about various metalworking techniques, including casting with enameling. She introduced a new line of brass lanterns in a Mamluk design, using a new technique. These lanterns were made to the same proportions as the old traditional brass lanterns.

Randa believes that part of the reason why these lanterns have been so successful is that they are properly proportioned, as well as being well designed and skilfully made.

6. *Success of innovation*

Randa now has six workshops employing a total of some 60 workers, including designers, administrators and handcraft workers, and is in the process of expanding her business by opening a factory at the Sixth of October Industrial City. Her products are in constant demand: they are sold to tourists, tourist offices, five-star hotels, restaurants and private residences. They also sell briskly in the export market, including the Gulf Co-operation Council market, with its hotels and palaces. Indeed, she can hardly keep up with the demand under her current production scheme.

She is now considering the possibility of expanding her production capacity by introducing automation, especially for her simpler designs. She is also studying the Western countries with a view to learning more about consumer tastes in heritage products, hoping to break into hitherto untapped markets.

7. *Impact of innovation on other firms*

The introduction of the various types of well-designed, high-quality lanterns has been useful to Egyptian architects, who had been looking for a traditional, functional, aesthetically acceptable lighting device. Traditional lanterns had long since disappeared from the Egyptian market, despite their important heritage role. Ever since Randa's replicas were introduced, architects have been using lanterns of various sizes and shapes that are not available from Al-Ain. This has created further demand, and such lanterns are now being supplied by other metalworking shops, although they are not of the same quality and finesse. Similarly, Randa's other small heritage metalwork items have opened up fresh opportunities for other workshops. As a result, today there are plenty of attractively designed heritage products for tourists to take away with them as souvenirs of Egypt. The Khan El-Khalili is no longer the standard in terms of quality and variety; the items now available are of much better quality and better designed.

8. *Lessons diffusible to other SMEs*

(a) Rediscovery of a domestic market for traditional lanterns, supplying architects with functional and aesthetically acceptable lighting devices;

(b) Creation of a market for traditional lanterns in the GCC countries;

(c) Reactivation of old lantern production techniques, and updating and modernization of those techniques;

(d) Introduction of new designs;

(e) Manufacture of customized products to satisfy buyers with different tastes.

BELLA DONNA

1. *Nature of innovation*

Innovation in organization and marketing. Bella Donna has introduced new, innovative concepts in industrial organization and marketing techniques.

2. I*ntroduction to innovation*

Fouad Houdrojj, Bella Donna's general manager, decided to reorganize the company and restructure its operations in order to meet the needs of a changing environment and remain competitive. He altered his company's strategy, shifting from production for the local market to production for the export market. Houdrojj introduced new concepts in industrial organization, operation and production. He approached the production of fashion clothing in a novel way, focusing on selected fashion items, improving production quality, applying international costing techniques, exporting to branded retailers in Europe and selling locally through franchises.

3. *Historical background: challenges addressed by innovation*

Bella Donna was established in 1978 with two factories producing a variety of knitwear. Since then, the company has expanded its production twice, first in 1983 and again in 1990, in order to meet the needs of the local market. Protectionist policies in Egypt gave clothing producers monopolistic power over the consumer, dictating prices and product quality. In 1993, due to market growth, there was a boom in private industrial production. However, with a limited domestic market for quality fashion products, this expansion eventually led to overproduction, followed by severe competition among local producers. In 1995 the problem worsened: the market became oversaturated, and companies found themselves burdened with huge inventories of unsalable goods, incurring heavy losses. Fortunately, the export market was not affected, and companies that were producing for export were able to sustain their operations.

During this time, Bella Donna made several attempts to export its production, but without success, and consequently was having trouble keeping afloat. Houdrojj quickly identified the problem: his company's production and operating costs had doubled, while sales had declined sharply. He also learned that Egypt's operating and production costs were similar to those of Europe, particularly Italy, and far higher than those of competing producers in China, India and Malaysia.

Houdrojj decided to accept the challenge of producing for the export market in an effort to keep his company profitable. He conducted market research on consumer tastes, fashion trends and style preferences in foreign countries. He increased his production of certain styles to meet demand from the export market, and reduced production lead times in order to respond quickly to that demand. His promptness in delivery and his willingness to be flexible in providing additional supplies gave him an edge over his competitors. He was able to implement this strategy while maintaining competitive prices through proper costing and hedging against exchange rate fluctuations.

His new strategy yielded benefits in the domestic market as well, as domestic producers now had to cater to a more demanding consumer who required variety, quality and a more fashionable product.

4. *Objective of innovation*

Bella Donna's main objective is to continue to improve productivity and increase its capacity while focusing on production that conforms to international standards. Houdrojj's goal is to capture a larger share of the export market while also keeping a large share of the local market.

5. *Process of introducing innovation*

One of the first things Houdrojj did was to separate production and marketing into two separate business entities. He then replaced all the old machinery with new, state-of-the-art machinery, with the result

that the company's work force was reduced from 500 to 270, while production increased. International costing methods were adopted in order to reduce production costs, and competitive prices were achieved.

Concurrently with the above, Houdrojj began to participate in the Euro-Partenariat Conferences organized by the European Union. After three years, five Danish firms expressed interest in Bella Donna's products. They all submitted offers, and the most suitable one was selected as a partner. Under the terms of the partnership, the Danish company provides the machinery, the designs and the expertise, while the Egyptian company makes the products and sells them to the Danish partner.

In the local market, the company has its own Bella Donna brand, and in 1999 it began making branded products under the franchise name of Rodier. The company organizes fashion shows and sells its clothing at Rodier shops. It now produces an extensive collection of knitwear in a wide variety of colours, styles and designs, providing the consumer with a wide range of options and enhancing the company's sales prospects. Many of the designs produced are copied from their export market counterparts, such as those produced for Rodier in Paris, and this gives Bella Donna an edge over its local competitors.

The company has benefited tremendously from its affiliation with a foreign company and its exposure to the export market. It has acquired knowledge of operating, production and marketing techniques, and it has been able to follow fashion trends, focus on popular designs and address quality and other sales-enhancing aspects. Bella Donna's most recent recruit is an in-house German designer to help with the production of the company's seasonal fashion marketing brochures. His fees and the cost of the brochures are 50 per cent financed by the Egyptian Government through an American aid programme.

6. *Success of innovation*

The company's production and exports have grown, with a 25 per cent increase in sales. The company's success in attracting foreign partners has been a key factor in its success in widening the base of its market share outside Egypt, and indirectly its share of the domestic market as well.

In October 2000, the company was preparing for its 2002 winter collection. It is currently in the process of establishing a French Polytechnic Institute for fashion design, to be known as Esmod. A family-owned clothing empire is taking shape. Bella Donna's owner has sent his younger brother to the United Kingdom to study textiles engineering, and his two daughters to Italy to study design.

7. *Lessons diffusible to other SMEs*

(a) Creative response to faltering conditions in the domestic clothing market: catering to a different market segment and identifying a niche export market in Europe of new concepts in industrial organization and management;

(b) Market research as a means of understanding consumer tastes, fashion trends and style preferences in Europe and in the domestic market;

(c) Introduction:

(i) Separating marketing from production management, creating two independent business entities, each specialized in its own field, to facilitate the operation of the business and to help in evaluating its performance more effectively;

(ii) Adoption of international costing standards as a means of maintaining price competitiveness;

(iii) Acquisition of new technology to reduce lead times, improve product quality and eliminate overemployment;

(d) Quick response to export market demand by reducing lead times and increasing production of fashionable styles;

(e) Enhancement of the company's edge over its competitors by prompt delivery of products and willingness to display flexibility in providing additional supplies;

(f) Adoption of different marketing approaches by identifying branded partners in the export market, and branding their products and adopting franchising methods for sales distribution in the local market.

COM.COM

1. *Nature of Innovation*

Product innovation: Web site and CD ROM combined with culture.

2. *Introduction to innovation*

Com.Com has developed a software programme on Egypt entitled *Age of the Pharaohs*. It was researched and prepared using 3D modeling, digital sound and high-quality video, and is enriched with over 500 true-colour photographs. It is an interactive guide containing in-depth coverage of ancient Egyptian history. The programme meets international standards and is available in English, French, German and Italian. Its features include the following:

(a) Pharaohs Chronicle: An index of 100 Pharaohs containing all relevant information over 3200 years of Egyptian history;

(b) Gods: Descriptions of 20 important gods and goddesses, their glories, mysteries and wealth;

(c) Crafts: The secrets of ancient Egyptian crafts, such as mummification, pottery, jewellery and agriculture;

(d) Monuments: A detailed audio-visual panorama of the glamour and prosperity of ancient Egyptian art and architecture as reflected in the buildings and relics found throughout Egypt;

(e) Capitals: Fifteen ancient Egyptian capital cities during the Pharaonic era;

(f) Pharaohs in Focus: Includes 15 topics unveiling secrets of ancient Egyptian daily life: the ankh (the "key of life"), astronomy and astrology, the calendar, etc;

(g) Mythology: A selection of five amazing tales from ancient Egyptian mythology.

The software also includes a tourist map of Egypt. This is a complete interactive guide to tourist facilities in Egypt covering 16 different fields: hotels, travel agencies, recreation centres, resorts, transportation, sport centres, restaurants and so on. The map comes with a highly comprehensive search engine that can make any information item available at the touch of a button.

3. *Historical background: challenges addressed by innovation*

Maged Mustafa, a computer engineering student at the American University of Cairo, developed a new program for his final graduation project, one that enabled the "midi card" in a computer to read oriental music by familiarizing it with the quarter-tones and *maqamat* (modes) of Arab music. When the computer was connected to an electric piano, the program would send instructions and the music was played on the piano. Mustafa was awarded several prizes for this ingenious software, and in 1996 he was given an opportunity to participate in the GITEX fair in Dubai, one of the largest IT fairs in the Middle East. There he was able to sell his programme.

In 1997, after graduating, Mustafa and two associates founded a company called "Com and Com". The company sold software, computers and computer accessories and provided IT consulting for commercial firms. It was not long, however, before Mustafa realized that he was not the only one in the market providing that type of service, and that he had to be innovative in order to compete.

The Luxor terrorist incident of 1997 and the subsequent decline in the numbers of tourists visiting Egypt were the inspiration for Mustafa's new business idea of developing software programmes on the attractions of Egypt that would be accessible to anyone anywhere in the world.

4. *Objective of innovation*

To offer customers a product promoting knowledge of Egyptian heritage and culture.

5. *Process*

Mustafa's first step was to develop an Internet site, egyptguide.com, to provide information on Egypt. He then sought to promote Egypt through software programmes that would acquaint foreigners with Egypt, including its history and historic sites, with the objective of enticing and encouraging them to visit the country. Seeking a wider market, Mustafa approached the Ministry of Tourism with a proposal to set up a Web page for a "Shopping Festival" that was being promoted by the Ministry and to develop a CD describing the various events and facilities, enriching it with colour photographs of Egypt. The Ministry agreed to back the project.

After completing the Web site and the CD, Mustafa went on to design a 3D modeling CD narrating the story of the Holy Family's flight into Egypt. His next accomplishment was an interactive CD guide to Sharm El-Sheikh and Ghardaqa. The Sharm El-Sheikh guide includes maps showing the best diving locations as well as detailed information about hotels, recreation facilities and shopping areas. The Ghardaqa guide, for its part, provides the user with colour photographs of all the fish species and types of coral found along Egypt's Red Sea coast, as well as the topography of the area. His idea is to market this product through travel agencies, so that they can provide every tourist travelling to Egypt with a useful guide.

Mustafa has copyrighted his innovations and officially registered them with the relevant Government authority.

In order to raise more capital, Mustafa made a public offering of shares in his company, and succeeded in attracting a number of established companies as shareholders. However, he kept 40 per cent of the company for himself and his management team. At that time, the name of the company was changed to Com.Com.

6. *Success of innovation*

Com.Com's business has continued to expand, so that it has been compelled to increase its work force. It currently has 24 employees, of whom 20 are engineers. It has received good exposure both locally and internationally: an Irish company recently subcontracted the development of an Internet education programme to Com.Com.

7. *Innovation-promoting factors internal to firm*

Mustafa has grouped his engineers into five teams, each consisting of four engineers working together, as a means of enhancing efficiency and productivity through the creation of a healthy competitive environment. In order to motivate his staff, he rewards hard- working, innovative, productive employees on the spot; he does not believe in promotion based on seniority, especially in the field of IT.

Working in the field of IT requires continuous learning and constant updating of knowledge. It is a highly specialized field in which a company will find it difficult to remain competitive unless it keeps abreast of all the latest developments. Mustafa and his team regularly attend training courses and information sessions, and the company subscribes to all the international magazines in the field.

8. *Lessons diffusible to other SMEs*

(a) Combination of culture with advanced technology;

(b) Identification of a niche market;

(c) Quality products;

(d) Formation of teams of software engineers as a key software development strategy;

(e) Incentives to employees;

(f) Continuous learning and skills development;

(g) Domestic and international exposure as a result of working with the Ministry of Tourism's "Shopping Festival" and the creation of a Web page, and as a result of marketing a product through travel agencies;

(h) Enhancement of the company's potential by raising new capital through a public share offering which attracted other established companies.

THE EGYPTIAN KNITTING AND READY MADE COMPANY (ETC)

1. *Nature of innovation*

Innovation in human resource management: The introduction of a participative approach to management, a learning culture in corporate operations and a welfare-oriented system of incentives in the area of working conditions.

2. *Introduction to innovation*

ETC's innovative approach to management and administration has involved the creation of a working environment of committed employees through the adoption of a collective consultation policy in management. ETC has developed a culture that is learning-oriented and technically aggressive. It has introduced incentive systems to attract and retain employees while addressing issues related to their welfare and well-being.

3. *Historical background: challenges addressed by innovation*

The company was founded in 1975, with 10 machines in a basement making knitwear and ready-made clothing. From 1975 to 1982, it employed 200 workers and produced for the fiercely competitive local market. At that time, there were eight factories in Egypt producing similar products; within nine months, all but two of them had been eliminated as a result of competition from their rivals.

ETC's main objective at that point was to diversify its products and thereby gain an edge in the export market. There were several conditions that had to be met, notably sourcing the unfinished fabric on time, efficient production schedules and prompt delivery without compromising on the quality of the clothing. In a strategy of vertical integration, ETC simultaneously introduced its own fabric production facility and developed a contract manufacturing business, producing underwear under licence for the Spanish brands Gims and Miss, which compete with the French brand Gil.

By the end of 1982, ETC was exporting around 35 per cent of its production, and in 1987 the figure had reached 90 per cent. By 1997, ETC had 1000 employees and the value of its exports exceeded 25 million Egyptian pounds per year.

4. *Objective of innovation*

Bahaa El Din Rafaat, the general manager, was determined that Com.Com should continue to grow as a profitable business while maintaining product quality and prompt delivery, with commitment and dedication on the part of its employees. He saw the fostering of conscientiousness and a binding culture among the work force as key elements in the development of a profitable, successful learning organization, especially in the case of a large company. Realizing that its employees were its most important asset, ETC focused on human resource development.

5. *Process of introducing innovation*

ETC moved into new premises in 1997, and a new staff development programme was introduced at that time.

The company adopted a decentralization policy and a participative approach to management, to be implemented in several stages. Middle management and workers were associated with decision-making and the running of the business, as well as matters relating to employee welfare. Such issues as labour force turnover and absenteeism were of great concern to the firm's management.

As a means of enhancing self-management, a committee has been established to handle all administrative matters relating to productivity, punctuality and appearance. Responsibilities are distributed among workers' subcommittees that meet monthly with the manager in charge of the matters in question.

As a financial incentive, employees own 10 per cent of the company's shares and are allocated 10 per cent of the profits; the money is distributed on the basis of productivity (as measured by the number of pieces produced per unit time). Bonuses are paid for increases in productivity, provided the requisite quality is maintained.

Rafaat is particularly interested in creating a learning environment, and sets aside time for the identification of current issues. He also organizes lectures and small seminars in management, covering personal development as well as technical issues. Through these programmes, ETC helps unskilled new recruits to learn how to operate a sewing machine. They are then given training courses at the factory to enable them to master the work and acquire self-confidence. ETC has published its own training manual,[1] which is used by other companies in the clothing industry, and is also used by technical colleges for teaching purposes.

The Company is also building a library with relevant up-to-date documents and magazines for its employee. It encourages them to attend courses after working hours to widen their knowledge base, and it pays the fees involved, including fees for English courses for those who do not know the language, so that they can have access to new knowledge from foreign sources. The company is acting in accordance with the well-known Chinese proverb, "Don't feed me with a fish every day, but teach me how to fish."

ETC provides its employees with free transportation and a dining hall where they have their lunch breaks, and it will shortly be offering full restaurant service at affordable prices.

Welfare and social committees have been formed with a view to promoting a co-operative cultural environment for employees' benefit. Members of senior management, including the company's general manager, participate in these committees, where a friendly informal atmosphere prevails. The following are some of these committees:

(a) The Good Citizenship Committee, to increase employee awareness of the importance of proper working habits and codes of conduct, such as punctuality, time management, a positive attitude, openness and honesty, cleanliness, politeness, etc;

(b) The Bonus Committee, to reward those who excel in their work in terms of productivity, attendance, etc;

(c) The Co-operative is a shareholding company owned and operated by the employees and subsidized by the company. It sells products such as refrigerators, washing machines, clothing, food products and the like at wholesale prices;

(d) The Industrial Safety Committee is concerned with employee safety. It organizes training courses on safe machine operation, first-aid techniques, emergency measures in the event of fire or earthquake, and lectures on public health;

(e) The Bulletin Board Committee publishes a quarterly newsletter that covers social news of interest to employees: marriages, births, new staff members and promotions, as well as interviews and profiles of prominent personalities in the field;

(f) The Cleanliness Committee promotes the concept of hygiene and the maintenance of a clean environment in the factory and offices;

(g) The Colleagues Fund is financed from monthly contributions and payments by employees who have been fined for various offences. The money is used for social purposes and for emergencies. The fund is accessible to all employees.

6. *Success of innovation*

[1] Bahaa Rafaat and Aidya A. Al-Zarka, *Manufacturing Ready Made Garments* (Heliopolis, Egypt, 1993).

For a big company at this stage, the margin of profit is still low, and the innovation, which was introduced in 1997, has been slow in proving its worth. Otherwise, ETC has been successful: it is sustaining a competitive business, it enjoys a good reputation in the industry, and it has kept its customers and attracted new ones. Most importantly, work force turnover is low, and the employees show their satisfaction through their co-operation, dedication and commitment to the company.

7. *Innovation-promoting factors internal to firm*

Top management's creative vision has created an environment charged with creativity, efficiency and productivity. The collective approach to management enables workers at all levels to feel they can participate in an innovative process. ETC has pioneered a new way of operating a business that is innovative in itself, by establishing a learning environment that gives employees freedom to exercise creativity and achieve success.

8. *Lessons diffusible to other SMEs*

(a) Adoption of a participatory approach and collective consultation in management;
(b) Introduction of a welfare-oriented incentive system in the area of working conditions;
(c) Development of a learning culture within the company.

THE EGYPTIAN INTERNATIONAL TRADE COMPANY

1. *Nature of innovation*

Innovation in product design and quality: The introduction of differentiated embroidered textile products for household use, applying a unique variety of designs and colour schemes, using new technology to achieve high quality and efficiency.

2. *Introduction to innovation*

Heba El-Shafei wanted to introduce unique, high-quality embroidered textile products of sophisticated taste in a variety of designs, products that could be differentiated from those currently available in the market. In the event, she has succeeded in producing a wide range of bed linens, bed covers, towels, floor mats and the like, targeting new patterns of use and applying new designs and colour schemes. The production technique used is highly advanced, featuring the use of computerized machines for the entire production process, with new supporting programmes. This has helped Heba achieve good finishing and high-quality products, and has also improved production efficiency.

3. *Historical background: challenges addressed by innovation*

In 1985, when Heba El-Shafei was looking for bed linen for her home, she was unable to find products that were to her taste. Although embroidered bed linen was available in the Egyptian market, the designs, colours and finishing of the products were old-fashioned and unattractive. El-Shafei decided to buy fabrics, design the patterns she wanted and commission an embroidery workshop to execute them. The product turned out to be a great success, winning recognition and appreciation among her circle of friends. Some of those friends asked her to design bed linen for them as well, and it was not long before she realized that she had started her own business.

She now produces fifteen different high-quality, excellently finished products in unique designs.

4. *Objective of innovation*

El-Shafei set out to secure a larger share of the embroidered linen market by targeting a niche market: sophisticated customers. To that end, she introduced a variety of differentiated designs and high-quality products.

5. *Process*

El-Shafei started with a small showroom to exhibit her products to her customers, who in those days were mostly her friends. To make those products, she had acquired a second- hand computerized eight-head machine. However, her production technique changed substantially as time went on, and in due course she installed new computerized machines with new supporting programmes. The introduction of new technology enabled her to differentiate her products by introducing a unique variety of designs and improvements, mixing different materials and thereby adding new dimensions to the quality of the products. Heba was thus able to broaden her product range, targeting new patterns of use. All this gave her a competitive edge and a good deal of exposure.

The company had been profitable from the outset, and in 1995, El-Shafei took everything that she had saved from her earnings and relocated to the Sixth of October Industrial City, where she opened her own factory in roomier quarters. New finishing machines were added in succession to enhance the quality of the final product, until there were eight of them, with a total of 100 heads. She imported her machines from Italy and recruited experts to train the workers in their use. For the sake of maximum efficiency, she separated the production space from the design room and the rest of the operation by inserting a glass window.

The production process, which is automated, involves several stages: drawing the motif→ scanning→punching→preparing samples→downloading the patterns to the appropriate

machines→implementing the selected design→cutting→finishing→ironing→and packaging the products. Prior to the four final steps, all the work requires the use of computerized machinery and supervision by skilled workers at each stage.

Heba has gradually opened new marketing channels, selling her products in her own fashionable shops in three of the grand malls in Cairo and Giza, and in other shops as well, and she has also begun to export to Saudi Arabia. She has achieved exposure by attending numerous international exhibitions, where she also gets the feel of new ideas and trends in the international market.

Heba's ability to introduce continuous improvements and expand her business has been greatly facilitated by her practice of ploughing her profits back into the enterprise by investing in better-quality machines and equipment and opening new shops.

6. *Success of innovation*

El-Shafei began producing in 1985 in a small workshop with two workers and one second-hand embroidery machine. By 1995 her factory was employing 20 workers, and today she has 86 workers and eight machines. Her products are now sold in three fashionable shops that she owns in Cairo and Giza, and she has ventured into the export market, with sales to customers in Saudi Arabia.

7. *Lessons diffusible to other SMEs*

(a) Use of up-to-date technology (IT) for better quality finishing and greater efficiency;

(b) Identification of a niche market and targeting of sophisticated customers;

(c) Timely response to increased demand;

(d) Manufacture of differentiated products;

(e) Continuous improvements to the production process;

(f) Continuous exposure to new ideas and international trends through attendance at international exhibitions.

GLOBAL MARKETING OF TECHNOLOGY (GMT)

1. *Nature of innovation*

Innovation in marketing strategy: Networking for the global marketing of software for Egyptian shareholding ICT development firms.

2. *Introduction to innovation*

Networking is a completely novel and innovative approach to marketing in Egypt that has been introduced by GMT. Founded in 1998, this marketing company represents and acts for eight Egyptian ICT[2] development firms. GMT markets ICT solutions, applications, services, systems and innovations produced by its shareholding Egyptian companies. The firm's marketing efforts are directed toward the export markets of Europe and Africa. In Egypt, GMT has no competitors as yet, because the concept of networking for marketing is totally new.

3. *Historical background: challenges addressed by innovation*

The idea behind this innovative marketing approach is to address the difficulty of reaching the export market in information and communication technology applications, specifically in Europe and Africa. During the early 1990s, several Egyptian companies were established in the field, initially producing applications for the local market, and subsequently adjusting their applications to conform to international standards. These companies were quickly confronted with the problem of a limited domestic market, and consequently began to export their services to the neighboring markets of the Middle East, where some of them have been successful in establishing branches. In their efforts to expand into the markets of Europe and Africa, however, they encountered great difficulty and stiff competition.

In the case of Africa, the difficulty consisted in the absence of reliable statistics. It was hardly feasible for a single company to collect enough information on market assessment, and ICT firms, in general, had neither the time nor the necessary expertise. In addition, it was too expensive for one SME to do the job alone. Another problem was the dominant presence of other firms: competition in the African market was fierce. In Europe, on the other hand, the problem was of a different nature: Egyptian firms faced problems in marketing their software and expertise because they were unknown in that market and had had no previous experience there. In general, the challenge was how to penetrate new markets and increase market share in others.

These firms, realizing what a massive investment would be required for such an endeavour, decided to unite their efforts and pool their resources by forming a joint company to act on their behalf, promoting synergy and vertical integration among them as well.

4. *Objective of innovation*

GMT was formed to promote and expand the sales of its constituent Egyptian software firms in the export market, enabling those firms to focus on the development of applications, solutions, services, systems and innovations.

[2] The companies are: (a) Data Management Systems (DMS), est. 1993, producing software applications for hospital management information systems, 250 employees. The largest software house in Egypt; (b) Advanced Computer Technology Company (ACT), est. 1992, producing software applications for banking information systems, more than 300 employees; (c) Industry Management Information Systems, est. 1996, producing software for various industrial fields, 80 employees; (d) Com.Com, est. 1998, producing software for Internet Web site applications and designing, 18 employees; (e) Software Development, est. 1999, provides software development services, 25 employees; (f) Cairo 2000, est. 1998, provides software development services, 16 employees; (g) CIT, est. 1998, provides software development services, 30 employees; and (h) Alpha Masr, est. 1996, develops licensed software applications for users and provides patented ready-made applications.

5. *Process of introducing innovation*

GMT has been the dream of Sayed Ismail, the CEO of Advanced Computer Technology (ACT). Mr. Ismail is a prominent Egyptian businessman with 23 years of experience in ICT. He is the Chairman of Egypt's Chamber of IT and the President of the Egyptian Commodity Council, which is associated with the Union of Egyptian Industries.

At first Ismail encountered great difficulty in introducing his innovative concept, and he had to work very hard to convince his colleagues in the field of the importance and effectiveness of a marketing entity of the kind he was advocating. It took him four months of negotiations and discussions with the other seven companies before he was able to launch GMT.

A market study was conducted in the targeted export markets to assess immediate needs and requirements. To the surprise of all concerned, it appeared that there was strong demand for information technology experts, including developers, programmers and analysts. Egyptian firms' competitors in Africa were Indian firms, and in Europe, Israeli firms. The Egyptian ICT companies had an advantage over competing firms in the African market in that they were not focused exclusively on software development, but were also knowledgeable about general technical support consultation, project management and general maintenance. In Europe, GMT's biggest challenge is competing on a cost advantage basis. Overhead costs in the field are high, inasmuch as every expert needs his own PC, printer, multimedia equipment and other hardware. As sales increase, however, these firms will be able to reduce their prices considerably. At the same time, their network can be expected to grow, as Egyptian experts outnumber Israeli experts in the field.

The other major challenge was finding qualified sales and marketing experts and obtaining the funds required for the penetration of new markets.

Confronted with these difficulties, GMT responded by establishing ICT partnerships with experienced local firms that were knowledgeable about their respective markets. To date, GMT has acquired three local partners in Morocco, two in Kenya, one in Botswana, two in Libya and two in Ireland. All GMT's agreements with such local partners feature a division of labour whereby GMT handles the marketing aspects of any given project. It prepares marketing campaigns, provides materials needed for promotion such as brochures, press releases, booklets and CDs, and supplies professionals specializing in presentations and demonstrations.

In addition, GMT provides the business plan and, where required, technical assistance, while the local partner implements the business plan, handles contractual and legal agreements with customers and provides the necessary technical support on a project-by-project basis.

In promoting its products, the company assesses the ICT applications and services produced by the participating companies. It selects the applications that are most exportable, then matches the selected applications and services with the export market's needs. For that purpose, the company conducts market research and collects the necessary data. In carrying out this preliminary work, the company focuses on trade missions to targeted markets and holds brainstorming meetings with local professionals and experts in various fields (health care, communications and so on) in order to determine their needs and requirements.

6. *Success of innovation*

GMT signed its first substantial contract, with an Irish firm, in July 2000; the contract called for the work to be done in Egypt and the output delivered through the Internet. GMT has also bid on a number of projects in various countries in Europe and Africa, and is awaiting the results of the tendering process. It is worth mentioning that in the case of IT projects, especially large-scale Government projects, the winning tenders may not be announced for anywhere from six months to two years.

7. *Internal innovation-promoting factors*

GMT provides a comprehensive training program that includes new techniques in product development, maintenance, training and technical support, and sales and marketing.

The company has obtained good exposure by organizing a series of international conferences in relevant markets such as health care, banking and telecommunications. Private firms and public agencies in the European Union, the Middle East and Africa are invited to participate.

GMT aspires to be an innovative leader in its field through its dynamic marketing approach. Even more importantly, it is seeking to attract and retain the employees it needs by providing them with an environment that promotes constant learning and creativity as well as opportunities of drawing on their personal resources to harness their abilities. GMT is thus creating a company culture that is highly innovative and values and rewards its employees.

8. *Lessons diffusible to other SMEs*

(a) Co-operation and networking;
(b) Assessment of market needs;
(c) Division of labour among partners
(d) Additional joint services among partners in other forms, such as training;
(e) Creation of a new culture in the area of human resource development policy.

THE HATEM ABDEL GHAFFAR WOODEN FURNITURE COMPANY

1. *Nature of innovation*

Innovation in product and marketing strategy: Production and sale of customized wooden furniture in a wide variety of unassembled units at affordable prices, allowing each customer to select and assemble a combination of furniture parts according to his or her taste.

2. *Introduction to innovation*

The company sells wooden furniture in a wide variety of units such that every customer can select a combination of the various available parts in accordance with his or her own preference and taste and then assemble them by following the instructions provided. The factory produces a range of 15 products, including desks, bookshelves, dining-room sets, bedroom suites, tables, cupboards and chairs.

3. *Historical background: challenges addressed by innovation*

Abdel Ghaffar formerly had a showroom in downtown Cairo where he sold locally produced wooden furniture, an old and well-established industry in Egypt. By the late 1980s, he had realized that the selection of wooden furniture available in the local market was old- fashioned and had not evolved in response to the changing lifestyles of Egyptian consumers. This inspired him to produce wooden furniture sold unassembled, as parts, to give individual customers maximum flexibility and choice.

The production of furniture in the form of unassembled parts was an industry that had long been established in Europe and the United States. Unassembled furniture was imported into Egypt, but due to the high custom duties imposed, it was very expensive. Abdel Ghaffar recognized a niche market for modern, flexible and durable furniture at affordable prices.

Unassembled furniture has advantages over traditional furniture with respect to both production and shipment. It is cheaper to export, as it takes up less space; for example, 30 unassembled bedroom suites take up no more shipping space than five assembled bedroom suites.

Abdel Ghaffar is in a business in which big, established names dominate most of the market. Consequently, he must be competitive and innovative, on pain of losing market share.

4. *Objective of innovation*

Abdel Ghaffar's main objectives are to increase his share of the Egyptian market and to increase his export sales by tapping into new markets.

5. *Process*

The company started out in the Sixth of October Industrial City in 1990, producing parts for desks. Owing to increasing in market demand, however, other products were progressively added, and the factory currently turns out 15 different items. Abdel Ghaffar has followed signals from the market very closely: when some of his products proved unpopular, he made modifications and reintroduced them in response to customers' requirements. The factory also provides its clients with customized products, and its strategy is to develop new products annually in order to guarantee complete market absorption.

Abdel Ghaffar visits international fairs to make the acquaintance of the latest types of machines and new product designs. By attending fairs, he is able to upgrade his machines and broaden his product range.

Since the founding of the company, there have been substantial changes in production technique. Abdel Ghaffar has introduced new machines that minimize defects and turn out high-quality products while keeping his prices reasonably low. Production is 80 per cent automated, and human labour is required for

only three steps: putting parts together, varnishing and packaging. According to Abdel Ghaffar, one of his main innovations was his decision to automate the factory.

Local demand is strong, and the domestic market absorbs some 70 per cent of the company's sales. Abdel Ghaffar sells his products at his showroom in Bab El Louk and through international fairs. He is flexible in responding to customer demand, particularly in the export market: he is willing to produce items other than those included in his usual line of products, when feasible.

6. *Success of innovation*

Over the past 10 years, Abdel Ghaffar's operation has seen its sales increase by 30 per cent and its profits by 25 per cent. The work force has grown from 20 employees to 45. The company's export sales are expanding, and the product range has become steadily more varied.

7. *Innovation-promoting factors internal to firm*

(a) Flexibility in production;
(b) Exposure through participation in international exhibitions.

8. *Lessons diffusible to other SMEs*

(a) Identification of a niche market for customized products at affordable prices;
(b) Fast response to market needs;
(c) Up-to-date information on latest types of machines and new product designs;
(d) Continuous improvement in business operation, keeping prices reasonably low.

HORREIA FOOD INDUSTRIES - HORREIA 2000

1. *Nature of innovation*

Product and marketing innovation: Production, for the first time in Egypt, of different varieties of high-quality hard candies, presented in attractive packaging.

2. *Introduction to innovation*

Horreia has successfully broken into the Egyptian market with high-quality hard candy products in a variety of flavours, shapes and sizes. The products conform to international standards and are attractively packaged. They are designed to meet the changing tastes of local consumers.

3. *Historical background: challenges addressed by innovation*

Until 1985, the food products industry in Egypt was undeveloped. Factories were small places where goods were produced by hand methods. Quality was low, variety limited and packaging poor. When Egypt liberalized its foreign trade, a gradually swelling flow of high-quality foreign confectionery products appeared in the market. These products, with their delicious flavours and attractive packaging, created increased competition for hard candies in the local market. Under the growing pressure, Hassan Imam El-Fandi, one of the family partners and the company's manager, reasoned that there must be ways of improving hard candy production. The main challenge was to introduce products that could cater to the changing tastes of consumers who had become more sophisticated as a result of exposure to candies from elsewhere in the region and further afield.

4. *Objective of innovation*

El-Fandi's goal was to be able to compete with imported high quality hard candies, increasing the company's share of the domestic market and exporting to Arab and eastern European markets.

5. *Process of introducing innovation*

Horreia 2000 is a family business that had produced hard candies ever since it was founded in 1985. However, fierce competition and the open door economic policy that allowed foreign products into the Egyptian market had exposed local producers to competition from producers in other countries.

El-Fandi realized that in order to survive, he had to compete with foreign products by adjusting his business operation to the changing conditions of the domestic market in response to demand from increasingly sophisticated consumers. This meant supplying the market with high-quality, competitively priced hard candies in a variety of flavours, shapes and sizes in order to cater to consumers with different tastes, introducing attractive packaging, and conforming to international standards. In pursuit of this goal, El-Fandi had to find and install state-of-the-art machinery.

In 1986, Horreia 2000 became the first candy producer in Egypt to install new, up-to-date machinery, with a capacity of 20 tonnes per day. Having expanded its production capacity fivefold, the company launched its Vienna Fruit Bonbon, a competitively priced, attractively packaged hard candy of superior quality, available in a wide range of flavours and shapes. Horreia 2000's products enjoy a competitive edge over imports, not only because they are lower in price, but also because of the company's skill in identifying the needs and tastes of local consumers.

In order to remain competitive in the export market, the company has improved its marketing strategy. Horreia 2000 participates in exhibitions several times a year, launches publicity campaigns and distributes brochures advertising its products. With the help of Expolink, the company has recently established its own Web site to promote its products.

6. *Success of innovation*

Horreia 2000's production has expanded from two tonnes of hard candies per day to 20 tonness, as well as four tonnes of other products per day. The company's share of the hard candy market has grown from 5 per cent to 60 per cent. It exports 10 per cent of its total production to Arab and African countries. Its work force has increased from 50 employees in 1986 to 600 in 2000.

7. *Impact of innovation on other firms*

Today, most companies in this industry are following the example of Horreia 2000 by improving the quality and variety of their hard candies, thus benefiting consumers.

8. *Lessons diffusible to other SMEs*

(a) Introduction of new technology;
(b) Introduction of new products of high quality in response to changing market conditions;
(c) Adoption of a new marketing strategy consisting of:

(i) Establishment of a trade name;
(ii) Improved packaging;
(iii) Conformity to international standards;
(iv) Participation in exhibitions;
(v) Publicity campaigns;
(vi) Establishment of the company's own Web site on the Internet.

THE MODERN WORKSHOP FOR MANUFACTURING TENT TEXTILES

1. *Nature of innovation*

Product innovation: Production of differentiated, customized versions of traditional *khayamia* fabrics and textiles, with original designs and new colour schemes.

2. *Introduction to innovation*

Sameh Youssef has mastered the production of differentiated, customized versions of traditional Pharaonic and Islamic *khayamia* fabrics and textiles. He differentiates his products from their traditional counterparts by means of his own distinctive designs and new colour schemes, using computerized colour mixing. He also produces customized products that cater to individual customers' tastes in colour, design and material. His products are handmade and of very fine quality, and consequently are very special and expensive. Youssef produces about 20 different products, including household textiles and fabrics used as table covers, wall covers of all sizes, bed covers, pillowcases and customized covers for built-in seats. He produces traditional products as well as the customized products referred to above.

3. *Historical background: challenges addressed by innovation*

The manufacture of *khayamia*, formerly known as handmade tent material, featuring handmade shapes on textiles, is a traditional industry in Egypt. The production of a *khayamia* involves several steps, all done by hand: the shape of the design is drawn on the cloth, the colours are selected, the cloth pieces are sewn into the final piece, and then the product is ironed, cleaned and finally packaged. There is a whole area called El-Khayamia in El-Azhar. *Khayamia* manufacture is handed down within families. Workers tend to be members of a single extended family, and they usually begin working while they are still young, as was the case with Youssef.

He began while he was still a student, working with his uncle in the family business during his summer holidays. Upon graduating with a BA degree in social services, he decided to put his work experience and his university degree to good use by establishing his own business. In 1985 he applied for a loan from the Young Graduates Employment Authority in Cairo, obtaining a modest sum which he used to establish his own workshop in the El-Herafeen quarter. He began by selling his products in the traditional way, through intermediaries who in turn sold them to retail shops. It was a difficult struggle: the domestic market was limited, owing to the large number of producers supplying the same traditional designs and colour mix of red, green, and blue, regardless of the changing tastes of local consumers and the specific tastes of tourists and the foreign community.

4. *Objective of innovation*

Youssef's goal is to keep up with the changing tastes of domestic consumers, to cater to Egypt's large and growing tourist sector, to satisfy the tastes of the foreign community in Egypt, and to open new export outlets.

5. *Process*

Initially, Youssef tried to learn more about the market and seek suggestions for improvements from the intermediaries who bought his products and sold them to shops in Luxor and Kerdasa, two popular tourist destinations in Egypt. In 1992, however, he adopted the more effective marketing policy of dealing directly with shopkeepers in Luxor and Kerdasa, who in turn dealt directly with tourists from various countries and were familiar with their tastes and preferences. The shopkeepers provided Youssef with feedback on the market, passing on customers' comments and information about their preferences and offering suggestions for improvements. As a result, it became clear to him that he had to differentiate his products from those of his rivals. He began by introducing new colour schemes, adding violet, orange, brown and other colours.

Youssef also began to pay more attention more to tourists. He would go in person to shops in an effort to learn more about their preferences by watching them buy, talking to them and acquiring an understanding of what they were like and how they decided what to buy.

Youssef realized that he had to be constantly innovative. He introduced new designs besides the traditional ones. He imitated real paintings, an innovation that made his products unique in terms of patterns, drawings and colour mix and gave them a special attraction.

His sales grew, and his business began to expand. In order to cater to all tastes, Youssef has turned to the production of customized *khayamia* for his clients according to their preferences in terms of colour, design and material. His products are mostly bought by tourists and foreigners, who find his creations most impressive and buy them freely. However, he has to face stiff competition from his own aunt, who is also very innovative in her work, forcing him to be constantly in search of new ideas, designs and colors.

To meet this competition, Youssef has adopted a strategy of constant innovation. He has introduced an innovative way of changing his colour schemes, linking them to changing seasons and fashion trends. He has also devised a new distribution strategy based on colour and design themes that reflect the various regions of Egypt. In Sharm El-Sheikh resorts, for example, the products on offer reflect the sea environment in their colours and designs, while the products sent to retailers in Luxor and Aswan reflect historical and Pharaonic themes.

Youssef has begun to export his *khayamia*, mainly to the Gulf countries through local traders and foreigners living there. He participates in local and foreign exhibitions in an effort to sell his products in new markets. He is now in the process of developing his own Web site as a means of establishing direct contact with his foreign clients and broadening the scope of his export market.

6. *Success of innovation*

Sales and profits have doubled, while the work force has grown from two (Youssef and his father) to 15. Although Youssef faces redoubtable competition from his creative aunt, his products dominate the *khayamia* market, accounting for 75 per cent of all sales.

Youssef produces customized products in response to special requests from tourists, resorts, foreign embassies and various Arab princes and Presidents.
Production, which was formerly seasonal, now continues all year round, thanks to strong demand for the products, and Youssef now enters into longer-term contracts with retailers.

7. *Innovation-promoting factors internal to firm*

(a) Strong family ties which are conducing to good relations, strengthened by Youssef's practice of attending to his workers' needs, paying them well and treating them as partners in the success of the enterprise;

(b) A new approach to workers' remuneration, consisting of adequate wages based on the number of pieces produced;

(c) Youssef's practice of training the workers himself;

(d) Good product exposure as a result of Youssef's frequent contacts with the External Exhibitions Administration, the Ministry of Culture and the Cairo Governorate Exhibition.

8. *Lessons diffusible to other SMEs*

(a) Identification of a niche market;

(b) Awareness of changes in the market;

(c) Responsiveness to customers' tastes;

(d) Introduction of an innovative marketing and distribution strategy;

(e) Introduction of new production technology (the computer);

(f) Good product exposure as a result of frequent contacts with the relevant Egyptian administrative bodies;

(g) Innovative management/worker relations which have won workers' loyalty and commitment.

THE EGYPTIAN NATURAL OIL COMPANY - NATOIL EGYPT

1. *Nature of innovation*

Product innovation and market creation: Identification of a specific crop plant, the jojoba, as being ideally suited for the Egyptian environment, production of jojoba oil in commercial quantities in Egypt for the first time, creation of a market for jojoba products and development of new industrial applications using jojoba oil.

2. *Introduction to innovation*

Natoil's innovative contribution consists in having introduced a new crop plant, the jojoba, and produced jojoba oil in commercial quantities in Egypt for the first time, as well as having developed new applications for naturally processed jojoba oil in the fields of pharmaceuticals, cosmetics and pesticides. The company has licensed a pharmaceutical firm to manufacture three products to date: a gum gel for dental care and two other preparations used to treat skin disorders (rashes and psoriasis). The company has also licensed an associated chemical firm to produce natural pesticides.

3. *Historical background: challenges addressed by innovation*

Nabil El-Mougy's interest in the jojoba plant was kindled when he learned that it was a good source of oil, adapted easily to its natural surroundings and was a valuable crop that could generate substantial income for growers. At the time, El-Mougy was looking for a means of keeping occupied after his imminent retirement, and a viable agro-industrial project that would also benefit his country seemed like a promising possibility. Accordingly, he began to look into the potential, industrial uses and advantages of the "magical" jojoba plant.

El-Mougy decided to take up the challenge. He subscribed to a periodical entitled *Jojoba Happenings*, joined the international Jojoba Growers Association and attended several international conferences. He learned that many countries, particularly Israel and the United States, but also Malaysia, India, France, Belgium, Spain and a number of Latin American countries, have undertaken extensive research and experimentation on the uses of this plant and the oil obtained from it. The jojoba is an oilseed plant. The oil itself has a unique structure: it is a liquid wax, and is an ideal substitute for the oil of the sperm whale.

El-Mougy traveled to countries where jojoba research had been conducted, and discovered that jojoba oil, like petroleum, is a strategic product with a wide range of industrial uses, and that Egypt is ideally suited for jojoba cultivation in terms of its weather, climate and soil. The jojoba flourishes in the desert soil of Egypt, as it requires minimal water, possesses high salinity tolerance and needs little fertilizer. Above all, the cost of producing jojoba oil in Egypt is very competitive: in the United States, for example, the cost of producing one kilogram of seeds is $2, in Israel $1.50, in Australia $1.50 and in Argentina $1.25, but the corresponding figure for Egypt is only 60 cents.

4. *Objective of innovation*

El-Mougy's ultimate aim is to develop new uses for jojoba oil in the fields of cosmetics, veterinary medicine, pharmaceuticals, pesticides, lubricants and other industrial applications.

5. *Process*

El-Mougy started out by buying a plot of land approximately 22.5 hectares in extent, brought in infrastructure (water and electricity) and undertook soil reclamation work with a view to an initial experiment in jojoba cultivation, hoping that other farmers would follow his lead. In May 1991, he recruited agricultural experts from the United States, and in 1993 he harvested his first crop of oilseeds. El-Mougy discovered by experiment that he could obtain higher yields and better quality by cultivating jojoba and palm trees together.

In 1996, encouraged by his successful results, El-Mougy joined with other partners to found Natoil Egypt, a company producing naturally processed jojoba oil for the domestic and export markets. The company acquired a further 16 hectares of land for jojoba cultivation and built a factory at Tenth of Ramadan City. Until such time as domestic jojoba seed production might have increased to the point where it could meet Natoil's needs, the company had to import seeds and grow its own jojoba.

El-Mougy's ultimate goal was to promote jojoba oil and create market demand for it by developing new industrial applications of various kinds. The objective was thus not an agricultural project as such, but a manufacturing industry that would extract oil, develop new applications for its use, register those applications and license associated companies to manufacture various products while promoting jojoba cultivation in Egypt. In the early stages of its operation, the company encouraged farmers to grow jojoba by undertakig to buy it at a good price. El-Mougy launched awareness campaigns about the plant and its manifold uses through the media, including television, and by participating in exhibitions in neighboring Arab countries.

At this point, it is worth noting that 90 per cent of all jojoba oil is used in cosmetics and pharmaceuticals, while the other 10 per cent is used for aircraft lubricants, industrial applications and medical products. Jojoba oil is used as an antibiotic and anti-inflammatory, thanks to its impressive healing power and soothing effects. The head of the National Authority for Drug Monitoring and Research asked Chemical Industries for Drugs, a public company, to develop samples of pharmaceutical products using jojoba oil. To date, nine such products have been developed for the treatment of a number of disorders, including mouth and gum ulcers, skin inflammation, psoriasis, burns, arthritis and wounds. In 1997, a private pharmaceutical firm known as Sedeco reached an agreement with Natoil whereby the two companies would undertake joint research for the development and production of new pharmaceutical applications. Natoil provides the jojoba oil and is paid royalties on the new products that Sedeco manufactures from the oil.

6. *Success of innovation*

Production started in 1998. Two tonnes of oil were produced in that year; in 2000, by contrast, the company's output was 15 tonnes. Natoil now employs 16 workers and had a turnover of 608,000 Egyptian pounds in 1999. Through its patents and licences, the company has generated a supply of natural products for the treatment of ailments which are less dangerous than conventional pharmaceutical products and cause only minor side effects, if any at all.

By the end of 1997, Natoil had acquired Egyptian and international patents for two new products, one for the treatment of psoriasis and the other for the treatment of baby rash. Rash Cream, its registered trade name, was a breakthrough product, as it is cortisone-free, in contrast to most products used to treat baby rash. Moreover, Rash Cream has proved highly effective.

In 1999, Natoil patented another pharmaceutical product under the name Jogel. Jogel, which has jojoba oil as its active ingredient, is an oral gel used for the treatment of gum and mouth ulcers. It is also used as natural soothing pomade for teething infants.

Natoil also makes a veterinary product (a pet shampoo), and has recently developed a pesticide for the control of spider mites, which attack fruits and vegetables. The pesticide has been registered under the trade name Nat, and an agreement has been signed with a pesticide company for its manufacture and packaging.

Natoil has applied for a patent on a new pharmaceutical product for the treatment of psoriasis which it is seeking to register under the trade name Sorana. Sorana is to be released at the end of 2000.

Natoil continues to concentrate on improving the quality and packaging of its products in its efforts to expand its share of the export markets of the European Union and the Mediterranean countries.

7. *Impact of innovation on other firms*

Natoil has created widespread awareness of the importance of the jojoba plant and jojoba oil. As a result, farmers have been encouraged to cultivate more desert land and generate income by growing jojoba.

8. *Lessons diffusible to other SMEs*

(a) Identification of a niche product, jojoba oil;

(b) Creation of a market for the niche product through the development of new applications;

(c) Acquisition and constant updating of information about the niche product through technical and commercial references, specialized international periodicals, specialized international associations and international conferences on jojoba;

(d) Registration of new applications as they are developed.

El-PHARAANA METAL ENGRAVING

1. *Nature of innovation*

Product development: Introduction of a concept for engraving on silver and gold using new technology and designs.

2. *Introduction to innovation*

The company introduced, for the first time, the concept of engraving on silver and gold. The resultant engravings featured Egypt's Pharaonic and Islamic heritage for a niche market.

3. *Historical background: challenges addressed by innovation*

In 1967, Mr. Bayoumy, an illiterate man with artistic talents, started his own metal engraving business, thereby carrying on his family's traditional craft. At first, his output consisted of likenesses of ancient Egyptian Pharaohs and Islamic motifs engraved on copper. In 1973, he approached a friend who owned a gold craft shop producing traditional ankhs or keys of life, and suggested that engraved likenesses of Ramses I or Ramses II, together with their names, would be an interesting improvement. The goldsmith welcomed the idea as a creative initiative that would enhance the value of his products and differentiate them from those of his competitors, and he and Bayoumy formed a partnership.

4. *Objective of innovation*

The objective is to add an artistic and historical dimension to a special product, thereby enhancing its aesthetic value and uniqueness.

5. *Process*

Bayoumy decided to add a measure of variety to his craft by introducing silver and gold. His engravings conveyed an idea or story in pictorial form—the only possibility open to an illiterate man.

Metal engraving is done largely by hand. There are four main steps: preparation of the metal, the engraving proper, hammering the item, and polishing. What makes Bayoumy unique is that he does not use common engraving methods, such as those involving the use of acids. He sticks to his manual tools, and has designed special engraving pencils of various sizes that enable him to delineate any size and shape with great precision.

Bayoumi makes frequent improvements to his work by adding different shapes and designs. In 1999, by way of a further improvement, he bought a forming machine, the only machine in his enterprise. He uses it to shape his work, a step in the production process which he can now execute himself instead of contracting it out to other craftsmen to have the necessary hammering done by hand.

In the domestic market, Bayoumy's sales have increased, especially after he participated in the Development and Housing Fair sponsored by the Ministry of Tourism. Egypt's President Mubarak was so impressed with Bayoumy's products that he recommended that all gifts and artistic items for the presidential Council should be purchased from his firm. Bayoumy also travelled to Iraq to produce a commissioned piece of work for one of the presidential palaces there.

Bayoumi sells his products through fairs, and exports to various Arab and foreign countries.

6. *Success of innovation*

Bayoumi now sells in domestic markets ranging from the Khan El Khalili to most of the five-star hotels. He now has two workshops in Cairo. His work force has grown to 40 employees. His annual sales and profits have increased by 100 per cent since he started the business, and he is now venturing into export

markets, mainly in the United Arab Emirates, Bahrain, Italy, Spain and the United States. Both the Ministry of Culture and the Social Fund for Development have encouraged him to offer his work in those markets. Bayoumy is one of a number of artisans who have been invited to participate in the finishing of an Egyptian beach resort that is in the shape of a huge pyramid.

7. *Impact of innovation on other firms*

To date, Bayoumy has trained some 148 persons in his craft, and most of them have gone on to open their own workshops and are now training others. He has thus ensured that his specialized skills will be passed on to future generations.

8. *Lessons diffusible to other SMEs*

(a) Identification of a niche market: combining an art craft with the Egyptian heritage;

(b) Application of new techniques and technology: engraving on silver and gold, acquisition of new technology;

(c) A marketing strategy featuring exposure to foreign markets through participation in international fairs.

THE EL-RASHIDI EL-MIZAN CONFECTIONERY

1. *Nature of innovation*

Process development: Modification of a paint-making machine for halawa production.

Product development: Introduction of a new halawa snack product suited to customers' changing tastes and lifestyles.

2. *Introduction to innovation*

El-Rashidi El-Mizan has introduced a selection of halawa[3] products in a wide variety of forms, including a halawa energy bar, a halawa and chocolate energy bar, a halawa spread and others. The company decided to produce and market halawa in a novel way, adding a new dimension to the product by introducing it as a snack that could be eaten anywhere, instead of being eaten only at home. This innovation was intended as a response to demand arising from Egyptians' changing lifestyle, and from the tastes of consumers in foreign countries. Another innovative input was the modification of a paint-making machine for halawa production.

3. *Historical background: challenges addressed by innovation*

Halawa is of Turkish origin, and the El-Rashidi El-Mizan family, whose company is a leading producer, has been in the business since early in the nineteenth century. Until the 1970s, El-Rashidi made three main products: plain halawa, halawa with nuts and halawa hair. During the 1970s, demand for halawa increased as a result of economic liberalization, both domestically and in the other Arab countries, as well as among Arab communities living in the United States and Europe.

4. *Objective of innovation*

El-Rashidi's objective was to enhance the company's ability to survive, grow and expand in highly competitive local and international markets by attracting new customers and responding to changing tastes.

5. *Process*

El-Rashidi wanted to take advantage of the booming market by increasing the company's production, improving the quality of its products and introducing new ones. El-Rashidi needed a machine that would produce halawa faster, so that less human handling would be required and better quality achieved. What made this task difficult was that halawa is a country-specific product, and there were no existing machines that were suitable for the purpose. By sheer coincidence, one Rashidi partner, an engineer who had been able to enlist the co-operation of an East German firm, discovered a machine which had originally been used for paint-making, but which, with some adjustments, proved to be equally suitable for making halawa. This was an important innovative step that paved the way for more innovations later on. The latter, in turn, helped the company produce a wider range of halawa products.

The introduction of this and other machinery resulted in the automation of 85 per cent of the company's production. As a result, product quality was substantially improved, and the company was able to expand. In an effort to tap new markets, it began to vary its halawa products, introducing the concept of the halawa bar and producing it in several different flavours.

El-Rashidi currently produces 39 products, all presented in attractive new packaging, with creatively designed labels.

[3] Halawa is a confection made from sesame and sugar that has traditionally been popular in Arab households.

El-Rashidi focuses on the domestic market: exports still account for only five per cent of the company's total production, the rest being sold in Egypt. El-Rashidi supplies 97 per cent of the packaged halawa and 56 per cent of the bulk halawa sold in the Egyptian domestic market.

6. *Success of innovation*

Between 1970 and 1990, the company's production of halawa in all forms progressively increased, with annual growth of 10 per cent; production volume expanded from 10 tonnes to 120 tonnes per day. The work force increased from 250 employees to 1000 employees during the same period, with turnover of less than one per cent. Furthermore, a multinational corporation has approached the company with an offer to purchase a substantial percentage of its shares.

7. *Internal innovation-promoting factors*

El-Rashidi is fortunate in possessing an educated, highly specialized managerial staff, and it has adopted a creative approach to management. Each department is autonomous and is responsible for the preparation of its annual plans and specific targets. Each department manager is responsible for achieving those targets. This approach, along with good management-worker relations and the development of a committed work force, helps enhance creativity and innovation at the middle management level and encourages innovation at all levels of the company.

8. *Lessons diffusible to other SMEs*

(a) Recognition of a need for new products in the market to suit customers' tastes and changing lifestyles;

(b) Adaptation of appropriate technology for automation of the manufacture of an indigenous product;

(c) Adoption of a new marketing strategy via the introduction of attractive product packaging and labeling;

(d) Adoption of a bottom-up approach to planning, with the company's various departments and their managers having autonomy in producing their plans and achieving their targets as they see fit, and thus enjoying latitude to originate innovative ideas.

SEKEM

1. *Nature of innovation*

SEKEM has been innovative in every aspect: products, processes, objectives and marketing efforts. SEKEM's culture and approach to management, organization, working conditions and labour relations are innovative and creative and have undoubtedly been a factor in the company's successful development.

2. *Introduction to innovation*

The name SEKEM is a transliteration of a hieroglyph meaning "vitality from the sun". SEKEM was founded in 1977. It is an agricultural and manufacturing company that was the first to introduce biodynamic, organic agricultural products, health products and infants' clothing, all of which had previously been unknown in Egypt. SEKEM has been innovative, not only in manufacturing organic products, but also in achieving a "learning organization", instituting a collective approach to management, creating a bonding atmosphere among its employees, building a sophisticated working environment and adding a developmental dimension to business by establishing support institutions, most of which are funded by foreign sources.

"…SEKEM's sustainable approach of comprehensive social, economic, and cultural development 'illustrates how mankind can find its way back to fundamentals, in balance with nature, via a technology which serves rather than exploits."[4]

3. *Historical background: challenges addressed by innovation*

Egypt, with its six million acres of cultivated land, and was known to be the world's largest user of chemical insecticides and fertilizers per acre. Dr. Ibrahim Abuleish, a former Egyptian expatriate, a visionary and an entrepreneur, returned to Egypt in 1977 with the goal of starting a family business that would be unique in the country and perhaps the region: he wanted to produce organic health and medicinal products using environment-friendly processes, integrating a developmental program that would affect every worker, every worker's family and the entire surrounding community.

Dr. Abuleish found the mentality dominating the business community one of the most daunting challenges confronting him. It is materialistic, short-sighted and sadly lacking in humanistic attributes. Quick profits are the driving force, the culture of long-term cultivation and investment in human beings is almost absent, and the business world is detached from the surrounding community.

4. *Objective of innovation*

Dr. Abuleish wanted to introduce a new concept: a profitable business producing environmentally friendly products of which the country was in dire need, and characterized by a work environment that would have workers' well-being as its main objective.

5. *Process of introducing innovation*

Dr. Abouleish founded SEKEM at a time when people did not believe in what the company was advocating. Faced with farmers' reluctance to use the cultivation methods he specified, he decided to go into farming himself. The company acquired 70 hectares of desert sand in the vicinity of Bilbis, 60 kilometers northeast of Cairo. The first three years were devoted to infrastructure preparation: electricity and irrigation water were brought in and a sewer system was installed. Cultivation began on a small scale. However, when Dr. Abouleish failed to find local farmers who were interested in growing the crops that SEKEM needed to manufacture its organic medicinal products, he acquired additional land himself and expanded the company's planting operations. Eventually the situation improved: as awareness of environmental and health issues increased and farmers became more willing to accept organic methods, SEKEM began to train farmers in the new methods and subcontract its raw material production.

[4] SEKEM, *SEKEM - Company guide* (Cairo, n.d.), p. 19.

SEKEM sent its first shipment of medicinal products to the United States in 1981. In 1983, it entered the Egyptian domestic market with its herbal remedies (under the brand name SEKEM Herbs) and its organic food products (under the brand name Isis). In 1985, Isis brand herbal drinks were launched both in the domestic market, with the support of a strong advertising campaign, and in the international market through German and Dutch companies with which SEKEM had established business relations.

SEKEM's operations expanded progressively thereafter in both the domestic and international markets. The company had distributed its production to four subsidiaries specializing in particular lines: Atos (established in 1986) is a joint venture producing pharmaceutical and phyto-pharmaceutical products. Libra (1988) packages and exports fresh produce to Europe and co-ordinates organic production; in 1996 it opened a new mill to produce cereals, rice and dried vegetables. Conytex (1990) manufactures various organic cotton textile products. Isis packages and distributes organic cereals, breads, spices, condiments and a wide variety of herbs and teas.

SEKEM has been equally innovative and creative in marketing, establishing a chain of shops called Nature's Best shops to promote and sell organic and health products in the domestic market and, with ten foreign partners, in Europe and the United States. A company named Mercury has been created to handle local distribution for the SEKEM group, and another, known as Perfect, has been established to provide consultation and general services.

In management, Dr. Abuleish believes in an open, non-hierarchical approach: all employees have direct access to the management team or the company's general manager. In order to promote a healthy, creative and efficient environment, all employees meet with management every morning to report on the previous day's accomplishments and plans for the next day. There is also a general assembly every Thursday at one o'clock at which work problems are discussed, feedback occurs in both directions between management and employees, and suggestions for solutions are put forward. This open policy and these rituals are intended to reinforce the idea that no one can do anything in isolation, and to strengthen the sense of belonging to the group and to the company. They are also aimed at conferring a feeling of worth upon the lower category of workers. The effect is observable in the way they walk upright with dignity and pride.

The developmental dimension of the business, as visualized by Dr. Abuleish, encompassed humanitarian, cultural and social aspects. His goal was to introduce a developmental initiative that would influence the entire surrounding community, consisting of 17 nearby villages. SEKEM has established two associated non-governmental organizations (NGOs), the Egyptian Society for Cultural Development (SCD), founded in 1984 to develop and promote educational, social and health projects and programmes, and the Egyptian Biodynamic Association (EBDA), founded in 1994 to carry out research and development activities and, with the co-operation of SEKEM's foreign subsidiaries, to provide training and advisory services in the field of organic agriculture. Both these NGOs are concerned with spreading the company's philosophy and message through awareness creation and networking.

Employees and management work in a clean, healthy, non-stressful and beautiful environment and enjoy adequate wages and benefits, working hours and breaks, with health meals and appropriate eating facilities. In addition, social and cultural activities are available on the company's land.

The Medical Centre, which was established in 1996, services approximately 15,000 rural Egyptians. It is not only a comprehensive health care facility, it also addresses preventive medical issues by promoting increased awareness in the areas of hygiene, birth control and diagnostic symptoms. Among its other facilities, SEKEM has provided a club, a praying area and a cafeteria for its employees, as well as housing for them and their families.

6. *Success of innovation*

According to Dr. Abuleish, SEKEM's success is to be measured, not only in terms of its profits, but also, indeed primarily, in terms of its employees' development and their dedication, enthusiasm and commitment to their work. They display a sense of honour and pride and a degree of hope and ambition such as are rarely seen in a community. Dr. Abuleish says, "If you ask us how we produced 6000 tonnes of potatoes, 7000 tonnes of herbs, 600 tonnes of dried herbs and spices, etc., the answer is that we couldn't have done it if we hadn't been so concerned for the welfare of the younger workers and their children."

Today, SEKEM's competitive success is apparent from its share of the domestic market, which is currently close to 80 per cent in the case of the company's main products, i.e. health products, herbs and herbal teas. It cultivates an area of approximately 7000 acres (*feddan*s) in 150 different locations, and it provides employment for some 3000 people, including farmers working under subcontracting arrangements. It produces about 6000 tonnes of fresh produce annually, of which 65 per cent is exported to Europe. It also produces approximately 7000 tonnes of fresh herbs annually, of which 60 per cent is distributed locally in the form of pharmaceuticals, cosmetic products and tea bags. In addition, it produces 300 tonnes of organic cotton, which is used to make infants' underclothing in the Conytex garment factory. This product line is worth 7 million Egyptian pounds annually. Eighty per cent of the company's production is exported to Europe.

The company has also won an international reputation. It was recently registered as a world-wide project at Expo 2000 in Hanover, Germany: its sustainable approach to comprehensive economic, social, cultural and humanitarian development makes it a model of the mission of Expo 2000.[5]

7. *Impact of innovation on other firms*

Thanks to SEKEM, organic farming methods are now accepted, and there is great interest in the cultivation of organic crops in Egypt. The country has been transformed as far as the use of pesticides is concerned, applying only three million kilograms yearly, in constrast to the 36 million kilograms that were previously applied every year. Aerial crop spraying is now prohibited. Furthermore, Egyptians generally are better informed about health issues and the importance of environmental protection, owing to the awareness campaigns conducted by SCD and EBDA, the company's NGOs. SEKEM is also having an impact on other developing countries through the numerous international expert meetings it organizes and the various consultant services it provides.

8. *Lessons diffusible to other SMEs*

(a) A new approach: environment-friendly products;

(b) Institution of a human-resource-based management that takes a collective approach, and the development of a "learning organization";

(c) Creation of group loyalty among employees;

(d) Enlistment of foreign partners to support the company's efforts in the export market;

(e) Diversification of activities by the establishment of specialized manufacturing and marketing subsidiaries;

(f) Business bonded with developmental objectives, and establishment of development support institutions;

(g) Success in attracting foreign funds to finance the company's developmental activities.

[5] *SEKEM – Company guide*.

THE EGYPTIAN AGRICULTURAL AND FOOD PRODUCTS COMPANY – VITRAC

1. *Nature of innovation*

Innovation in marketing strategy: Introduction of new packaging in response to domestic and international market needs.

2. *Introduction to innovation*

Vitrac was the first company in Egypt to pack marmalade in glass containers. Beginning with one product, namely marmalade, it went on to introduce glass packaging for several other products.

3. *Historical background: challenges addressed by innovation*

Vitrac was established in 1995 after its founders had discovered from their market research that there were only two companies in Egypt that produced marmalade. Both of them were public companies, and they packed their marmalade in the traditional tins. Although marmalade had been on the market for a long time, very little in the way of improvements or changes either to product quality or to the packaging had ever been introduced.

4. *Objective of innovation*

Vitrac's objective is to compete in the domestic market and to secure a growing share of the export market, particularly in the European Union and the United States.

5. *Process*

In order to promote the new packaging and educate Egyptian consumers about its benefits in terms of taste, quality and environmental desirability, Vitrac launched an aggressive advertising campaign on television, in the print media and on street billboards and posters. It also set up kiosks in public gardens and at service stops on highways, inviting the public to sample the product.

Vitrac's international marketing strategy was aimed at increasing its share of the marmalade market in some countries and tapping new markets in others. The simple introduction of glass containers opened up promising export opportunities for the company. It has now succeeded in expanding its share of the international market, exporting marmalade, at competitive prices, to a wide variety of countries, including Asian countries such as Japan, China, and Korea, most of the Arab countries, the United States, Canada and Australia.

In support of its marketing strategy, the company keeps up to date on the latest developments and the most recent technology used in marmalade processing, and it constantly conducts market research to assess demand and determine consumers' preferences and taste trends. Vitrac's senior management attends all major trade fairs, including the ANOGA trade fair in Germany, SIAL in France, the Gulf Food Fair in the United Arab Emirates and FOODEX in Japan.

After making a name for itself with its successful introduction of marmalade in glass jars, Vitrac extended its innovation to other products, including honey ketchup, tomato sauces and *sharbat* (Egyptian traditional juices), all packed in glass containers.

6. *Success of innovation*

Vitrac currently supplies 70 per cent of the marmalade consumed in Egypt, and its exports have increased from 150 tonnes in 1995 to 6000 tonnes today. Vitrac exports to various markets at competitive prices, including the Far East, Japan, Korea, China, most of the Arab countries, the United States, Australia and Canada. Sales have increased by 15 per cent, and total production has grown from 10,000 tonnes to 30,000 tonnes. The company's work force has increased fourfold, totalling 800 in the year 2000. Vitrac

began by using glass packaging for one product, and went on to extend its innovation to several other products.

7. *Internal innovation-promoting factors*

The company provides exposure to new technical developments and new marketing strategies by sending its employees on training courses in the United States and Japan.

8. *Lessons diffusible to other SMEs*

(a) Adoption of an aggressive marketing strategy in promoting the company's product, using all available media resources, and following up with direct sales;

(b) International exposure through attendance at international food exhibitions.

B. LEBANON

BCHAMOUN INDUSTRIAL PARK, 1997/98

1. *Nature of innovation*

Innovation in clustering and incubation of manufacturing workshops: Establishment of an industrial park as an incubator for a variety of industrial activities, particularly metalworking and plastics and related industries.

2. *Introduction to innovation*

The Bchamoun Industrial Park is home to autonomous industries of various kinds, complementary industries in some cases, each firm making a component of a single finished product. The Park acts as an incubator for industries that are in getting started, and the Park's management helps industrialists promote their businesses and provides them with new machinery and technology transferred in from abroad. Furthermore, the space and facilities of the Park constitute an enabling context for ad hoc industrial transactions.

3. *Historical background: challenges addressed by innovation*

Mohamad El-Jamal is a university graduate in business administration from a Lebanese family that has long been established in the international transport business. He originated several innovative transport and manufacturing projects in Lebanon and other countries in the 1960s, 1970s and 1980s. Possessing as he did extensive experience in industrial operations and industrial technology transfer, when he returned to Lebanon in the early 1990s after the end of the civil war, he felt impelled to put his skills and knowledge to good use by developing technology transfer projects that would benefit his country. An industrial park seemed like a promising idea in that connection.

4. *Objective of innovation*

The clustering and incubation of small and medium-sized manufacturing facilities and workshops in an industrial estate close to Beirut, providing them with an opportunity of owning premises appropriate to their needs and within their budgets.

The exploitation of business opportunities by subcontracting manufacturing operations utilizing available facilities and space in the Park.

5. *Process*

Between 1977 and 1997, the initiator and founder of the project, Mohamad El-Jamal, together with his partner, an engineer named Jihad Zembarakji, assembled, in stages, a large plot of land in a location classified as an industrial zone near the capital, Beirut. The subsequent period, from 1994 to 1996, was devoted to the preparation of designs and drawings for the construction of an industrial park with an area of 42,000 square meters, comprising ten big halls capable of accommodating ten factories, and other constructions adequate for the accommodation of approximately 300 small workshops. The plan was to create 1500 jobs. The first stage of the Park was built in 1997. It now houses some 50 industrial concerns of various kinds, employing roughly 500 persons.

Those concerns are factories and workshops producing plastic bags and agricultural tents, printing plastic bags and tents, manufacturing and printing packaging materials made from hard cardboard, printing and binding books, diaries and calendars, manufacturing metal rolling doors, applying powder coatings, making road signs and pedestrian lane markers, manufacturing illuminated revolving prism billboards, manufacturing and coating false ceiling components, producing wrought-iron items for the antique market, rolling, bending and cutting metal to various sizes and shapes, shaping and assembling woodwork, and performing various other kinds of industrial operations.

The Park acts as an incubator for industries that are getting started, and the Park's management helps industrialists promote their businesses and provides them with new machinery and technology transferred in from abroad. It also provides them with technology and the patents on that technology for new inventions to be manufactured in the Park, such as turnkey rotational molding. In addition, the Park's management, in association with a technology transfer company, the Saudi-Lebanese Research Institute (SARI), helps industrialists with facilities in the Park to transfer new technology in accordance with their needs. Members of the Board of the Bchamoun Industrial Park also sit on the Boards of resident companies, helping them by facilitating their access to technical and marketing information and linking them with a far-flung network.

The Park provides financing facilities through its banks, and it also offers long-term financing for the purchase of space in the Park.

Mohamad El-Jamal has been able to utilize available free space in the Park to conclude various ad hoc contracts with local and foreign customers, taking advantage of the various industrial facilities the Park offers and the ample space at its disposal.

In 1998/99, El-Jamal joined forces with a group of industrialists to bid on a contract for the supply of 200,000 school desks for an Arab country in accordance with strict specifications and subject to a short delivery deadline. They were bidding against suppliers from Russia, Pakistan, India and Turkey, but they won by offering the lowest price and the earliest delivery date. The main factors that enabled them to deliver the products on time were the ample space that the Park provides for such projects, and good planning and close supervision in the performance of the work.

To execute the contract, the management of the Park, together with its partners, bought the machinery and equipment needed to manufacture the desks. They hired about 250 ironworkers, carpenters and painters, recruiting them from the local market for the duration of the contract, and worked around the clock to complete the project on time.

In 1998, the Park's management began manufacturing turnkey rotational molding systems for the manufacture of big polyethylene containers usable as water tanks or for other storage purposes. These turnkey manufacturing systems were a pioneering initiative in Lebanon, competing with imported Italian and American systems. The Park produces them for half the price of the imported systems, and they are adapted to Lebanese and Arab needs in terms of design and facility of operation. They are currently being sold in Saudi Arabia and the Syrian Arab Republic, as well as in the Lebanese domestic market.

El-Jamal is now manufacturing pulverizers for milling polyethylene into powder. Industrial operations and workshops in the Park will have several uses for these pulverizers, as in rotational molding and other applications in the field of plastics.

6. *Success of innovation*

In less than three years, the Park has been able to attract some 50 factories and workshops occupying approximately 30 per cent of the available space, despite deteriorating economic conditions in Lebanon and the neighbouring countries and political instability.

Buyers are duly meeting their financial obligations to the Park's owners.

The facilities of the Park are being used to good advantage for profitable ad hoc contracts with customers both within Lebanon and in the region.

7. *Innovation-promoting factors internal to firm*

The energizing nature of the Park's project manager, El-Jamal, fosters the promotion of innovation. He is a member of several international professional industrial associations, and consequently he has access to technical information that can be used for the improvement of production facilities in the Park. In addition, he is constantly on the lookout for emerging technologies, and to that end he consults many

sources, mainly those available to him through his professional associations and through technical Web sites and magazines.

The Park's management has access to technical information through its affiliation with international associations. In this way, the management obtains readily applicable technology which it adapts to suit the needs of the market.

8. *Lessons diffusible to other SMEs*

Identification of a market need: the advantage accruing to small manufacturing facilities and workshops from the clustering of complementary activities and the possession of premises in a an industrial estate, with the Park providing advisory services and financing facilities and acting as an incubator for industries that are getting started.

CONSERVES MODERNES CHTAURA S.A.L.

1. *Nature of innovation*

Innovation in product development and market creation: Development of the Med-Gourmet line of health products, consisting of dips and dressings produced for the European market.

Marketing innovation: Introduction of the "Chtaura Chef" 2.5-kilogram catering packages produced for institutional consumers such as restaurants and hotels.

Packaging innovation: Application of a new technology, the steritort (rotary) sterilizer, thereby improving packaging quality. The company was the first in the Middle East to adopt this technology.

2. *Introduction to innovation*

Conserves Chtaura has successfully introduced a stream of innovations in its business operations. These include the recent reformulation of some of its products to meet the needs of the health-oriented European consumer and the reintroduction of those products as the Med-Gourmet dips and dressings, now pasteurized and packed in glass for the European market. The company has also identified a niche market for institutional consumers by introducing its 2.5-kilogram "Chtaura Chef" ready-to-eat catering packages, which it supplies to hotels, restaurants, international and regional conferences and events and the like. In addition, the company is the first in the Middle East to have installed a new sterilization technology to solve the problem of low-quality packaging.

3. *Historical background: challenges addressed by innovation*

Conserves Chtaura is a well-established Lebanese industrial firm that has been producing food products ever since it was founded in 1961. The company has built its success on cumulative innovations that have been progressively introduced, particularly during the past 10 years. The company's strength is reflected in its ability to export approximately 60 per cent of its production, particularly to competitive markets such as Europe and the United States of America as well as Arab countries. What made it easier for the Company to access those markets was the fact that it initially targeted the ethnic Arab communitie living in the countries in question. More recently, it has been trying to attract the Western community generally. This has compelled it to devote greater efforts to the task of improving the quality of its products in order to conform to international standards and adapting its products to Western consumers' tastes.

One of many recent examples of the company's innovations concerns improvements in canning. Conserves Chtaura had encountered difficulty in exporting to Europe because of the quality of its containers. During one of the company's regular quality evaluation brainstorming sessions, the problem of its sterilization system was raised. Conserves Chtaura, like other companies in the region, used the still retorting method, which caused uneven heat distribution, leading to discoloration of the products in the cans, a major obstacle in accessing the European market. Another problem was the new trend toward glass containers and flexible pouches in response to consumers' health concerns.

Conserves Chtaura is not only demand- but also supply-driven, creating markets for its innovative products. The company has recently recognized the untapped institutional consumer market, and, with the help of USAID, has developed a product aimed at that market in the form of complete, ready-to-eat meal packages. To date, Lebanese food products companies have targeted only individual consumers by producing individual products. Conserves Chtaura, however, sees institutional consumers as a potentially lucrative market, and it is working to create that market.

4. *Objective of innovation*

Continuous introduction of innovative products and marketing techniques to access competitive new markets and maintain and/or expand the company's share of existing export markets.

5. *Process*

In 1997, to solve the problem of product discoloration during the sterilizing process, the company installed a sophisticated new device, the steriotort, which had previously been unknown in the Middle East. The steriotort is a state-of-the-art sterilizing system that yields better-quality products: it agitates as it sterilizes, and the result is a product that is more homogeneous in terms of texture, flavour and colour.

In response to European consumers' health concerns, the company has developed a new line of health products, the Med-Gourmet dips and dressings. It reformulated the original products, which had been aimed at Arab consumers, and adapted them with a view to attracting health-oriented European consumers. They were presented as pasteurized end products packed in glass. The Med-Gourmet dips and dressings were developed with the help of a German food expert, who defined the terms of reference for the necessary reformulation and packaging. Conserves Chtaura's research personnel worked with the German expert in the development of marketing materials and the launching of the products. Initial trials in the local market were followed by presentations at the ANOGA trade fair in Germany in 1999 and the SIAL exhibition in France in the following year. Both products were introduced in Lebanon in an effort to attract the middle-aged, well-traveled ("yappy") consumer.

Conserves Chtaura currently has a new line of products undergoing trials, namely its "Chtaura Chef" institutional ready-to-eat meal packages. In the context of its trials with these items, the company was able to fill a somewhat unusual order: the Emir of Qatar, wanting to serve Arab food at the recent Islamic Summit Conference in Doha, Qatar, ordered no fewer than 5000 of the packages, weighing 50 tonnes in all. The ready-to-eat market is still undeveloped in Lebanon, and special packaging and products are needed. Conserves Chtaura is currently developing this product line, which it has already presented in Lebanon at the Horeca Exhibition in April 1999 and in Europe at the SIAL exhibition in September 2000, and which it is planning to present again this year at the Chicago Restaurant Fair.

6. *Success of innovation*

The improvement in the quality of the company's products and the introduction of its dips and dressings have resulted in more effective penetration of the European market and rising sales, especially in Germany, Denmark and Sweden.

7. *Innovation-promoting factors internal to firm*

(a) Good market information;
(b) Specialized marketing team;
(c) Identification of appropriate steps, good organization and good marketing;
(d) Targeting of specialized consumers and markets;
(e) Excellent contacts in local and exports markets.

8. *Lessons diffusible to other SMEs*

(a) Identification of a niche market initially by targeting ethnic Arab groups in Europe and subsequently institutional consumers in the local, regional and international markets;

(b) Creation of a market for ready-to-eat catering packages;

(c) Adjustment to market needs by:

(i) Reformulating some products to meet the needs of health-oriented European;

(ii) Consumers;

(iii) Conforming to international standards;

(iv) Application of new technology;

(v) Adoption of a good marketing strategy by seeking expert advice, putting together a good marketing team and obtaining sound market information.

KINDOU

1. *Nature of innovation*

Adaptation to market conditions through computerization of production, application of a combination of different costing methods, outsourcing through small workshops, franchising, and production of the company's own designs

2. *Introduction to innovation*

The Kindou company, founded in 1991, has beaten the odds by establishing itself as a leading brand name in made-in-Lebanon children's clothing without benefit of the exchange of know-how that is a frequent feature of joint ventures with foreign companies. The company has adapted its operations to market conditions, initiating a set of innovative approaches in all its business operations, including design, just-in-time production, quality products, the costing system, computer-aided design, and the use of IT to link its retailing to its the factory.

3. *Historical background: challenges addressed by innovation*

Roy Badaro comes from a family that has been solidly established in the textile and clothing business in Lebanon since the late nineteenth century. In 1979 he founded a clothing manufacturing company under the name International Trade and Industry (Intrind) and began producing infants' underclothing exclusively for the European market. Intrind flourished until the period 1989-1991, when the escalating civil strife in Lebanon ultimately resulted in the total destruction of its factory and the ruin of Badaro's export business.

By 1991, however, political conflict in Lebanon had come to an end, and Badaro established a new company which he called Kindou, with the intention of going back into the garment manufacturing business. However, conditions in the international market and the domestic market had undergone drastic changes, particularly in the textile and clothing industry. In the international market, globalization had unleashed unprecedented competition, while in the Lebanese domestic market, production costs had skyrocketed, and most of the factors required for competitive manufacturing were absent. As a result, most Lebanese manufacturers were producing under capacity, and Badaro found that his company could not export its products. Nor was it possible to sell in the domestic market, because many retailers were experiencing financial difficulties or had turned to importing clothing from the Far East. Confronted with this situation, Badaro decided to forgo exports and to concentrate instead on expansion in the local market. This policy proved to be the key to the company's success.

4. *Objective of innovation*

Production, initially for the Lebanese domestic market, of high-quality children's fashion clothing that would have an edge over imported European products in terms of price, product differentiation and customization, customer service and delivery.

5. *Process*

Despite the unpromising economic situation, Kindou was established in 1991. The company was immediately confronted with all the above-mentioned domestic market constraints. Its policy was first to reach critical mass in production volume by operating on low profits and high turnover. By 1993, critical mass had been achieved, and during the next five years, the company initiated a series of innovative approaches to all its business operations

The company established its own "Kindou" brand, targeting the middle and upper segments of the Lebanese consumer market. It used its own exclusive designs to differentiate its products, which were just as good as products imported from Europe in terms of quality but cost some 30 to 40 per cent less.

To maximize profits and minimize costs, Kindou introduced the manufacturer-retailer system, establishing its own retail distribution network through franchising. This approach, which has been adopted by international companies such as Benetton, helps keep retail prices down by cutting out the middleman. In that way the company was able to expand without heavy investment and could obtain the highest operating margin, which in the textile and garment industry is in the 50-to-60 per cent range on retail sales.

To minimize its costs, the company began to outsource some of its manufacturing, subcontracting sewing and trimming operations to a number of small workshops while keeping design, cutting and control within its own factory. This enabled it to save on its labour costs, especially social security costs: Kindou currently employs 100 workers, while its subcontractors employ approximately 170 workers in all.

In an effort to achieve high product quality and achieve more efficient marketing and distribution, Kindou became market- and IT-oriented. In pursuit of its goal of high-quality products, it invested in new technology and sophisticated equipment, including a computer-aided design and manufacturing (CAD/CAM) system which enabled it to modulate its basic designs quickly. This gave it an edge of a few days, a crucial advantage in the fashion industry, where styles change rapidly.

IT also helps the Company to respond immediately to market needs. Franchise holders are required to buy hardware, and the company installs its own software (developed in-house) to obtain a complete on-line data system that allows efficient monitoring of stock movement at all points of sale and is a useful aid to judicious decision-making by management. Kindou was one of the first companies to introduce a person-to-person marketing strategy by introducing its fidelity card, the Kindou Club Card, which enables the company to track all purchases and estimate the potential of every customer. Holders of the card are entitled to special benefits. Since January, moreover, Kindou has been on line with its own Web site. It also delivers door to door to customers all over the world.

Having established Kindou nationally, Badaro's next goal is to regionalize the brand during 2001-2002. He hopes to establish Kindou thoughout the Arab countries, and to that end he is currently looking for regional partners, particularly in Egypt, Jordan and, eventually, the Syrian Arab Republic. Badaro plans to open the first global retail shop carrying Kindou brand clothing, teaming up for the purpose with other Arab manufacturers.

6. *Success of innovation*

(a) The company's sales have been growing at an annual rate of 20 per cent since its inception;
(b) The number of Kindou retail shops has grown from one in 1991 to 17 in the year 2000;
(c) More than 2000 of the company's customers carry Kindou Club cards;
(d) The company's profits have grown year by year.

7. *Lessons diffusible to other SMEs*

(a) Identification of a niche market in high-quality children's fashion clothing for the Lebanese market;

(b) Manufacture of customized products to meet different consumer tastes, and good customer service;

(c) Adoption of a low-profit, high-turnover policy to capture the market;

(d) Application of new technology, notably IT.

LA LAINIÈRE NATIONALE

1. *Nature of innovation*

Innovation in production and marketing management: Introduction of the just-in-time and quick-response approach in textile production and marketing, for the first time in Lebanon

Networking innovation: Development of an advanced supplier-customer relationship through good networking with the company's customers, i.e. clothing producers and exporters

2. *Introduction to innovation*

La Lainière successfully adopted the just-in-time and quick-response approach as a means of adapting to the changing conditions of the international market, particularly as regards the seasonal changes in fashion that have become increasingly frequent. The company installed new knitting, colouring and finishing technology, developed its know-how and its human resource expertise, and established good networking by developing a more advanced supplier-customer relationship.

3. *Historical background: challenges addressed by innovation*

The Khattar family established La Lainière Nationale in 1936 as a company producing woven textile fabrics. The Company supplies fabrics to domestic producers of clothing, much of which is exported to foreign markets. Traditionally, this industry has been characterized by standardized product flows, with regular orders at relatively low prices. Since 1990, however, new trends have been emerging in the international market, with increasing numbers of fashion seasons as a means of stimulating sales of fashion products. This has made it more difficult for traditional industries to compete. At present, in France, Italy or New York, there is a new fashion every 15 days.

This trend has changed the way the textile and clothing industry operates, from reliance on scale to reliance on scope and customized fashion production. Initially, a change in fashion during the same season began with a partial style change, such as a change in the length of skirts or dresses or a change of colour, but by now the trend has reached the point where there may be a complete change of fashion within a single season, including a change of material. Suleiman Khattar, La Lainière's owner and managing director, explains that the company's objective is to introduce changes at a rate faster than fashion copiers in the Far Eastern countries can track, in order to preserve the niche market consisting of fashion design exports to the developed countries.

The company's main concern was thus to keep up with every fashion trend in Europe, as otherwise both it and its customers would lose business.

Another emerging concern of the company was increased production costs and price competition. During the 1980s, La Lainière Nationale had ceased to be competitive with respect to the prices of its basic items, such as men's fabrics, because of the Southeast Asian products that were flooding into the local and export markets. It was also having progressively greater difficulty in the domestic market, particularly since the mid-1990s, mainly because of tightening economic conditions. As production costs rose steadily, the company and its customers were having to struggle to survive.

4. *Objective of innovation*

To respond quickly to frequent changes in fashion demand in the international market by producing the required quantity and quality on time, and by reducing production costs to become more price-competitive.

5. *Process*

Khattar attended fashion fairs and visited machine suppliers more assiduously than ever, returning with clear ideas about upcoming trends in fabrics, colours and technology. At his initiative, La Lainière Nationale began working in co-ordination with the clothing producers that were its customers, holding regular joint sessions to address common market concerns. The direct supplier-customer relationship thus established has helped both the company and its customers to respond jointly and more efficiently to the constantly changing needs of the European fashion market, in particular by adopting the just-in-time and quick-response approach in their production and marketing.

Before 1990, La Lainière Nationale was a weaving mill. Khattar came to realize that every fashion trend in Europe had to be followed immediately by his customers, and that in turn required a quick response from his company in terms of producing and dyeing the fabrics. He decided that under the circumstances, the only way of responding quickly enough was to switch to knitted fabrics instead of woven fabrics. In 1990, the company acquired circular knitting machines and began turning out knitted fabrics on demand, mainly for youth and children's wear, sportswear and fashion wear. With respect to dyeing, Khattar devoted a great deal of time and effort to the task of ensuring that the company understood the meaning of quick response in that area. This, he explains, was because of the diversity and mix of fibres involved. There are now a minimum of 10 kinds of yarns and blends of fibres, making processing and dyeing operations more difficult.

The company had to acquire the necessary know-how in order to achieve the targeted colour. Accordingly, in 1995 Khattar sent technicians to Europe for on-the-job training at dye manufacturing establishments specializing in dyes for short-circuit knitting machines. Next, during the period 1996-2000, the company invested in a huge dyeing machine and a number of finishing machines. This new knitting, dyeing and finishing technology has improved the company's production efficiency, enabling it to respond quickly to changes in market needs and supply its customers with products of the required quality, delivered on time. The company has also been able to cut its production costs by producing on demand, thereby avoiding the outlay required to maintain large stocks of product and reducing waste.

In order to build a strong supplier-customer relationship, the company decided to provide just-in-time industrial services to its customers (as well as to its competitors). To that end, it diversified its manufacturing operations, cumulatively adding new industrial service lines and directing its production activities in quick response to day-to-day market needs. This has helped the company keep its machines operating as close to full capacity as possible, thereby further reducing its production costs.

The Company introduced a new industrial service in 1995, in the form of a "prepared for dyeing" (PFD) service, which it offered to competing companies that imported their textiles. The companies in question now import "grey" (i.e. raw or undyed) fabrics from Asian countries and keep them at La Lainière Nationale's factory on a stand-by basis. The fabrics are dyed upon the customer's demand, just in time to conform to the latest fashion trend on the same day it is launched in Europe. In this connection, the company has joined a virtual data bank for colours that provides it with the exact formula of any colour referenced in the Pantone Textile international colour classifier. This data bank has enabled the company to provide a high-quality colour service efficiently and just in time. It has also helped it to keep up to date with day-to-day changes in colour fashions, and to respond quickly by providing exactly the colours demanded in the required quality. The PFD service has given the company an edge by enhancing its speed of response and product quality and enabling it to reduce waste.

Another industrial service that the company introduced on a quick-response basis in 1992 is finishing. This is a post-dyeing service: La Lainière treats fabrics, both domestically produced and imported, to make them flame-resistant or waterproof, thinner or thicker, or to confer other characteristics. This line of activity is undertaken on ad hoc basis. The company makes the service available to its competitors, and earns a good profit doing so.

6. *Success of innovation*

La Lainière Nationale is one of the few textile companies in Lebanon that have survived the changing market conditions and are still thriving. It is growing at an annual rate of 10 per cent in terms of sales, and 20 per cent in terms of production volume. This has been achieved under progressively tighter local market conditions.

7. *Impact of innovation on other firms*

The Company has contributed indirectly to the success of other SMEs in applying the quick-response and just-in-time approach through its own effective application of it. Its success in establishing good supplier-customer relations has encouraged other SMEs that are its customers to apply the networking concept.

8. *Innovation-promoting factors internal to firm*

(a) The vision and leadership of the company's manager;

(b) Constant updating of information on market fashion trends and technology through attendance at international fairs, perusal of fashion magazines, and utilization of the services of the Internet and specialized Web sites;

(c) Recruitment of young persons who are adequately educated;

(d) A participative approach to management, with daily morning brainstorming sessions with managers and other relevant staff to follow up on daily business and management issues.

9. *Lessons diffusible to other SMEs*

(a) Identification of a niche market: quick response in knitted products and industrial services;
(b) Establishment of good supplier-customer relations and networking;
(c) Constant updating of market information through customer feedback and the Internet;
(d) Application of new technology;
(e) Adoption of a participative approach to management.

INDEVCO

1. *Nature of innovation*

Innovation in human resource development: Promotion of the growth of the business through an advanced human resource development strategy.

2. *Introduction of innovation*

The starting point of every Indevco project is attracting and developing the right work force. The idea stems from Indevco's main concept and philosophy, which is that the success of any project depends on the people who run it and the skills they possess and acquire. The Human Resource department recruits good people, trains them and develops them, and once they are ready, a new project is launched.

3. *Historical background: challenges addressed by innovation*

During the 1960s, Lebanese apple growers were having difficulty finding suitable boxes in which to package their produce. At that time, the only form of packaging for fresh produce was wooden boxes, which, *inter alia*, were very hard to find. The scarcity of boxes had become a bottleneck in apple marketing. Indevco was founded to meet this market need by manufacturing board boxes that were lighter and easier to pack, safeguarded the produce during transport and were available in quantity.

Today, Indevco's worldwide affiliates are organized around the company's three core products: paper and containerboard, flexible packaging, and tissue and disposables. In addition, there is a division for joint ventures.

The general managers of these affiliates run their Indevco divisions as independent entities. They have complete autonomy with respect to management, and their responsibilities are not confined to daily operations; each of them has a business plan to develop and a budget to work with. These largely autonomous product divisions are linked to a centralized core entity that provides continuous guidance and support to all the general managers in the areas of human resource management and development, treasury and finance functions, business development, project management, information technology, and legal and audit functions. Indevco is the sum of the collective skills of the professionals who run its centralized departments and affiliates.

4. *Objective of innovation*

Mr. George Frem, the founder and chairman, aspires to achieve success and growth by resolving the problems that hamper the community's social and economic development. His goal is to develop a successful business enterprise that is committed to its employees' social welfare, enriching the lives of its people while growing and being profitable.

5. *Process of introducing innovation*

During the 1950s, when George Frem was building his company, he realized that any organization's most important asset is the human element. He believed that market opportunities may be available, the necessary technology obtainable, plant, equipment and land accessible, but the factor that matters most and is crucial to an organizations's success is attracting employees with the right skills, developing them within the organization and retaining them.

In 1974, thanks to Mr. Frem's vision and insight and the help of an American expert, the Human Resource Department was established and assigned a prominent role in the company. The Department has

an executive and between three and five functional managers running four sections: Recruitment, Compensation and Benefits, Training and Organizational Development.

Indevco's success is mainly attributable to its emphasis on attracting a good work force. It does not go out and hire a general manager, it trains and develops its employees, and in due course promotes one of them to an executive position. This has been Indevco's main strength in addressing human resources issues.

When recruiting, the company considers not only a prospective employee's academic qualifications and/or experience, but also his or her character, spirit, behaviour, background, culture and value system. What the applicant stands for is what matters most. The company looks for compatibility with the Indevco philosophy; it tries to determine whether the applicant will be likely to fit in as an Indevco employee and be able to develop in the company's culture. New recruits go through an extensive interviewing and selection process lasting several weeks and involving meetings with executives from the various departments. Naturally, the outcome is not always satisfactory, and where that is the case, the person is immediately informed, perhaps as much as a year later, that he or she has no future with the company. Staff assessment is performed on a regular basis, quarterly to begin with, and subsequently once a year.

Indevco has an extensive training program for which a yearly budget is allocated. It possesses in-house training facilities, as well as programmes under which employees are sent overseas in search of the latest in technology and manufacturing techniques. As far as the company is concerned, there are no limitations when it comes to people development.

Indevco is a company that grew sixfold during the war; it survived 16 years of civil war, street war, social crisis, economic hardship and devaluation, and at every stage it worked out an innovative solution that enabled it not merely to keep going, but to grow and prosper. The company could not have won through in the face of such appalling difficulties without the commitment, hard work and dedication of its employees. Such high work standards can be maintained only when people feel secure and their basic needs are met, when they are nurtured and cared for—and that is precisely what Indevco has done and continues to do, that is what Indevco stands for.

During the worst periods of the war, Indevco would subcontract ships to provide its employees with basic supplies such as wheat, meat, sugar, rice and the like, and bring them over from Cyprus at a time when ships did not dare to put in at the port of Beirut, in order to provide a sense of commitment and safety for its employees. The company relocated those who were living in unsafe areas and provided housing and transport for them. Now it provides schooling and medical care. A reward and incentive programme has been established, particularly for the sales and production departments of Indevco affiliates.

6. *Success of innovation*

Indevco has grown from an entrepreneurial vision to a successful privately owned multinational industrial group. In Lebanon, it grew from a 700-employee company during the 1970s to one employing 1500 workers today, and its low staff turnover is an indication of its success. World-wide, Indevco today has 36 manufacturing and commercial companies and employs over 5000 people in Brazil, Cyprus, eastern Europe, Egypt, England, Greece, Lebanon, Saudi Arabia and the United States.

7. *Lessons diffusible to other SMEs*

Human resource management is characterized by a policy of promoting learning and open communication. There is an overall understanding that mistakes ought to be admitted openly and shared, so that instead of being repeated they are discussed, analysed, understood and learned from. There is an ongoing learning process, and knowledge is channeled and developed among the people who work for the company.

The human element is a company's most important asset. A company must provide an environment that fosters the development and training of its employees, while fostering motivation and commitment by developing incentive programs and rewards.

General managers are given autonomy in running their operations and are trained to tap into their employees' creative capabilities while providing them with systems of guidance and support in the core aspects of their functions.

THE SCOUT SHOP ESTABLISHMENT – FABRIC CLOTHES INDUSTRY CENTRE

1. *Nature of innovation*

Innovation in marketing: Adjustment to changing conditions and needs in the domestic and export markets.

2. *Introduction to innovation*

The company responded quickly to domestic demand for ready-made clothes due to shortages resulting from civil strife, despite the hardships of wartime. It successfully accessed the European market after encountering difficulty in marketing its products locally. By dint of great effort, the company was able to access the Gulf market, identifying niche markets in customized clothing and penetrating the institutional market for costume clothing.

3. *Historical background: challenges addressed by innovation*

Abdul Rahim Bodon set up the Scout Shop Establishment in 1972. Thanks in part to his network of relationships in the world of scouting, his establishment eventually became the main provider of scout supplies in Lebanon.

In 1975, civil strife erupted in Lebanon, and demand for scout uniforms declined drastically. Bodon directed his production activities to the manufacture of ready-made clothes, seizing the opportunity presented by the market shortage resulting from the conflict. This helped the company to build its expertise in the trade and gradually to expand its business.

After 1985, however, the situation in Lebanon deteriorated, and Bodon had to think of alternatives to keep his machines going and his stocks at low levels. He decided to turn to exporting.

4. *Objective of innovation*

To adjust to changing market conditions and needs.

5. *Process*

Bodon worked hard to access the Kuwaiti market in the hope of improving his company's situation. He focused all his efforts on that market, and in response to Kuwaiti customers' preferences, began producing other lines of clothing. Kuwaiti retailers required customized clothing products in relatively small quantities, which Far Eastern suppliers were not prepared to supply. Bodon successfully exploited this market opportunity, despite the hardships his company was experiencing in its home country.

In 1988, Bodon was able to expand his exports by accessing the United Arab Emirates market, thanks to a deal with the UAE Red Crescent. To its satisfaction, he was able to meet his commitments on time and according to contract specifications, supplying them with 10,000 pieces of clothing for charity distribution during the month of Ramadan. This helped to open up a new and promising market opportunity in the Emirates. Bodon's expertise in manufacturing costume clothing enabled him to become a supplier to Governmental institutions in the Emirates, such as the Ministry of Defence, as well as municipalities and other public and private institutions, always working through local companies.

In 1991, Bodon was offered a contract to supply trousers according to certain specifications for export to France, and this gave him an incentive to look more closely into the possibility of exporting to the European market. Next came a contract to supply trousers for the Belgian market, upon request, subject to tight delivery deadlines, and in accordance with strict design, colour, size and material specifications.

Owing to the company's expanding exports to Europe, Bodon added a textile line in 1995 with a view to reducing costs and addressing the problem of the European Union's forthcoming new rules of origin on

textiles and clothing. At the same time, the company's name was changed to the Scout Shop Establishment - Fabric Clothes Industry Centre.

As time went on, however, changing market conditions made it more difficult for Bodon to export his products, especially to Europe: large companies were merging, and orders increasingly called for quicker responses, lower prices and higher quality.

Bodon has now turned back to the domestic market, targeting institutional customers, a market in which he enjoys a competitive edge. Besides producing scout uniforms, he produces clothing for hospitals, restaurants, hotels and the military, as well as uniforms, sportswear, costumes for ceremonies such as graduation, and other products.

Bodon still aspires to export his products. However, he is well aware that the emerging new era in international trade requires changes in the way businesses operate, and accordingly he is preparing long-range plans for accessing the export market in a more aggressive way. He is currently developing a co-operative project for the establishment of a textile park, the Industrial City for Textile, which he is seeking to market with the support of the Lebanese Syndicate for Textiles. The main objective of the park project is to accommodate complementary and integrated textile and clothing industries within a single industrial area in a low-labour-cost location. The project opens up new opportunities for Lebanese producers in that sector by addressing the problem of high production costs and the challenges of changing market conditions. SMEs can no longer face these challenges individually; they must co-operate with each other and adopt an integrated approach to doing business by clustering their activities and networking.

6. *Success of innovation*

(a) Exporting to Europe has resulted in a 20 per cent annual increase in export growth;

(b) The value of direct and indirect sales of the company's products amounts to $2 million annually. The company employs 130 workers, 45 on a permanent basis and the rest on a seasonal basis;

(c) The company has won two international awards, the Ninth International Europe Award for Quality in 1995, and the Twenty-first International Trophy for Quality;

(d) The company has also won an award from the Association of Lebanese Industrialists as the country's leading exporter.

7. *Impact of innovation on other firms*

If the Industrial City for Textile project is successfully implemented, other investors may be encouraged to follow suit. The ultimate outcome may be a radical change in the way manufacturing SMEs operate in Lebanon.

8. *Innovation-promoting factors internal to firm*

(a) Management's ability to visualize changing market trends and seize business opportunities;

(b) Teamwork among managers as "family members";

(c) New approach to worker remuneration in the form of a free choice between being paid on a piecework or on a wage basis. Open factory hours, a more effective means of achieving efficient and speedy production than employing new workers;

(d) Subcontracting of specific simple functions (currently 1000 items are sent out for trimming daily), eliminating the cost of a new machine and reducing congestion at the factory;

(e) Hiring of 20-30 students during the summer holidays, who earn some pocket money by helping with ironing and packaging during the peak season;

(f) Good relations with customers;

(g) Good relations with employees;

(h) Availability of up-to-date information on international market trends and needs as a result of assiduous participation in national, regional, and international exhibitions, and from the Internet.

9. *Lessons diffusible to other SMEs*

(a) Advantageous utilization of new business opportunities under changing market conditions;
(b) Identification of niche markets: customized clothing and institutional customers;
(c) Adoption of flexible human resource management;
(d) Constantly updated information on international market trends and needs.

TIMEZERO – INTERACTIVE TECHNOLOGIES

1. *Nature of innovation*

Innovation in information technology product development and in management: Development of new applications on CDs and other educational and commercial applications oriented to the needs of learners and the business community in the Lebanese market. Adoption of a management style aimed at encouraging creativity and promoting efficiency.

2. *Introduction to innovation*

The company has developed a CD-ROM application for Lebanese pupils in the upper elementary classes, aged 9-11, to help them with problem-solving in science, based on the new Lebanese curriculum introduced this year. It has also developed company and product promotion applications such as screen savers, subscription-type CD-ROMs and screen mates. In developing its products, the company uses small teams and encourages a relaxed environment and a sense of camaraderie to promote creativity and hard work. In addition, flexibility in decision-making allows new ideas to be implemented very quickly.

3. *Historical background: challenges addressed by innovation*

Tony Feghali, Director of Timezero, earned a Ph.D. in instructional design and educational computing in the United States of America, returning to Lebanon in 1992 with a vision of establishing his own educational software business. IT is a major source of know-how which is heavily dependent on human resources, and Feghali believed that Lebanon had a competitive advantage over neighbouring countries in that respect. Its population is well educated and easily trainable in technology, its society is open to change, and there is a culture of small business and a high level of entrepreneurship, as well as cumulative private initiatives in the promotion of the information technology industry. Feghali believed that Lebanon had good future prospects in IT, but until 1995-1996 the Lebanese market was not ready, and it took him four years to establish his business.

4. *Objective of innovation*

To help companies accept new information technology applications, and to facilitate student learning in science under the new Lebanese curriculum that has been introduced this year.

5. *Process*

In 1996, Feghali established a company which he called Timezero, recruiting a team of eight local experts in software engineering, graphic design, editing and production management. His strategy was to begin by developing applications for the Lebanese market and promoting his company. During the first three years he developed digital products for companies, such as screen savers, subscription-type CD-ROMs and screen mates, which are company and product promotion applications. The screen saver is not new, but using it for product promotion in the local market is new in Lebanon; the way it is designed and fitted into the corporate plan is also new. The screen mate is a little object that appears on the screen, talks to the user, checks his e-mail and so on. It was introduced recently for Christmas as part of a package. The CD-ROM includes several digital programs that serve as an end-of-year gift for a particular bank's patrons.

Another CD-ROM application, named KARLI, which the company launched one year ago, is on role-playing scientific investigation for students aged 9 to 11. It is based on the new Lebanese school curriculum, and it is designed to help students in the upper elementary classes with problem-solving in science. It is accompanied by a reference book, with all illustrative examples being taken from Lebanon. KARLI is available in English and French versions, and the Arabic version is to be launched as soon as the company's returns reach a level adequate to cover its cost.

In developing this programme, the company enlisted the expert assistance of instructional design professionals to ensure its credibility. An instructional designer from the United States, a former fellow-student of Feghali's, was contracted to develop and design the software, with the help of the company's own experts, and ensure that it was scientifically correct, user-friendly and intellectually engaging. To that end, he was invited to Lebanon and spent six months there, simply to get the feel of the country and the local environment and thus be in a better position to help orient the programme to suit the Lebanese market.

Five hundred copies of this CD have been produced to date, and the company has launched an aggressive campaign to promote it, targeting institutional and individual consumers in the local market.

6. *Success of innovation*

(a) Sales of digital products for promotional purposes grew at a rate of 30 per cent annually during the period 1996-2000;

(b) Digital products for promotional purposes are generating profits of 25 per cent;

(c) Two innovative CDs have been developed; the company has marketed 500 copies of one of these and is currently conducting a promotion campaign for the second.

7. *Impact of innovation on other firms*

The products developed by the company have been replicated in a few instances. However, this phenomenon has not been widespread. Other firms may not be familiar with the rates of return on such products, or may not know how to develop them, from need identification (in co-operation with the client) to final product delivery.

Two other firms have begun to develop educational CD-ROMs for the local market.

8. *Innovation-promoting factors internal to firm*

Relaxed environment, small team size, sense of camaraderie at the company and flexibility in decision-making.

9. *Lessons diffusible to other SMEs*

(a) Identification of a niche market: development of a support programme for problem-solving in science based on the new Lebanese school curriculum; development of digital products for the company and product promotion;

(b) Introduction of a new management style featuring team work and flexibility in decision-making.

Annex II

INNOVATION EXPERIENCES FROM OTHER REGIONS

DORE-DORE: PROCESS INNOVATION

Dore-Dore is a world-class manufacturer of fashionable knitted products. Its Hosiery Division produces socks for men, women and children; its Knitwear Division produces a line of children's play-clothes and sweaters. Since its establishment in 1819, Dore-Dore has been an innovative company, committed to its workers and customers. Dore-Dore focuses on the high end of the market with regard to both quality and fashion. Its hosiery line is characterized by unusual breadth and detail.

1. *Superior customer service – high inventory problem*

One of Dore-Dore's competitive strengths is its superior customer service for its hosiery clientele. A key strategy was immediate filling of replenishment orders for basic hosiery items. Although beneficial to Dore-Dore's customers, such rapid response taxed the company's resources by requiring it to hold substantial inventories of finished hosiery products.

2. *Forecasting demand vs. market unpredictability*

Forecasting demand was complicated, especially for weather-dependent articles such as hose, the popularity of different styles was highly unpredictable, and even successful styles often enjoyed only short periods of popularity.

3. *An innovative director*

Marguet, the director of operations, wanted to reduce manufacturing lead times while allowing production to closely track seasonal demand fluctuations. This, however, would conflict with the company's desire to maintain its level of employment in its manufacturing facilities. Marguet's dilemma was that Dore-Dore had a social and legal obligation to provide its workers with year-round employment.

4. *Innovative process solution – "quick response" strategy*

To address this problem, Marguet began to investigate "quick response" strategies that would link production to actual demand more closely. "Quick response" was a concept that advocated linking "upstream" manufacturing operations and retail activities to "downstream" consumer demand in order to create a supply chain with the requisite speed and flexibility to respond quickly to shifting market demand. Operating in a "quick response" mode involved making demand forecasts and establishing production schedules closer to the selling season, reducing manufacturing lead times and basing replenishment on actual sales data, thereby ensuring that the supply chain could meet consumer needs in an efficient manner.

5. *The production process – children's knitwear*

Dore-Dore's average production batch size in sewing was 200 pieces of the same style and colour, with an average of eight different sizes within a batch. Workers were compensated under a piece-rate system. The knitwear sewing room had 55 sewing machines and was staffed by 42 workers. Sewing an average garment took 10 minutes of actual labour. The discrepancy between this time and the three-week period it took a garment to pass through these operations led Marguet to investigate possible changes in organizational and operational design to shorten production lead times.

6. *An innovative alternative – the cell design*

Marguet's suggestion was a cellular manufacturing system. A key principle underlying the cell concept was that groups were autonomous, managing their own time, their distribution of work and their workflow.

The first cell was assigned to six people and twelve sewing machines. If a machine in a cell broke down, it would have to be quickly repaired and the worker would move to another machine within the cell to continue working.

In the cell, batches were split and passed from operation to operation as individual units. When a batch arrived at the cell, an operator would perform the first operation on the first piece in the batch and then place the completed piece next to her station where it was accessible to other operators. In contrast to traditional production methods in which large numbers of batches were in progress at any time, there would be at most two batches in the cell, with one moving into a cell as the previous batch was completed.

7. *The cell results – a success story*

The cell system quickly showed a number of improvements over line production. Throughput time for a garment dropped from 15 working days (three weeks) to one day only. The defect rate dropped from 5 per cent to 2.5 per cent. Moreover, defects usually were found before the item left the cell and could be corrected more easily, due to cross-training. The workers seemed to maintain their motivation. They also performed additional tasks, such as completing delivery slips and shipment orders, that had previously been the supervisor's responsibility.

Pleased with the results, Marguet began to plan for the remaining operators to be divided into cells to create a total of seven cells for knitwear sewing machines.

8. *The hosiery operation – introducing the cell design*

In July 1990, the cell system was introduced to the company's hosiery operation, after its successful implementation in the knitwear division. Enfert, the director of manufacturing, hoped to reduce total manufacturing throughput time to one week, so that the finished hosiery goods inventory would drop by 30 to 40 per cent. To accomplish this, he envisioned a one-day throughput time for post-knitting operations. A key consideration was that ironing required an expensive (350,000-800,000 French francs), high-capacity, extremely specialized machine. The machine, with its steady output, would set the rate of production in the cell and physically dominate the area.

The proposed cell design was based on the capacity of two ironing machines. Enfert assigned 36 workers to a cell in order to balance the capacity of two ironing machines. They would function as two teams of 18 each, and as a whole would be capable of producing the entire line of hosiery. He believed that quality control personnel should not be trained in other operations, as he feared that quality standards might be compromised if those controlling quality understood how difficult some of the sewing tasks were.

9. *Innovation, an eye-opener*

Dore-Dore's experimentation with cells had exposed the limitations of some of the company's supporting systems. With the current flexibility of knitwear cells, the greatest constraint often was the availability of raw materials. A preliminary supplier-partnership programme with two different vendors, one for dyed yarn and another for undyed yarn, was under consideration.

Dore-Dore found it necessary to rebuild its computerized forecasting systems in the hosiery division, knowing that the sales force needed to pursue earlier and better indications of sales demand. Marguet was already experimenting with new incentives to encourage sales representatives to negotiate orders with significant clients early.

ZOLL MEDICAL CORPORATION – INNOVATION IN PRODUCT DEVELOPMENT

1. *The company*

Zoll Medical Corp, incorporated in 1980, manufactures non-invasive cardiac resuscitation devices and external pacemaker/defibrillators, to meet the needs of health care providers treating cardiac arrest victims both inside and outside the hospital.

Today Zoll, under the management of Rolf Stutz, a leader and a mentor who urged the company's team to continually strive for excellence, is one of the country's fastest-growing providers of cardiac resuscitation equipment, and the second-largest.

2. *Twenty years of innovation*

Zoll has grown by providing unique, high-quality, innovative products through worldwide distribution. Its mission is to improve resuscitation outcomes by developing and marketing products that deliver superior clinical performance, rapid therapy and meaningful information, to provide higher user confidence and economic value.

Its goal is to establish an integrated and standardized product line with a reputation for quality and innovation. Zoll products are all about time!

The company's culture fosters a self-motivated, entrepreneurial spirit and values each employee.

3. *An innovative strategy – marketing and distribution*

Selling a defibrillator was a complex process because salespeople had to call on multiple parties within a hospital during a sale. Efforts were generally located within certain areas of a hospital, i.e. the cardiac care unit or an emergency room. Brand loyalties were generally very strong within areas and some hospitals. However, Zoll believed that a successful sale and performance record in one area had the potential to influence not only the purchasing decisions of other areas within the hospital but also regional emergency medical care providers such as ambulance companies.

Therefore, Zoll, unlike many other small medical device companies, had made a decision early in its history to employ a direct sales force dedicated to the sale of its equipment and to employ a focused distribution strategy similar to that of its competitor Physio. Stutz, the CEO, felt technical innovativeness alone would not be enough to overcome the strength of the Physio brand name. Though initially a very expensive strategy, employing a direct sales force became less expensive than using distributors, as Zoll's unit sales rose over time. By 1992, Zoll's US sales force had 24 people, with each salesperson covering 200 to 250 hospitals across a two-state region. Zoll also sold its products internationally through a series of partnerships in both Europe and Japan.

4. *FDA approval – a necessity*

Research and design efforts focused on two main areas: increasing the clinical effectiveness of defibrillation and pacing technologies, and increasing the portability and automation of the devices. Once developed, defibrillators were put through clinical testing before they were submitted to the FDA for approval.

5. *The innovative product*

Zoll introduced its PD1400 portable pacemaker/defibrillator in February of 1992 at the price of $8,945. The PD1400 was the smallest and lightest transport pacemaker/ defibrillator monitor and operated on removable batteries.

Introduced in conjunction with the device was a battery support system (PD4420) that could simultaneously charge four batteries. The PD 1400 competed primarily with Physio's LifePak10, the company's principal competitor, which sold for $8,995 and was powered by a similar battery system. In addition however, Physio's LifePak10 could run on AC power when attached by a cord to Physio's remote Charger unit, which plugged into an AC outlet.

6. *Product development*

The PD1400 encountered some resistance within the hospital market because it operated only on battery without an AC power backup; many hospitals were reluctant or refused to buy the device.
On April 25, regional sales meetings identified the AC power charger as their number one product development priority.

7. *Timing is of the essence*

Rolf Stutz and senior management organized a product development team with the defined purpose of developing an AC power supply for the PD1400. The AC charger of this model was to allow the device to operate on either battery or AC power, as well as charge the battery while the device was not in use.

When the FDA shut down Physio's production of the LifePak in May and it was temporarily off the market due to regulatory problems, Zoll managers realized that they had an unusual window of opportunity to boost the PD1400's sales if they responded immediately to customer requests for back-up AC power capability. Scrambling because of the time pressure, the project team quickly formulated a solution very similar to the remote charger and adapter used by Physio's LifePak10. The design was relatively straightforward, could be quickly developed and would directly address the AC power requirement of some hospitals.

On August 13, the team presented the design to Stutz: a reliable, rechargeable, lead-acid battery system and accessory charger. The team also generated the product comparison chart between their stand-alone charger design and Physio's remote charger. It seemed clear to the team that time was money in this case, and they were looking for the go-ahead signal.

Stutz was uneasy that the product model sitting in front of him was too similar to the competing product LifePak10, and that perhaps more time spent on design and development would generate a more distinctive product that could differentiate Zoll more in the long term. However, he decided to take the product quickly to market to take advantage of the window of opportunity, especially when Physio, Zoll's key competitor was facing setbacks due to regulatory problems.

By capturing an opportunity and acting upon it, Zoll was able to accelerate and maximize its sales performance of the PD1400 during that period as well as gain an edge in the market.

E INK – PRODUCT INNOVATION

1. *The product – a new communication vehicle*

It looks like an invention that could revolutionize the publishing industry: a versatile display technology that can be produced on thin sheets of plastic and can flash text messages almost anywhere.

Electronic ink (e-ink) has the potential to span virtually every industry and create new communication vehicles. Ultimately, E-ink will permit almost any surface to become a display. E-ink combines the superior look of ink on paper with the dynamic capability of an electronic display.

2. *The innovation*

Electronic ink is the brainchild of Joe Jacobson, an assistant professor at MIT's famed Media Lab. Jacobson's idea for an electronic book was not unique. The idea had surfaced in the mid-1970s at large companies such as Xerox. Two types of images had emerged: electrophoretic displays (EDs) and liquid crystal displays (LCDs). EDs were abandoned due to unsolved problems, and LCDs became the ubiquitous display technology for portable electronics.

Jacobson's breakthrough was discovering a process called micro-encapsulation, whereby particles were packaged into microscopic bubbles instead of floating freely between the glass and the back plane.

3. *The team- undergraduate students*

In 1996, Jacobson found two undergraduate students at MIT who began work on the project (Barrett Comiskey, who worked on networks in the MIT Media Lab, and J.D. Albert, a mechanical engineer). During that year, the pair essentially reinvented the electrophoretic display, and in January 1997 they dedicated all of their time to building a successful working prototype. In March 1997, Russ Wilcox joined the team, two years after graduating from Harvard Business School, to monitor the technical effort, recruit staff, develop corporate relationships and negotiate investments. In due course, Comiskey and Albert graduated, and in August 1997 E Ink was founded with the idea of revolutionizing print communication through display technology. James Iuliano joined the company in February 1998 as President and CEO.

4. *Small-company mentality*

Small as the team was, it attracted considerable attention from the press and secured substantial funding. E Ink was named one of *Fortune* magazine's "Cool Companies" of 1998—in recognition, clearly, of the "cool" technology itself as well as the eccentric scientists who were building it.

Initially, the founders of E Ink hired generalists. They were looking for people who had a variety of experience and could adapt to an environment that was bound to change quickly. However, the top team realized that hiring specialists would expedite the technical development process and subsequently the manufacturing process. Later recruiting efforts revealed that attractive candidates were interested in E Ink because of the great potential of the company and its products, the revolutionary technology, the interdisciplinary nature of the work and the small-company mentality.

5. *The culture – youthful spirit*

The most pervasive and most visible aspect of E Ink's culture is its youth. Many of its employees had never had a job before, and so everyone is fresh and willing to get along. Employees are the funk of E Ink. They are smart and inquisitive, and they never say, "It can't be done." E Ink is pulling together a bunch of different technologies to create a new industry, and it is this youthful culture that has marked E Ink with competence and intelligence. The sense of good will and collaboration makes the lab feel more like a large family. There is a natural optimism in the culture and a belief that there is no such thing as a technical challenge that can't be conquered.

Another prominent feature of E Ink is its informal, flat organizational structure. Every E Ink employee, regardless of position, has made a commitment to learn about and understand the technology. E Ink promotes an environment of constant learning through weekly lunches at which all relevant issues are discussed.

6. *The innovative approach – the signage market*

The first practical application of the technology is in retail signage. E Ink's first product is aimed at retailers who want point-of-sale signs that can be changed in stores across the country from a single computer headquarters.

J.C. Penney Corp. is testing the signs, which it has installed in Penney's Marlboro and Chicago stores. The Marlboro store saw sales of its women's athletic apparel increase by about 30 per cent when it ran a series of promotions on an E Ink sign during the Mother's Day weekend. Internal portal Yahoo! Inc is pushing its online shopping service by having people wear sandwich boards that convey messages promoting the virtues of online shopping, such as "Parking always available" and "Open late at night". The word- of-mouth they are getting is good, and that counts for even more than exposure through advertising.

7. *Success of the innovation – time will tell*

Like any innovation, electronic ink faces plenty of challenges before it can take hold. Part of E Ink's commercial promise lies in its novel approach, its ability to manufacture its displays for a fraction of the cost of today's flat-panel displays. The next test is moving beyond single-colour electronic displays to full colour—a critical step if the company plans to move to high-resolution displays that can depict images and animation. Its ultimate goal—to "kill paper" through "radio paper"—is at least five years off.

By December 1999, E Ink's staff had increased to nearly 90—three times as many people as the company had had one year earlier. In order to manage the growth and focus on technological breakthroughs while maintaining the creativity and drive, the fun and informal culture, E Ink has provided more infrastructures for communication between people and across projects. The company has introduced structure while maintaining the level of autonomy that allowed it to innovate so quickly, and it continues to do so in pursuit of its ultimate goal.

SUN HYDRAULICS CORPORATION – INNOVATIVE AND UNIQUE MANAGEMENT APPROACH

1. *An innovative entrepreneur – characteristics*

Bob Koski is a visionary, far-sighted entrepreneur who enjoys developing innovative solutions for complicated problems. According to him, the single most obvious culprit in the "standard" organizations of his acquaintance was the organization chart. The mere existence of a formally defined hierarchy tended to force individuals into defensive, unproductive and damaging behavior patterns. Another problem he associated with typical business organizations was the process he called "ossification", an exaggerated focus on prescribed procedures as they "congealed" over time in the minds of employees.

In early 1970, Bob's goal was to design and create a new company that would avoid the human relations problems and politics that crush the human contribution they are designed to harness.

2. *An innovative product – combines force, speed and motion*

Industry growth and Koski's experience, capabilities and innovativeness led him to design and manufacture one of the most comprehensive lines of screw-in hydraulic cartridge valves and manifolds in the world. Sun Hydraulics, based in Sarasota, Florida, sells its products for use in various "mobile" applications, such as construction, agricultural and utility equipment.

3. *An innovative approach – the ideal employee*

The first measure of Koski's success would be whether he could attract talented engineers, whose contribution would be critical to Sun Hydraulics' performance in the fluid power industry.

Bob planned to focus on accurate self-assessment as a critical asset for prospective employees. Using self-knowledge as a hiring filter, each individual was expected to choose the range of activities in which he or she could best contribute to the organization.

There were no special benefits for anyone in the company, nor any official titles, apart from two that seemed indispensable for interactions with the "outside world" (Bob Koski was president and one of his close colleagues was comptroller).

About 20 per cent of Sun Hydraulics' outstanding stock had been made available to a few highly competent employees whose contributions were critical in shaping the company's future in the marketplace. These stock options were offered as an incentive for key employees to stay with Sun Hydraulics, not for individuals considering joining the company.

4. *Innovation in management – horizontal management*

There would be no hierarchy, no titles, no formal job description, no special benefits, no reporting relationships, and no close supervision at Sun Hydraulics.

"Horizontal management" would encourage the formation of "natural clusters" to accomplish whatever work had to be done. Although some functions such as salary-setting and performance reviews would be difficult to perform in an entirely horizontal organization, new ways of approaching these functions were developed within the framework of horizontal management in so far as possible.

Critical to promoting mutual respect was the elimination of what Bob called "intimidation functions" in the organization. Sun Hydraulics would have no purchasing agent, no quality inspectors in the plant. Each shop employee would be responsible for the quality of his or her own work.

5. *Innovation in operations – enhancing self-management*

As an outgrowth of horizontal management, there would be no power structure controlling operational communications, and thus self-management would be enhanced. Natural clusters would emerge among employees according to their work locations and tasks. Employees now feel responsible to their peers rather than to a superior imposing an externally derived set of rules. Contrary to industry-wide practice, there are no standard production times or procedures and no piece-rate pay incentives. The work groups themselves are free to adopt whatever methods seem best to them. The focus is on the group's contribution rather than on any individual's performance record.

6. *A new approach to scheduling – "universal information"*

A sophisticated, fully automated system for scheduling has been developed internally. This provides accurate data on parts to be produced, delivery dates and other priorities for anyone in the plant who wants it. Within this framework of "universal information", shop workers are encouraged to make their own decisions about what to produce when. The system helps reduce inventories while affording greater flexibility in responding to customers' orders.

7. *Sun Hydraulics – a success story*

Sun Hydraulics has forsaken conventional management practices, allowing shop-floor employees the freedom to contemplate creativity and exchange roles at will in the production process, with a minimum of supervision. However, Sun Hydraulics has achieved widespread recognition in the industry for its innovative designs, its quality products and its high ethical standards for business dealings. Bob believes that many of these positive results have stemmed from the philosophy and practices he calls "horizontal management". It was this nonstandard approach to management that provided the foundation for the company when he established it in 1970.

Ten years later, Sun Hydraulics business results were positive by any standards. More importantly for Bob was the employment record: the company had not lost a single key individual in 15 years of operation. Among the 10-12 people generally recognized as the most creative hydraulics engineers in the United States, four had chosen to come to Sun Hydraulics. Employees agreed that the company was an extraordinary place to work.

In 1996, the successful 27-year old company had a *pro forma* net income of $3.8 million on sales of $54.6 million. Sun Hydraulics went public at the beginning of 1997 at $9.50 a share, and subsequently raised $19.3 million. It is currently listed on Nasdaq. In January 2000, the company had 677 employees, and its market capitalization was $51.5 million.