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**Development of a technological innovation capability assessment model: a case
study of manufacturing SMEs in Sialkot, Pakistan**

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Abstract

Small and Medium Enterprises (SMEs) play an important part in the economy of any country. Initially, a flat management hierarchy, quick response to market changes and cost competitiveness were seen as the competitive characteristics of an SME. Recently, in developed economies, technological capabilities (TCs) management- managing existing and developing or assimilating new technological capabilities for continuous process and product innovations, has become important for both large organisations and SMEs to achieve sustained competitiveness. Therefore, various technological innovation capability (TIC) models have been developed at firm level to assess firms' innovation capability level. These models output help policy makers and firm managers to devise policies for deepening a firm's technical knowledge generation, acquisition and exploitation capabilities for sustained technological competitive edge.

However, in developing countries TCs management is more of TCs upgrading: acquisitions of TCs from abroad, and then assimilating, innovating and exploiting them. Most of the TIC models for developing countries delineate the level of TIC required as firms move from the acquisition to innovative level. However, these models do not provide tools for assessing the existing level of TIC of a firm and various factors affecting TIC, to help practical interventions for TCs upgrading of firms for improved or new processes and products. Recently, the Government of Pakistan (GOP) has realised the importance of TCs upgrading in SMEs- especially export-oriented, for their sustained competitiveness. The GOP has launched various initiatives with local and foreign assistance to identify ways and means of upgrading local SMEs capabilities. This research targets this gap and developed a TICs assessment model for identifying the existing level of TIC of manufacturing SMEs existing in clusters in Sialkot, Pakistan.

SME executives in three different export-oriented clusters at Sialkot were interviewed to analyse technological capabilities development initiatives (CDIs) taken by them to develop and upgrade their firms' TCs. Data analysed at CDI, firm, cluster and cross-cluster level first helped classify interviewed firms as leader, follower and reactor, with leader firms claiming to introduce mostly new CDIs to their cluster. Second, the data analysis displayed that mostly interviewed leader firms exhibited 'learning by interacting' and 'learning by training' capabilities for expertise acquisition from customers and international consultants. However, these leader firms did not show much evidence of learning by using, reverse engineering and R&D capabilities, which according to the extant literature are necessary for upgrading existing TIC level and thus TCs of firm for better value-added processes and products. The research results are supported by extant literature on Sialkot clusters.

Thus, in sum, a TIC assessment model was developed in this research which qualitatively identified interviewed firms' TIC levels, the factors affecting them, and is validated by existing literature on interviewed Sialkot clusters. Further, the research gives policy level recommendations for TIC and thus TCs upgrading at firm and cluster level for targeting better value-added markets.

Key words: Technological capabilities, technological innovation capability models, SMEs, developing country, cluster, Sialkot, Pakistan

‘It is just impossible to talk only of technology transfer. One should talk of science transfer first and technology transfer later.....Unless you are very good at science you will never be good at technology’

Prof Dr Abdus Salam

Nobel Laureate from Pakistan

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Glossary

Absorptive capacity is the ability to evaluate and use outside knowledge is called absorptive capacity and is a function of the existing knowledge base of the firm (Cohen and Levinthal, 1990).

Cluster is geographical agglomeration of firms for mutual benefit and give SMEs an advantage of economies of scale and scope (Karaev et al., 2007).

Capabilities development initiative (CDI) is defined as the initiative taken by a firm involving human resource training, new process or product technology absorption/ development or improvement, which add to a firm's capabilities and result in innovations in processes and / or products (Li-Hua and Khalil, 2006a).

Technological capabilities management process has been described as capabilities identification, selection, assimilation and exploitation (Phaal et al., 2006).

Global Value Chain (GVC) where producers, suppliers and buyers are located in different countries (Morrison et al., 2008).

Process is taken as a sequence of individual and collective events, actions, and activities unfolding over time in context as defined by Van de Ven (1992) in (Pettigrew, 2007).

Processual analysis is the sequential analysis of process in a firm in the context of its inner and outer environment (Pettigrew, 2007).

Technological capability is a combination of a firm's physical, intellectual and cultural resources such as designing, manufacturing, testing, miniaturisation (Hafeez et al., 2002).

Technological competitive edge: Capability or bundle of capabilities which give a firm its technological competitive advantage over competitors is called its technological competitive edge (Hafeez et al., 2002).

Technology Management is the capability to make use of technical knowledge and skills, not only in an effort to improve and develop products and processes but also to improve existing technology and to generate new knowledge and skills in response to the competitive business environment (Jin and von Zedtwitz, 2008).

Technological upgrading is essentially to deepen the capabilities (increasing the level of TIC) within the same functions or in additional functions along the value chain (Morrison et al., 2008).

1. Introduction

1.1 Introduction to the thesis

The question of how firms achieve and sustain competitive advantage is central to their business strategy; and various capabilities are developed and maintained in synergy with their strategy for sustained competitiveness (Teece et al., 1997, Teece, 2007). All firms have physical, intellectual and cultural resources, which combine to give them various functional capabilities such as marketing, finance and technological capabilities (designing, manufacturing, testing, miniaturisation) (Hafeez et al., 2002). A firm's business strategy is about combining all their functional capabilities for a sustained competitive edge; while technology management (TM) is fusing technology strategy and technological capabilities with other functional strategies for managing existing and creating new technological capabilities for improved and/ or new processes and products (Gregory, 1995, Wu et al., 2011). With continuous technological changes, technological capabilities (TCs) management, an important part of TM, has become an important element in the competitive edge of a firm.

Technological capabilities management has been described as consisting of technological capabilities generation as well as assimilation, transformation and exploitation of the acquired technical knowledge (Phaal et al., 2006, Wei Wu et al., 2012). Most of the technological capabilities management literature relates to large and multi-national firms with little attention to Small and Medium Enterprises (SMEs), which play an important part in job creation and economic growth, both in developed and developing countries. SMEs often exist in clusters, which are geographical agglomeration of firms for mutual benefit and give SMEs an advantage of economies of scale and scope (Karaev et al., 2007, Knorringa and Nadvi, 2014). An SME's capabilities management process is affected by a firm's internal environment such as its competitive priorities and external factors such as government policies and local cluster capabilities (Ibid).

The TCs management literature related to developed countries is underpinned by an emphasis on the capability to generate new knowledge for innovation- new processes and products for sustained technological competitiveness. Therefore, various technological innovation capability (TIC) assessment models have been developed. They identify existing levels of technological knowledge generation capabilities of firms, and factors affecting innovation capability level. The models' output are intended to help policy makers and firm managers tailor support accordingly for firms' TCs upgrading (Rush et al., 2013).

However, the scope of TCs management in developing countries is TCs (and associated knowledge) upgrading: acquisition from abroad, their assimilation, improvement and

exploitation (Yam et al., 2011). A few TIC models exist as well for large firms, which identify the technological capabilities required by firms in developing countries as they move up the TIC ladder from acquisition to innovation level. However, these models (Lall, 1992, Kim, 1999) do not provide the means to identify the current TIC level of firms. The development of such a model would help to identify the causal relationships of different actors and factors which affect the technological capabilities upgrading process, to help manufacturing SMEs in their continuous TIC and thus TCs upgrading for sustained competitiveness.

Therefore, this research investigated the TCs upgrading process in manufacturing, export-oriented SMEs existing in clusters in Sialkot, Pakistan. Furthermore, this research focused on firms with mature products, where changes in TCs are mainly process changes (e.g. the introduction of more precise or more flexible machinery, higher levels of automation, or new forms of process control) that require some adaptations, but no active management of technological change.

The accomplishments and contributions of the present research could be claimed as:

- i. First, this research developed a TIC assessment model which identified the existing TIC level of the interviewed firms as per Lall's (1992) model and factors affecting their innovation capability upgrading.
- ii. Second, a firm categorisation criterion as leader, follower or reactor type was developed based upon the existing level of TIC of interviewed firms, their business strategy, competitive priorities and existing resources.
- iii. Third, Lall's (1992) TIC model has been modified in Sialkot's context as a result of this research's outcome.
- iv. Fourth, identification of leader firms and their characteristics such as business strategy, TCs, which could act as a bench mark for SME managers to follow.
- v. Fifth, this research gives policy level recommendations for TIC upgrading of interviewed firms and their respective clusters for targeting better value-added markets abroad. The TIC assessment model could be used for other SME clusters and the results could be used to make policy recommendations more robust.

However, the author would emphasise that the aim of this research was not to develop precise quantitative measurements but to rapidly generate a picture of how well a firm performs overall, and the positioning of the firm/ cluster along the TCs ladder- acquisition, assimilation or innovation (Lall, 1992).

1.2 The importance of the research topic

SMEs are generally considered the backbone of economic growth in all economies, both developed and developing. They contribute by providing jobs, and generally act as a supplier of goods and services to large organisations (Singh et al., 2008, Singh and Mahmood, 2014).

Recently, due to the shifting of manufacturing to developing countries, there has been an increased interest in understanding the process of TCs upgrading in SMEs, which are part of Global Value Chains (GVCs) in developing countries (Morrison et al., 2008, Pietrobelli and Rabellotti, 2011, Parrilli et al., 2013). To help upgrade (improve) the TCs of firms and their clusters, researchers (Ibid) have called for the longitudinal study of TCs upgrading processes to understand the types of innovations taken by the firms to upgrade their TCs, the level of TCs existing in a firm and cluster; and various actors and factors which affect the TCs upgrading process. For SMEs which are part of GVCs, TCs upgrading has been described as increasing (deepening) the skill content of existing TCs and/ or adopting new TCs for improved or new processes and products to target better value-added markets in the same sector (Morrison et al., 2008, Pietrobelli and Rabellotti, 2011).

In Pakistan, a developing country, small and medium enterprises (SMEs) form more than 99 percent of the total businesses (Pakistan, 2007, Speechley, 2011). They have a sizeable share in the country's industrial employment, and in manufacturing exports. In manufacturing and other sectors, 87 percent of SME employ fewer than five people while 98 percent currently employ fewer than 10 persons. The current SMEs sector accounts for 25 percent of manufacturing exports in Pakistan, while its share in value addition is 28 percent (Dasanayaka and Sardana, 2010b, Ahmad, 2014c). Only recently, the Government of Pakistan (GoP) realised the importance of SMEs to country's economy and an SME policy has been announced (Pakistan, 2007). As a consequence, Pakistan has setup various development organisations for SMEs, noticeable among them is the Small Medium Enterprise Development Authority (SMEDA) (<http://www.smeda.org/>) and the Technology Upgradation and Skill Development Company (TUSDEC) (<http://www.tusdec.org.pk/>). International development agencies such as the United Nations International Development Organisation (UNIDO) are especially assisting export-oriented SMEs through SMEDA and TUSDEC to improve SMEs for better productivity and quality (UNIDO, 2014b).

Most SME clusters in Pakistan exist in Karachi, Lahore, Faisalabad, Gujranwala, Sialkot, and Gujrat, which are the industrial hubs of Pakistan. These clusters belong to the low-technology segment as per the current literature categorisation (O'Regan and Ghobadian, 2005), and struggle to manufacture high quality products (Malik and Kotabe, 2009, Khan, 2012). Among the clusters existing in Pakistan, noticeable is the group of export-oriented clusters at Sialkot,

where more than 90% of the firms export their products and are an important source of revenue for Pakistan (Mansoor, 2010b, Mansoor, 2011a, Ranjha, 2014, Mansoor, 2015). The export clusters at Sialkot have been the subject of local and international research for increasing their quality and productivity (Zaidi, 2006, Lund-Thomsen and Nadvi, 2010, Knorrunga and Nadvi, 2014). These clusters manufacture for international brands and are a part of international manufacturing chains identified in the literature as Global Value Chains (GVCs), where producers, suppliers and buyers are located in different countries and/ or continents (Humphrey and Schmitz, 2002, Morrison et al., 2008).

Most of the literature and policy emphasis on export-oriented manufacturing SMEs in Pakistan relates to business performance, access to different markets, quality accreditations, supply chain management (Bhutta et al., 2007, Kureshi et al., 2009, UNIDO, 2010, Ahmad, 2014a). Recently, Government of Pakistan (GoP) has realised that export-oriented firms and their respective clusters have to upgrade their TCs in order to sustain competitiveness. Therefore, the GoP has formed a comprehensive policy to promote and encourage innovation, especially in export-oriented SMEs (Pakistan, 2012). Similarly, policy reports by international development agencies point to the need of Sialkot and other export oriented clusters TCs upgradation (TRTA, 2014b, TRTA, 2014a). However, none of the aforementioned policy documents and reports mentions how to assess technological needs of the firms and their clusters, which would assist in devising policies for clusters TCs upgrading. Therefore, it felt timely to investigate the TIC levels of the export-oriented clusters at Sialkot. The research findings could be used as input for policies related to firm-level and cluster-level TCs upgrading for improved processes and products for targeting better value-added markets abroad.

1.3 Research methodology

This research analysed the innovation capability level of Sialkot SMEs and factors affecting it, to give policy level recommendations for interviewed clusters TCs upgrading for sustained technological competitiveness. Based upon the nature of the research, which is studying capabilities development initiatives (CDIs) in the context of a firm's internal and external environment, case study was selected as the research strategy. This section explains the research aim and objectives, how they were achieved and how research results were validated.

Research aim

“To develop a technological innovation capability (TIC) assessment model to investigate the technological innovation capability level of manufacturing SMEs existing in clusters in Sialkot, Pakistan, to help practical interventions for their technological capabilities upgrading for sustained competitiveness”

Objectives

- i. Conduct a literature review to understand the relationship between TCs and TIC, resulting in innovation in processes and products.
- ii. Conduct a literature review on various firm level TIC models to understand their strengths and weaknesses.
- iii. Develop a TIC assessment model to help analyse TIC level of the interviewed Sialkot SMEs.

To assist aim and objectives, a research question was developed as mentioned below:

Research Question

How can the technological capabilities for sustained competitiveness of manufacturing Sialkot SMEs, Pakistan be better understood?

A TIC assessment model for continuous technological capabilities upgrading of manufacturing Sialkot SMEs, Pakistan for their sustained technological competitiveness

Further, the research question was assisted by the following sub-questions arising from a careful review of the literature. The sub-questions helped to define the context of the semi-structured interviews carried out in the field:

Sub-questions

RQ1: *What are the competitive characteristics and the level of technological capabilities of the interviewed manufacturing SMEs at Sialkot?*

RQ2: *What's the role of cluster(s) in supporting interviewed Sialkot firms' competitive characteristics and technological capabilities?*

RQ3: *What types of CDIs and resultant technological upgrading occurred in the interviewed Sialkot SMEs to sustain/ improve/ diversify their technological competitiveness?*

RQ4: *What are the internal factors and external actors which influenced or could influence interviewed Sialkot firms' technological capabilities upgrading?*

Overall to achieve the research aim and objectives, first a literature review was conducted (chapters 2 and 3). Second, a case study protocol was defined, third a TIC assessment model was developed, which was operationalised through various tools to collect and analyse field data (chapter 4). Fourth, research analysis is discussed in chapters 6 and 7. Contributions are

highlighted in chapter 8, while chapter 9 answers the research questions and summarises the research.

1.3.1 Literature review

The literature review consisted of multiple steps. In the first step (chapter 2), concepts of resources, routines and capabilities and their inter-relationship were analysed which helped to understand the role of TM in firm's competitiveness (Figure 2-2). Further, TM literature exploration showed that the emphasis has moved to TCs management: generation of new knowledge for improved or new TCs resulting in innovation- improved or new processes and products. Among others, new knowledge generation in a firm is underpinned by its innovation capability level, which is a representative of firm's learning capabilities level (Cohen and Levinthal, 1990, Yam et al., 2011). Therefore, the second step (chapter 2) of the literature review deals with identifying learning capabilities, and various actors and factors which help in increasing learning capabilities and thus TCs of firms (Rush et al., 2007, Rush et al., 2013). The third step of literature review dealt with analysing the scope of TIC models in developed and developing countries. In developing countries, the focus of TIC models are more of moving up the TC ladder i.e. upgrading TCs from absorption and assimilation to innovation (Lall, 1992, Morrison et al., 2008, Azadegan and Wagner, 2011). However, the TIC models for developing countries generally do not provide tools to identify or assess the existing TIC level of firms to help give policy and managerial level recommendations for TIC and thus TCs upgrading for improved (better value-added) processes and products.

Since the aim of this research is TIC assessment in manufacturing SMEs, the fourth step of literature review concerned with the TCs literature in SMEs (chapters 3). It showed that various external actors act as resource leverage in upgrading TIC and thus TCs of SMEs. Also, chapter 3 and especially chapter 5 discuss TCs upgrading literature on interviewed Sialkot clusters, focus of the research, which showed that there is an emphasis on upgrading of TCs of firms but no methodology or roadmap has been proposed as how to upgrade clusters TCs (Pakistan, 2012, TRTA, 2014a).

1.3.2 Research model

Addressing the research gap identified in chapters 2 and 3, a TIC assessment model for measuring existing TIC levels of manufacturing SMEs in Sialkot, Pakistan is developed in chapter 4. Taking technological innovation capability upgrading as a social process embedded in its internal and external environment, four constructs were operationalised from the literature review which affect the TCs upgrading process for an export-oriented firm existing in a cluster (Figure 1-1):

- i. Capabilities Development Initiative (CDI): is defined as an initiative taken by a firm involving human resource training, new process or product technology absorption/development or improvement, which add to a firm's capabilities and result in innovations in processes and / or products (Li-Hua and Khalil, 2006a). Overall, CDIs represent the TCs upgrading initiatives which a firm takes over its period of existence to sustain and upgrade its technical competitive advantage (Brophey and Brown, 2009, Brophey et al., 2013).
- ii. Internal firm environment: Firm's internal environment constitutes firm structure, resources, capabilities, and business strategy (Oyelaran-Oyeyinka and Lal, 2006, Rosenbusch et al., 2011).
- iii. Local external firm environment (cluster): Among others things, the external environment consists of competitors, suppliers, cluster constraints, academic institutions and government organisations (Hadjimanolis, 2000, Ismail et al., 2011).
- iv. Foreign environment: The foreign environment consists of customer requirements, technology and expertise availability, market accessibility (Cetindamar et al., 2006, Oyelaran-Oyeyinka and Lal, 2006, Khan, 2012). The foreign environment layer was added because the field research focused on export-oriented SMEs.

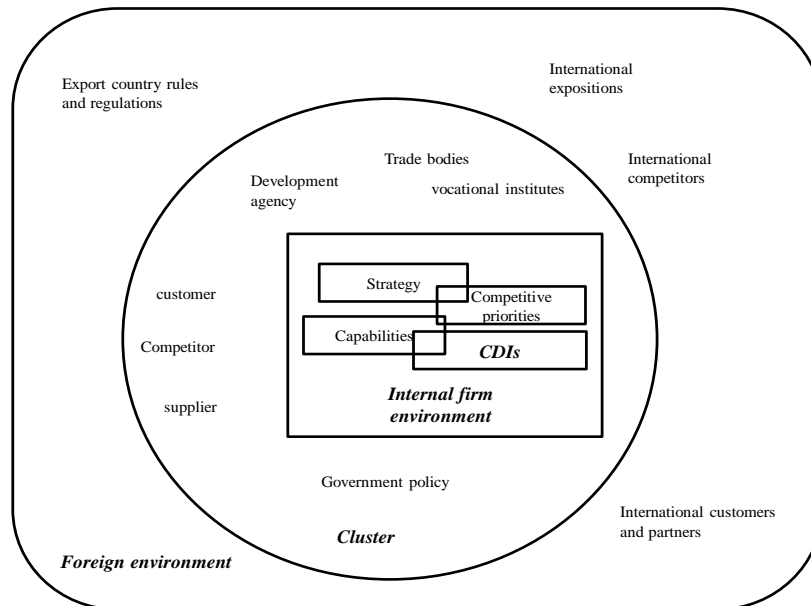


Figure 1-1: A model of TCs management process. (Source: Author)

1.3.3 Operationalising the TIC assessment model

To understand the dynamics between the constructs, various tools were operationalised which included a semi-structured interview, a CDI table, a CDI categorisation criterion, a firm's TIC level categorisation criterion and a time line. The semi-structured interview (Appendix-A) asked firm executives about their firm's competitive edge/ priorities, product portfolio, manufacturing technology, and CDIs carried out over time and how the CDIs added to a firm's technological capabilities and competitive edge.

1.3.4 Data analysis

To help coalesce the data, analysis was done at four levels: CDI level, firm level, cluster level and finally at cross-cluster level (multiple/ embedded case study design) (Figure 4-2). Each CDI was analysed for technological innovation capability displayed and type of innovation involved such as new process/ product acquisition or existing process/ product improvement (Li-Hua and Khalil, 2006a). For each firm, using visual mapping and temporal bracketing strategies for data processing (Langley, 1999), a chronological time line was designed which showed as how various CDIs carried out over the period of operation of a firm contributed to the firm's technological competitive edge. The time line for each firm helped:

- i. To indicate the level of TIC developed/ acquired by a firm: either routine/ basic capabilities or rather of higher, innovative and advanced order (Figure 2-4).
- ii. To identify whether a firm is in acquisition, assimilation or innovation stage, based upon a firm's technological innovation capability level (Table 2-3).
- iii. Help triangulate whether CDIs cumulatively add up to the competitive edge as stated by the interviewed executive.

To help triangulate interview data, firm websites and brochures were consulted and an observational checklist developed (Table 4-7). Similarly, analysis at cluster and cross-cluster level also helped triangulate research data, whether interviewed firms, in general, are in the acquisition, assimilation or innovation phase; and whether they are favouring process or product innovations.

1.4 Research validation and reliability

Numerous tools were developed to help research validation and reliability, which have been detailed in Table 4-9. Further, research findings were compared with previous research on the Sialkot's leather, sports and surgical clusters, and other regional clusters (section 7.3). It was found that the characteristics of leader firms among the interviewed sample were similar to large firms (Rana and Ghani, 2004) or progressive firms (Caniels and Romijn, 2003) identified in the extant literature relating to clusters in and around Sialkot, Pakistan.

1.5 Research conclusions and contributions

A TIC assessment model was developed which, through research data analysis, helped to identify the level of TIC in interviewed firms. The interviewed firms generally displayed ‘learning by interaction’ and ‘learning by training’ capabilities- an indication of the acquisition stage, which is only good for operational improvement (Cohen and Levinthal, 1990). The interviewed firms were acquiring TCs from abroad but did not exhibit any CDI improving upon their existing TCs. Also, the research data analysis helped to identify three types of firms based upon their TIC level, business strategy and resources possessed: leader, follower and reactor (section 7.2.3). Leader firms generally claimed to be the source of new CDIs in their respective clusters. In view of the research results, Lall’s (1992) generic model was amended in Sialkot’s context to show that within the acquisition stage, firms with various levels of capabilities exist (Figure 8-3). The amended model implies that policy makers should be more specific than merely employing a broad-brush policy approach for upgrading TIC and thus TCs of a sector or a cluster.

1.6 Thesis structure

This thesis is composed of nine chapters. A brief outline about the contents of each chapter is presented below.

Chapter 1: Introduction. This chapter introduces the research topic, research questions, and outlines the approach and structure of the thesis.

Chapter 2: Literature on technological capabilities (TCs) management. First, the chapter explains the concepts of resources, routines and capabilities and how they to integrate to give sustained competitiveness to a firm. Next, the relationship between TCs and their underlying learning capabilities for innovation in processes and products is analysed. Finally, scope of firm level TIC models for developed and developing countries is analysed.

Chapter 3: TCs management in manufacturing SMEs. In this chapter, first the SME definition and their generic characteristics are discussed. Next, TCs management literature in SMEs and various factors affecting TCs upgrading are discussed. Finally, existing TCs literature on Pakistan in general and on Sialkot in particular is introduced, which is more analysed in chapter 5.

Chapters 2 and 3 helped to answer first and second objectives of the research.

Chapter 4: Research Methodology. In this chapter, the research philosophy is identified according to which the research methodology was developed. An abductive approach has been used to develop a research model from the literature and the field research data to investigate

TIC level of interviewed SMEs existing in Sialkot, Pakistan. This chapter also describes the steps taken to achieve the validity and reliability of this research.

Chapter 4 describes the research methodology, and develops a TIC assessment model-which is the third objective of the research.

Chapter 5: Manufacturing clusters of Sialkot, Pakistan. This chapter introduces the country of research Pakistan, and describes the capacities and capabilities of the investigated clusters through extant academic and policy literature. The literature on Sialkot discussed in this chapter helps to validate or otherwise research findings in chapters 6 and 7.

Next, data analysis was carried out at four levels: CDI, firm, cluster and cross-cluster level. Chapter 6 explains CDI, firm and cluster level data analysis. Chapter 7 deals with cross-cluster level analysis.

Chapter 6: Firm and cluster level data analysis. In this chapter, first case study reports of the interviewed firms are presented and analysed. Next, firms are compared for commonalities at cluster level, which identified types of CDIs taken, their resources and strategies

Chapter 7: Cross-cluster level data analysis of the interviewed firms. This chapter extends the analysis conducted in chapter 6 to cross-cluster level. First, general competitive characteristics of interviewed firms are analysed. Second, CDI types and resultant TIC and TCs upgrading in the interviewed firms are identified. Third, the general characteristics of leader, follower and reactor firms found across interviewed clusters are collected. Fourth, general enabling and constraining factors affecting firm and cluster competitiveness are listed out. Finally, research findings are compared against the extant literature on Sialkot clusters for research validation.

Chapters 6 and 7 help to answer the four research question of the research in chapter 9.

Chapter 8: Contributions and recommendations. In view of the findings in Chapter 7, this chapter provides contributions and recommendations at the theoretical, managerial and policy level.

Chapter 9: Conclusions. This chapter proposes answers to the research questions, and summarises the findings and contributions of the research. The chapter also discusses the research constraints and shortcomings, and future avenues of research which could be explored.

2. Literature on technological capabilities (TCs) management

2.1 Introduction

Due to ever changing technologies, it has become imperative for firms to continuously manage their technological capabilities (TCs) for sustained innovation- improved or new processes and products, to help maintain their technological competitive advantage (Tidd, 2005). The TCs of a firm are underpinned by firm's technological innovation capability (TIC), which is an indicator of the level of firm's learning capabilities. Over the past two decades or so, the TIC level of firms has been regarded as an important strategic resource, enabling them to achieve a competitive advantage within their industry (Kim, 1999, Li and Liu, 2014).

Further, Hobday (2005) and Rush et al. (2013) state that TCs management and new knowledge generation in a firm should be understood in the context of its internal and external factors such as its business strategy, existing resources and capabilities and markets targeted, which influence innovation in TCs of a firm. Therefore, this chapter firstly analyses the concepts of firm strategy, resources, routines, capabilities, and how they are supposed to integrate to give sustained competitiveness. Secondly, TIC and its underpinning learning capabilities are discussed and how they could be enhanced for innovative processes and products. Thirdly, TIC models scope in developed countries is discussed. Fourthly, various TIC models for developing countries are analysed, and the scope of TCs management-upgrading, in firms which are part of global value chains are discussed. Figure 2-1 represents the structure followed in this chapter.

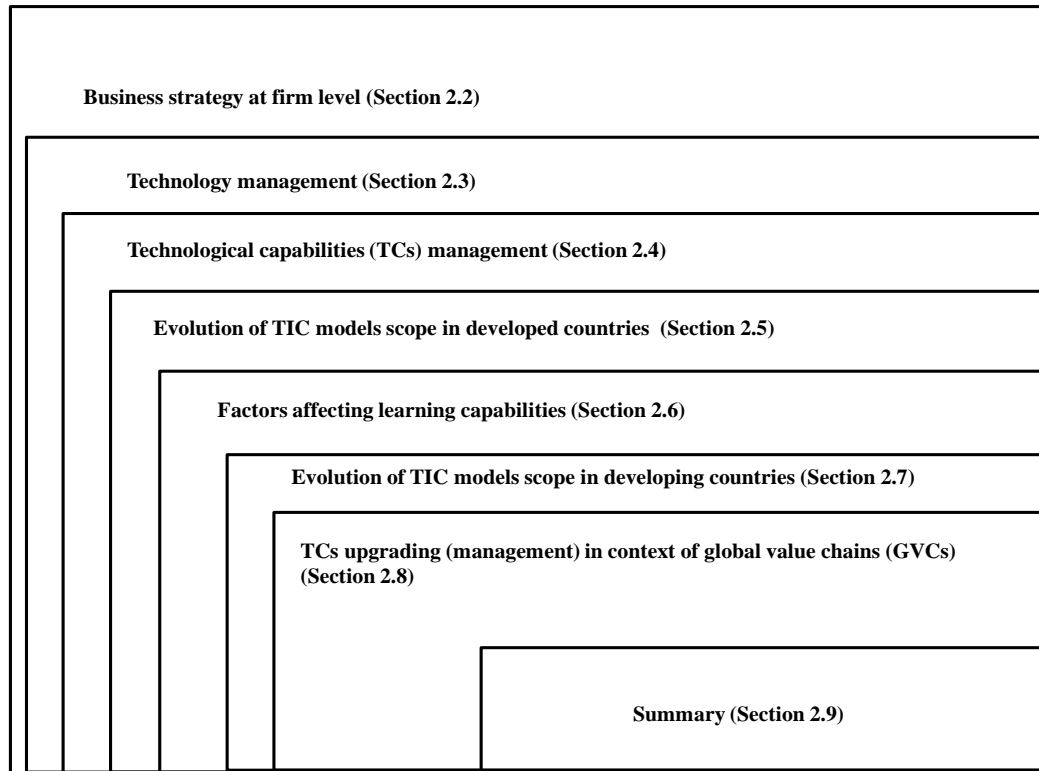


Figure 2-1: Chapter layout

2.2 Business strategy at firm level

The strategic process is about how a strategy is formed in an organisation, while the content deals with questions such as ‘what line of business is the firm in?’, ‘what sort of market is the firm targeting?’ and ‘what are firm’s competitive priorities?’ This section explains important philosophies of strategy, as well as capabilities and competitive edge concepts which underpin these philosophies.

2.2.1 Different strategy approaches

Generally speaking, there are various perspectives of strategy among which two philosophies are more famous. The first is the rational philosophy/ approach (also termed as planning or analytic approach). This approach is a top-down approach, where aims and objectives are set by the management and then resources are allocated to achieve those aims for a sustained competitive advantage. The main proponent of the rationalist/ analytical strategy is Alfred Chandler, who is recognised as the first academic researcher of strategy (Rumelt, 2008). He defined strategy as:

The determination of basic long term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals (1969, p.13).

The above definition has been amended by Andrews (1998, p.28) as:

The pattern of major objectives, purposes or goals and essential policies or plans for achieving those goals, stated in such a way as to define what business the company is in or is to be in and the kind of company it is or is to be.

Chandler proposes that unless structure follows strategy, inefficiency results. Porter (1990) is a proponent of analytic (rationalist) strategy and proposes to take a position in the industry and then defend it i.e. a firm's structure follows the strategy. A competitive advantage could be achieved through either overall cost leadership, differentiation or focus. Porter argues that firms are most likely to grow by concentrating on one of these generic strategies because they use different capabilities and are supported by different organisational arrangements and cultures. Porter has greatly influenced to the study of strategy by devising tools such as the five forces framework and value chain.

In response to rationalist strategy, various researchers argued that there is usually a big difference between what is planned and that which is realised because business environments are constantly changing, hence the threats and opportunities. Therefore, a second school of thought emerged called emergent or realised strategy philosophy, which questioned the assumption of a stable environment in the analytic strategy school. A firm starts with an intended strategy but as a firm implements it, the intended strategy changes due to its internal and external environmental (Thomas, 1984, Mintzberg, 1987, Rumelt, 2008). Mintzberg (1987) argued that strategy is not so much deliberately determined as evolving from events, strategy is the label attached to patterns of behaviour that accumulated over time.

The hierarchy of organisational strategy is commonly defined as corporate, business and functional strategies (Hofer and Schendel, 1978, Warren, 2008). A brief summary of characteristics of strategy at corporate, business and functional level is shown Table 2-1.

Characteristics of strategy components	Corporate strategy	Business strategy	Functional strategy
Scope	Scope of business portfolio and conglomerate diversification	Product/ market segment matches and concentric diversification	Product/ market development and product forms and brands
Differentiating capabilities	Primarily financial, organisational and technological	Varies with the stage of product/ market evolution involved	Varies by functional area, stage of product/ market evolution, and overall competitive position
Competitive advantage	Versus industry	Versus specific competitors	Versus specific products
Synergy	Among business	Among functions	Within functions

Table 2-1: Summary of hierarchy of strategy characteristics. Source (Hofer and Schendel, 1978), (Mooney, 2007)

This research mainly deals with firm level affairs, where the aim of firm level business strategy is to decide how best to compete in a given industry or product/ market segment. It does this by forming strong integration between the different functional areas (or departments) within that single business.

Business level strategy concerns typically include synergy among technological capabilities, marketing capabilities, financial capabilities and networking capabilities (Warren, 2008, Fortune and Mitchell, 2012). However, resources, capabilities lack clear definitions (Wang and Ahmed, 2007, Delgado-Verde et al., 2011). Therefore, in this section first relationships between firm resources, routines and capabilities are defined before explicating TCs management, and various TICs models in the next coming sections, which are the focus of this research.

2.2.1.1 Firm resources

Barney (1991) defines firm resources something a firm possesses which could be strategic assets and capabilities, organisational processes, firm attributes, information controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness. Similarly, Sanchez and Heene (1997) describe resource as either useful assets (tangible and intangible) or capabilities, and again in their terminology capabilities are considered as part of resources.

On the other hand, many researchers do not include capabilities within the definition of firm resources because of their ‘dynamic doing nature’ (Prahalad and Hamel, 1990, Grant, 2002, Yam et al., 2011). Grant defines resources as inputs to production processes. Similarly, according to Peng et al., (2008) firm resources could be anything such as:

- i. physical or tangible resources: plant and equipment, financial endowments, raw materials
- ii. Human resources: training, experience, skills
- iii. Organisational or intangible resources: firm image, processes, routines, internal systems for research, customer loyalty.

The basis of Grant and other researchers (Teece, 2012) approach is that capabilities are the results of resource deployment and organisational routines and should be treated independently. This research takes this approach and considers capabilities composed of firm resources and routines/ tacit knowledge.

2.2.1.2 Routines

Routines are what firms can do as clusters of resources working together; they are established ways of doing things and ways of deciding what to do in a firm (Teece, 2012). They have the task of coordinating various resources of a firm in specific ways, leading to their productive exploitation (Peng et al., 2008, Parmigiani and Howard-Grenville, 2011).

2.2.1.3 Technological capabilities and competitive advantage

There is no distinct definition of the term ‘technology’; the term has been widely applied to almost everything from manufacturing hardware and software-resources to search procedures and methodologies-routines. Some researchers have broad definitions while others have confined it to equipment and apparatus- firm resources (Sharif, 1995). In this research, the later definition is taken i.e. technology is related to equipment and apparatus. Firm resources combine through firm specific routines to give capabilities such as general management, legal affairs, marketing, technological capabilities (in R&D, design and production such as designing new products and processes, installing new production technologies, human resource training) (Burgelman et al., 2008). Capabilities help to perform specific tasks in a firm and can be developed inside a firm or collaboratively with the help of a firm’s stakeholders (Grant, 2002).

For each business function, capabilities may be formed by the integration of multiple activities (processes) or developed just from a single, discrete, activity. However, a capability generally helps to perform some basic functional activity and might not be a source of competitive advantage (Prahalad and Hamel, 1990, Protogerou et al., 2012). Discrete capability may include

those dealing with individual activities or specialised tasks such as surface mounting of components or wave soldering. While such capabilities may be indispensable to a business operation, on their own they have limited value to a firm.

A firm's competitive edge is generally viewed as a synergy of various discrete capabilities, realised through extensive communications and interaction among these capabilities, also known as 'collective learning' (Prahalad and Hamel, 1990, Mooney, 2007). Some of these capabilities by themselves or through interweaving with other capabilities through firm specific routines, help to develop a firm specific technological competitive advantage (Teece et al., 1997, Teece, 2007). A firm's competitive advantage should possess four qualities: valuable, rare, inimitable and non-substitutable, such as Canon's R &D capability represents the integrations of its optical, microelectronic, and precision-mechanical research activities (Ibid). Competitive edge involves complex patterns of routines and procedures which may not be visible to a competitor and thus difficult to copy. For instance everybody knows how Toyota's production and quality system works but finds it difficult to copy (Prahalad and Hamel, 2006, Xu et al., 2012)

However, given the present fast changing technological environment, a firm's competitive advantage, based upon technological capabilities, might depreciate quickly. Therefore, building and renewing capabilities is essential for in order to be sustainable and competitive in the long term (Grant, 2002, Yam et al., 2011).

2.2.1.4 Dynamic capabilities

Recently, in view of ever changing customer demands, technologies and business environment, it has been argued that a firm should also possess 'dynamic capability' - the capacity to renew and reconfigure strategic capabilities and resources so as to achieve congruence with the changing business environment for a sustained competitive advantage (Teece et al., 1997, Teece, 2007, Protogerou et al., 2012).

Dynamic capabilities are 'strategic' and different from ordinary capabilities. Firms can maintain and prolong competitive advantages by layering dynamic capabilities on top of ordinary capabilities. A firm's ordinary capabilities, if well practised, enable it to perform its current activities efficiently. However, if the capabilities are not continuously managed, they become obsolete and a drag on a firm's competitive edge. Therefore, dynamic capabilities, when combined with a good strategy, allows a firm to place itself to make the right products and pursuing the right markets to address the consumer requirements, as well as gaining the technological and competitive opportunities of the future (Ibid).

Eisenhardt and Martin (2000) support Teece's idea of dynamic capabilities through their definition:

Dynamic capabilities thus are the organisational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split and die

Other researchers have also argued that dynamic capabilities are higher order capabilities which overlay operational capabilities, and deal with transformation and reconfiguration of firm resources and capabilities (Zollo and Winter, 2002, Helfat and Winter, 2011).

Further, different researchers have put forward different processes underlying dynamic capabilities. Teece et al. (1997, 2012) proposes three processes notably coordination/integration, learning, and reconfiguration. Helfat et al. (2009) hold that dynamic capabilities are composed of search, selection and deployment capacities. Barreto (2010) explains dynamic capabilities from four dimensions, that is, the propensity to sense opportunities and threats, to make timely decisions, to make market-oriented decisions and to change its resource base.

In terms of the relationship of dynamic capabilities to the business environment, Eisenhardt and Martin (2000) contend that within the 'high velocity' (dynamic) environments, processes are experimental routines that rely on newly created knowledge specific to the situation, and need to be continuously reconfigured for sustained competitive advantage. Further, they state that in environments that are 'moderately' dynamic, dynamic capabilities appear very much like the traditional idea of routines where they are stable processes that rely extensively on existing knowledge, with predictable outcomes. Other researchers have also argued that generally dynamic capabilities are required in a business environment where technologies are changing rapidly and firms constantly need to reconfigure their TCs to maintain their competitive edge (Hobday, 2005, Li and Liu, 2014). These characteristics of dynamic capabilities have also been endorsed for transition, market-based economies, where dynamic capabilities are found to affect competitive advantage (Li and Liu, 2014).

Thus, in view of above discussion it can be said that firms are supposed to have a firm level strategy, and firm's capabilities and technological competitive edge should be developed in view of its existing capabilities, and markets and customers targeted.

2.3 Technology management

Over time, technology has assumed an important role in the competitiveness of firms. Various researchers have emphasised that the alignment of technological strategy and technological capabilities with business strategy is extremely important for a sustained competitive advantage and performance (Sun and Hong, 2002, Yam et al., 2011). They (Ibid) found a significant positive relationship between TCs-business strategy alignment and the improvement of business

performance. They argued that with coordination between business priorities and technological strategy, investments in R&D, process and product innovations may lead to a sustained competitive edge. Thus, the management of technology has become an important factor in the management of a firm's competitiveness.

Technology and technological capabilities are continuously changing, with new processes and products being developed or improved regularly, the need to acquire technology is also continuous, and one that grows with the expansion of economic activities. Therefore, researchers have called for proactive linking of firm technological capabilities development with other functions of the business to decide what capabilities to develop in house, procure off-the-shelf or develop through alliance. Thus, the technology management (Figure 2-2) deals with managing or fusing existing technological capabilities and developing new technological capabilities for improved or new processes and products for sustained growth, in synergy with other functional capabilities of a firm (Chanaron and Grange, 2006). Jin and Von Zedtwitz describe technology management (TM) as:

TM is the capability to make use of technical knowledge and skills, not only in an effort to improve and develop products and processes but also to improve existing technology and to generate new knowledge and skills in response to the competitive business environment (Jin and von Zedtwitz, 2008, p.328).

Above dynamic definition reflects the present knowledge-based economy of developed countries, where emphasis has moved from having infrastructural and technological tools to generation of new knowledge, which leads to innovation in processes and/ or products (Easterby-Smith et al., 2008, Rush et al., 2013).

However, other literature (Sun and Hong, 2002, Shavarini et al., 2013) cautions that technology strategy and supporting capabilities should be complemented by other strategic activities such as proper market scanning and threat evaluation for sustained competitiveness.

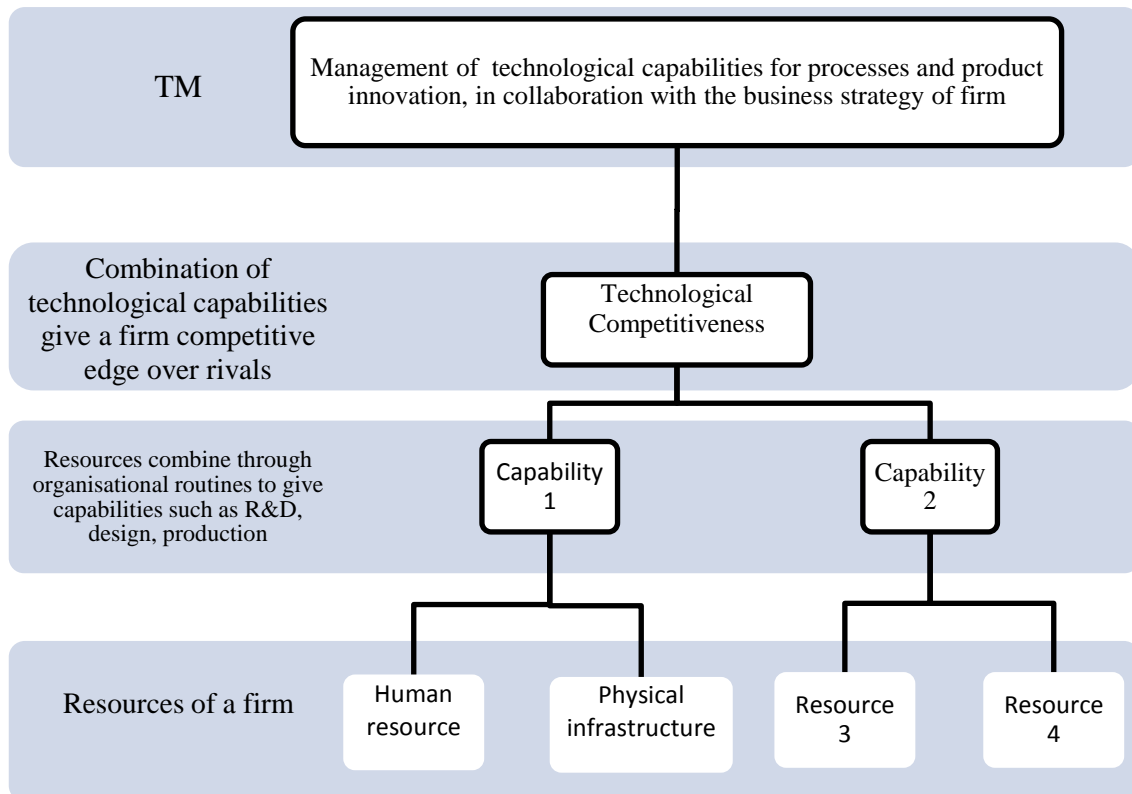


Figure 2-2: A relationship between firm resources, routines for firm specific capabilities and technological competitiveness. Source (Author)

2.4 Technological capabilities (TCs) management

Technology management does not necessarily involve the R&D activities or the appointment of a special technology manager. However, it does involve, at all levels, monitoring and evaluation of firm relevant technology fields. This requires a mindful effort to think about the impact of technological change on the market position of the firm and a readiness to acquire or develop new TCs for innovative products and processes in order to maintain a firm's competitive position (Tidd, 2005). Thus, in an ever changing technological environment, the technological capabilities management process has become an important part of firm's competitiveness. It has been described as TCs generation, assimilation and exploitation in new or improved processes and products-innovation, for a sustained technological competitive edge (Edwards et al., 2005, Yam et al., 2011).

2.4.1 Phases of TCs management process

- Search phase:** The first phase involves detecting indicators in the business environment about potential for change. These could take the form of new technological opportunities, or changing requirements on the part of markets; they could be the result of legislative pressure or rival action. Given the wide range of signals, it is important for successful

innovation management to have well-developed mechanisms for identifying, processing and selecting information from the dynamic market.

- ii. Selection phase: Given the costs and risks involved with innovation, this phase involves selection among the various market and technological opportunities. The choices should fit with the overall business strategy of the firm, and build upon their established areas of technical and marketing competitive edge.
- iii. Assimilation/ implementation phase: Having decided upon the technological change required, this phase decides how the technological change is to be brought about through activities such as in-house R&D, collaboration, off-the-shelf option.
- iv. Exploitation phase: This phase involves fusing its acquired and existing knowledge to improve existing or building new processes and products.

Finally, an inevitable outcome of the TCs management process is the creation of new stimuli for restarting the cycle as innovation is one sure way of maintaining competitive advantage. Further, the innovation cycle should also result in firm learning that is in terms of technological lessons learnt which add to the organisation's technological competitiveness. Learning could also be around the capabilities and routines needed for effective TCs management.

2.4.2 Technological innovation definition and types

The outcome of the TCs management process-innovation, contributes in several ways. New products help capture and retain market shares, and increase profitability in those markets. In cases of more mature and established products, competitive sales growth comes not simply from being able to offer low prices but also from a variety of non-price factors such as design, customisation and quality (Tidd, 2005, Wei Wu et al., 2012). This sub-section presents a discussion of definitions of product and process innovations used in this research.

2.4.2.1 Definition of innovation

Despite the extended discussion on innovation issues, so far there has not been a widely agreed definition of the term innovation (Peng et al., 2008). Garcia and Calantone (2002) point out that innovations vary enormously by type (product, process, organisational, system) and by degree of novelty. Some researchers describe technological innovation as (Oke et al., 2007, Gronum et al., 2012):

- i. adoption of new or improved products
- ii. or new or improved technological processes

to increase quality, productivity, competitiveness and overall profitability, based on customer needs and requirements. In this research, both new and existing process and product improvement is taken as innovation.

2.4.2.2 Types of innovation

The vast majority of researchers describe two types of innovation: ‘radical’ and ‘incremental’. Incremental changes relate to the notion of continuous improvement while radical changes relate to something new to the industry (Tidd, 2001, Tidd, 2005). In the management literature, researchers frequently use ‘exploitation and exploration’ to highlight the distinction between incremental and radical changes in technologies or organisations (Peng et al., 2008). Exploitation is characterised by refinement, implementation, efficiency, production and selection while exploration implies firms’ behaviours such as search, discovery, experimentation and innovation. Thus, continuous improvement relates to exploitive/incremental innovation but does not necessarily stimulate explorative (radical) innovation. What the vast majority of firms carry out are not radical innovations but hundreds of incremental innovations. For example, to support the manufacture of new products and improve plant competitiveness, process technologies, operational and organisational practices may be upgraded, modified or replaced with new and advanced processes.

This research is conducted in a developing country on low-tech firms using mature technology, therefore this research focuses on incremental innovation i.e. firms acquire TCs from abroad and try to assimilate and customise them to their needs.

2.4.2.3 Novelty of innovation

Along with innovation, the novelty of innovation is explained by adopting either a firm’s perspective or a customer’s perspective (Amara et al., 2008, Azadegan and Wagner, 2011).

- i. The customer’s perspective usually focuses on a product’s ability to provide features not found in previous products,
- ii. While the firm’s perspective on newness of innovation relates to the amount of resources, development time and changes to technology necessary for firms to undertake innovations.

The firm’s perspective of novelty of innovation is adopted in this research. Technological innovations for firm competitiveness have been emphasised by several researchers (Bessant, 1997, Antonio and Jose, 2008, Brophy et al., 2013) who indicated that for innovation to contribute to firm capabilities and performance, it should be carried out in the context of firm’s existing technological capabilities, competitive priorities, and business strategy.

2.4.3 Technological innovation capability (TIC)

Although technological resources can be purchased by a firm, TCs are improved gradually by self-learning: through knowledge gained from in-house R&D coupled with technological capabilities assimilated from outside the firm (Cohen and Levinthal, 1990). Learning results in enhancement of the knowledge and skills which firms need to choose, install, operate, maintain, adapt, improve, and develop their TCs (Prahalad and Hamel, 1990, Yam et al., 2011). In the literature, this ability of improving TCs has been called TIC and has been defined differently by different researchers as shown in Table 2-2, but all definitions emphasise exploitation of internal and external knowledge available to a firm for a sustained competitive edge.

Author	Definitions of technological innovation capability
Panda and Ramanathan (1996)	A set of functional abilities, reflected in the firm's performance through various technological activities and whose ultimate purpose is the firm-level value management by developing difficult-to-copy organisational abilities.
Kim (1999)	Dynamic process of acquiring technological capabilities
Yam et al. (2004)	Knowledge and skills firms need to chose, install, operate, maintain, adapt, improve and develop technological capabilities
Rush et al. (2007)	The ability to find and use technological capabilities to secure and sustain competitive advantage

Table 2-2: Various TIC definitions

2.5 Evolution of TIC models scope in developed countries

The literature on TIC integrates the concept of learning capabilities upgrading as a precondition for organising and upgrading TCs for targeting better value-added markets (Alizadeh, 2012). This section first describes the TIC scope in developing countries, and then analyses the learning capabilities underpinning TIC and factors affecting learning capabilities. Following the literature, the basic assumption of this research is that by identifying and improving the factors affecting learning capabilities, TIC level and thus TCs of firms could be upgraded for sustained innovation.

The scope of TIC assessment models has evolved over the last few decades (Drejer, 2002, Hobday, 2005, Wei Wu et al., 2012) (Figure 2-3). In the 1950s, competitiveness was measured by technological resources and assets of a firm and how quickly they could be deployed for production. Therefore, the TIC models were exclusively related to measuring R&D efforts in

manufacturing firms. The models presumed that scientific discovery preceded and ‘pushed’ technological innovation via applied research, engineering, manufacturing and marketing. In the 1960s, the emphasis moved to market based innovation, thus second stage TIC models began to measure market led (or pull) efforts for innovation. These models stressed the role of the market place and market research in identifying and responding to customer needs, as well as directing R&D investments towards them. The third stage of TIC models during the 1970s coupled the technology push and market pull philosophy.

However, the typical emphasis was on technology per se to get competitive edge. This ignored the fact that are other factors associated with technology such as human resource, knowledge management, organisational learning, suppliers and customer knowledge which could be exploited to become competitive. Therefore, the above mentioned models were criticised as being more or less sequential, deterministic and therefore not dealing sufficiently with various internal and external factors.

The fourth stage of TIC models during the 1980s attempted to capture the high degree of cross-functional integration within firms, as well as their external integration with activities in other companies including suppliers, customers and, in some cases, universities and government agencies. The fifth stage of the TIC models emphasised the learning that goes on within and between firms, suggesting that innovation was generally and fundamentally a distributed networking process. These models further emphasised vertical relationships with the suppliers and the customers and collaborating with the competitors.

Thus, the fifth model indicated a shift to developing and manipulating embedded knowledge for a competitive edge in business, where competition has moved from having infrastructural and technological tools to generation of new knowledge, in which learning capabilities play an integral role (Thorpe et al., 2006, Quinn and Strategy, 2013). Therefore, next sub-section describes learning capabilities undergirding TIC.

Various stages of TIC models	Scope
First stage	Focus on acquiring/ developing technological resources and how rapidly they could be deployed for production-technology push
Second stage	Now, the emphasis is on market place and market research in identifying and responding to customer needs-market pull
Third stage	Couples market pull and market push philosophy
Fourth stage	Measures cross-functional integration within firm and external integration
Fifth stage	Focus on creating and exploiting new knowledge

Figure 2-3: Evolution of scope of TIC models in developed countries

2.5.1 Learning capabilities underlying TIC

In the context of technological systems, knowledge represents an understanding of the principles that underlie their functioning, processes employed to create them, and the uses that these technological systems serve. These three facets represent know-why, know-how and know-what respectively and these different components of knowledge are underlined by different types of learnings (Garud, 1997, Easterby-Smith et al., 2008) (Figure 2-4). Learning is a costly and targeted process that takes place within a firm and may occur in the realm of production, design, engineering, R&D and marketing. Learning is cumulative and increases firms' stock of knowledge that firms have. Major types of learnings discussed in the literature are (Amara et al., 2008):

- i. First, 'learning by doing', internal to firm, relates to formal and informal efforts in production and directed at problem solving. Know-how is created by a process of 'learning by doing'(Garud, 1997).
- ii. Second, firms require an adequate pool of skilled manpower to develop innovations, whether incremental or radical. This pool of knowledge can be enhanced through investments in staff training-'learning by training'.

- iii. Third, 'learning by interacting', external to firm, occurs when a firm interacts with its suppliers, customers, competitors and academic institutions, which create new opportunities to access to knowledge in order to facilitate innovations.
- iv. Fourth, 'learning from inter-industry spill overs', external to firm and is related to what competitors and other firms in the industry are doing.

In the literature (Bell and Pavitt, 1995, Bell and Figueiredo, 2012) afore-mentioned learning capabilities are associated with the know-how of a TC, resulting in operational improvements such as increased productivity and quality. Know-how may reside in different 'storage bins', which include individuals, organisation routines and manufacturing processes. Some aspects of know-how are articulable through time and motion studies and through stories that form part of organisational culture. Other aspects of know-how, though, may remain tacit or invisible.

- v. Fifth, 'learning by using', internal to firm, is associated with the challenges associated with the use of new technologies, which create new opportunities for experimentation and problem solving on the shop floor. Learning by using is an important way by which know-what is generated. Learning occurs through interactions between vendors and customers. There usually is an attempt to document such knowledge in marketing and sales report.
- vi. Sixth, 'Learning by studying and searching' is associated with firm's internal R&D activities and underlies creation of know-why (Utterback, 1974, Garud, 1997). R & D activities are necessary to create new knowledge required to develop innovations, particularly those of a greater degree of novelty (Cohen and Levinthal, 1989, Garud, 1997). According to researchers (Ibid), existing stock of knowledge and capabilities play an important role in the absorption and generation of new technologies for firms. Individuals are proactive in seeking know-why in technological settings. A large portion of such know-why can be, and is documented for future reference in the form of laboratory notes and other technological documents. Particularly in the case of scientific findings, know-why is published in journals and disseminated to others in seminars.

Thus, firms may therefore be seen as learning organisations, characterised by different levels and types of 'knowledge capital' and accompanying TIC level. Therefore, this research assumes that learning by firm lies at the root of innovation in a firm. Identifying the type of a firm's learning capabilities in CDIs and various factors affecting learning capabilities would help firm managers and policy makers in formulating policies for continual TCs upgrading in firms for sustained competitive edge.

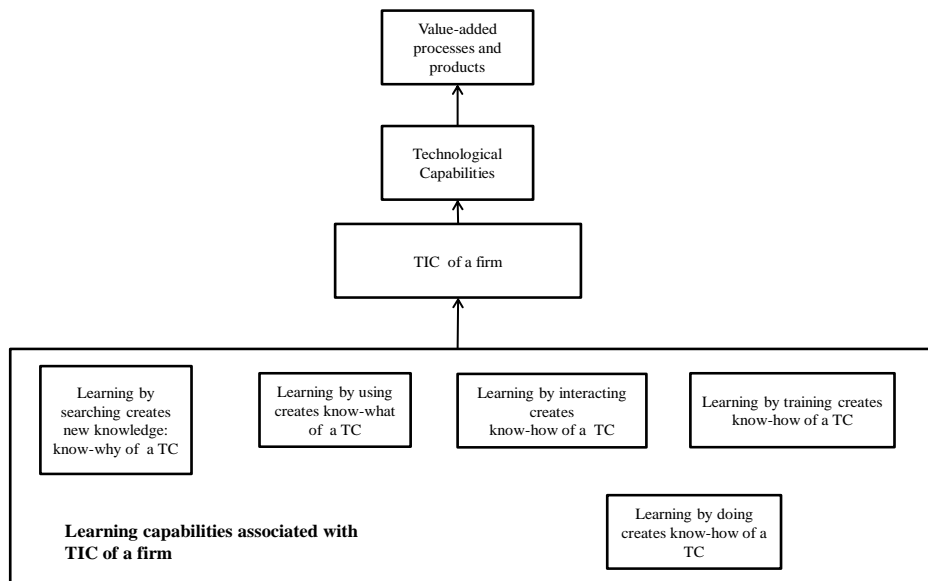


Figure 2-4: The learning capabilities underpinning TIC and thus TCs management in a firm. Source (Author)

2.6 Factors affecting learning capabilities

Various factors have been identified in the literature which affect firm's learning capabilities, but five important factors are discussed below (Wang and Ahmed, 2003).

2.6.1 Firm culture

Within the firm learning literature, there is a strong emphasis on the cultural perspectives of the learning firm. Culture serves as a sense-making mechanism that guides and shapes the values, behaviours and attitudes of employees. Various research works have been conclusive as to the key role of culture in innovation, where culture has been defined as the set of values, beliefs, behaviour patterns influencing the employees' behaviour and hidden assumptions that firm members have in common (Wang and Ahmed, 2003, Naranjo-Valencia et al., 2011). The main reason is that it can stimulate innovation behaviour among the members of a firm since it can lead them to accept innovation as the basic value of the firm and foster commitment to it. Thus, a creative culture promotes innovation. On the other hand, the existence of rules and regulations, excessive authority and poor participation of members of organisation in decision making limits the capacity of the members of a firm to assume the risks of innovation (Naranjo-Valencia et al., 2011).

As per Wang and Ahmed (2003), in the knowledge-based economy, knowledge is not reserved for people in managerial or professional positions. Every worker needs to be a knowledge worker. Therefore, according to Tesluk et al. (1997) the basic elements of an innovative culture have a twofold effect on innovation- from the perspectives of socialisation and of coordination. Through socialisation, individuals can know whether creative and innovative behaviour are part of the path of the business follows. At the same time, the business can, through activities, policies and procedures, generate values, which support creativity and innovation, and its innovative capacity will subsequently improve.

An innovative culture influences learning at individual and organisational level, which then feeds to firm competitiveness. Therefore, next sub-sections discuss how a learning culture affects individual and collective learning in a firm.

2.6.2 Individual learning

Academic research demonstrates a strong emphasis on the role of individual learning in firm learning. The ability of a workforce in a firm to learn faster than those in other firms constitutes the only sustainable competitive advantage. A learning organisation evolves as a result of the learning and behaviour of its people (Wang and Ahmed, 2003).

Also, as per Santos-Vijande et al. (2012) learning is achievable when the transfer of individual knowledge occurs through social interactions to different groups of individuals as a result of a shared interpretation. In turn, the accumulated knowledge allows individuals to learn from the organisation, thus generating an on-going, two-way process of knowledge transfer among individual groups, and the organisation. Regular trainings help in distribution and dissemination of new knowledge throughout the firm (Lin, 2003). Further, departmental meetings, discussions of future needs and cross-trainings help in knowledge dissemination in the firm. As per Wang and Ahmed (2003), the organisational learning system is viewed as one depending on individual learning. Therefore, next sub-section analyses organisational learning and its effect on firm's competitiveness.

2.6.3 Organisational learning

A portion of technological knowledge could be codified as documentation, hardware, software packages, standard operation procedures, and drawings. This portion of TCs is visible to competitors. However, a large portion of the technological knowledge is embedded in routines, which could not be imitable or visible immediately. The firms build sustained competitive advantage through facilitating the development of capabilities/ routines that are firm specific, produce complex relationships, are embedded in a firm's history and culture, and generate tacit organisational knowledge. Firm specific activities are both more efficient and qualitatively

more productive because of the opportunity to gain from asset interdependencies within the firm (Lin, 2003).

Four components of the organisational learning process have been proposed in the literature, which help in firm specific capabilities build-up (Wang and Ahmed, 2003): Knowledge acquisition, information distribution, information interpretation and organisational memory. An organisation can acquire knowledge through two mechanisms, either closed system or open system. Under the view of organisation as a closed system, organisational learning is restricted within an organisation itself. In open system, along with inter-organisational learning, knowledge is acquired widely, both within and outside of the organisation. Thus, in open innovation system, a firm adapts to its environment, learns from its people and contributes to the learning of the wider community or context of which they are a part. Learning at individual and firm level helps a firm continuously improve itself for sustainability in a competitive environment.

2.6.4 Focus on continuous improvement

Continuous improvement is viewed by many practitioners as being essential to achieving world-class performance and it continues to be a popular approach for process improvement. Researchers have explored how continuous improvement in processes and products affect learning and organisational improvement (Yang et al., 2010). A learning organisation should consciously and intentionally devote to the facilitation of individual learning in order to continuously transform the entire organisation and its contexts. Continuous improvement is focused on meeting, satisfying and exceeding the customer needs by improving processes, understanding the internal customer concept, involving each individual employee, implementing organisational wide training and development and concentrating on improvements in cost, quality and customer satisfaction. Thus for continuous improvement to happen, a firm has to continuously learn- either through internal or external means, to improve its processes and products and productivity.

However, in the present ever changing technological environment, firms have to continuously learn and update its capabilities not only for improved processes and products but also for new processes and products. Organisations relying simply on the traditional competence in cost and differential strategy find it increasingly difficult to sustain competitive advantage. A strategy of continuous improvement is not necessarily beneficial to organisations which operate in hyper-dynamic and hi-tech sectors such as microprocessors. Therefore, innovation- new processes and products has gained central theme in gaining technological competitive edge over rivals and in such context dynamic capabilities have become important for firms (Teece, 2012), which are analysed in next sub-section.

2.6.5 Focus on reshaping existing capabilities and developing new

Organisational learning should facilitate the creative quality process to deliver value innovation in the market place, in order to achieve organisational sustainability, rather than temporary profitability and incremental changes within the current competitive framework (Wang and Ahmed, 2003). Firms need to permanently renew their skills and resources to maintain competitive advantage and firm's dynamic capabilities represent a complex set of abilities through which organisations systematically modify their operating routines and reconfigure their resources and skills to achieve an adequate adaptation to changing market requirements (Santos-Vijande et al., 2012). Thus, sustained competitive advantage requires constant improvement and adaptation, especially under environmental volatility. Organisational learning underpins firm's competitive advantage through generating superior customer value in the long-term, since learning allows a continuous adaptation to rapidly changing market requirements as a true dynamic capability.

Further, turbulent business environment also requires increasing organisational flexibility i.e. the firm's ability to keep pace with market evolution as well as to respond rapidly to unpredictable and unexpected market conditions. Therefore, researchers argue that firm learning can strengthen a firm's ability to recognise opportunities, to pursue new ventures effectively, and to achieve continuous alignment with its environment (Teece, 2012). Thus, firm learning underpins dynamic capability which can, in rapidly changing environments enable the firm to modify it so to continue to produce, efficiently and or effectively, market offering for existing and new markets.

2.7 Evolution of TIC models scope in developing countries

The aforementioned literature addressed the evolution of the scope of TIC in developed economies, with the emphasis on the generation and exploitation of new knowledge. However, developing countries have to import technology, understand it, assimilate and then become competent in using it (Lall, 1992, Cetindamar et al., 2009a, Pietrobelli and Rabellotti, 2011). Historically, studies on TIC specifically related to developing countries date back to the 1960s, when the focus was largely on the problems associated with unsuccessful technology transfer from developed to developing countries (Lall, 1992, Kim, 1997). During this early period, the TIC level of a country was associated with the ability of its firms to effectively manage international technology transfer.

From the late seventies, and well into the eighties, the focus of attention started shifting to what happened to technology as it was imported and assimilated (Rosenberg, 1976, Dahlman et al., 1987). The development of TIC scope thus began to be interpreted as the ability to not only manage international technology transfer but also to master the transferred technology in the sense of making it operative, as effectively as possible, in the specific situation. However, the

work of Pavitt and Bell (1995), Lall (1992) , Sharif (1995) and Panda and Ramanathan (1997) led to a new and broad definition of TIC in developing countries. Their definition referred to the ability of a firm to buy, understand (assimilate), use and adapt (or change), and improve or create technology. Copying Porter's model of value chain (Porter, 1990), Panda and Ramanathan described TIC as the sum of certain strategic and supporting capabilities and developed various indicators for measuring these capabilities. In sum, the TIC literature in the 1990s emphasised first developing 'know-how' of the TCs before moving to 'know-what' and 'know-why' of the assimilated technological capabilities for improved or new processes and/ or products.

Recently, Yam et al. (2004, 2011) devised and tested a firm level TIC model in China and Hong Kong, which are newly developed regions. They represented TIC with a set of technological capabilities and defined metrics for measuring TCs. Similarly, Zawislak et al. (2012) defined a framework to assess the innovation capability at firm level by describing the TIC as composed of technology development, operations, management and transaction. Thus, recent work of researchers have built upon the TIC literature of the 1990s, and the scope is still to assess the existing TIC level of firms, factors affecting them to understand how TCs could be upgraded for sustained competitive edge.

Lall (1992) developed an illustrative matrix defining TIC as an array of functional technological capabilities broadly bifurcated along investment, production and linkages capabilities, where production capabilities are categorised along process, product and industrial engineering. He further categorised TIC at three levels: acquisition, assimilation and innovation stage (Table 2-3):

- i. Acquisition: At the acquisition stage, the process engineering is involved with debugging the production line, improving productivity and quality through liaison with its customers and suppliers. While product engineering involve assimilation and improvement of product design. 'Learning by interaction, training and using' capabilities play an important role in improving acquisition capability.
- ii. Assimilation: The assimilation stage requires adapting the acquired technologies for improved processes and products. This stage is assisted by linkages to technology transfer, cooperation with local S&T linkages, and this level is generally underpinned by the 'learning by doing' capability.
- iii. Innovation: The innovation stage requires in-house R&D for new TCs resulting in new products and processes.

Thus, mastery over level of TCs defines whether a firm is at acquisition, assimilation or innovation level. However, a methodology for identifying the existing level and types of TCs of

a firm is not provided in Lall's model (1992), which in turn would help to determine a firm's TIC level. Therefore, addressing the aforementioned research gap, the model proposed in chapter 4 extends Lall's by providing assessment methodology to categorise firms' according to their TIC level and identifies factors which affect the upgrading of TCs.

TIC level	Technological capabilities	Investment	Functional		Linkages within economy
		Project execution	Process Engineering	Product Engineering	
Basic/ acquisition	Civil construction, ancillary services, equipment erection, commissioning	Debugging, balancing, quality control, preventive maintenance, assimilation of process technology	Assimilation of product design, minor adaptation to market needs	Local procurement of goods and services, information exchange with suppliers	
Intermediate/ assimilation	Equipment procurement, detailed engineering, training and recruitment of skilled personnel	Equipment stretching, process adaptation and cost saving, licensing new technology	Product quality improvement, licensing and assimilation new imported product technology	Technology transfer of local suppliers, coordinated design, S&T links	
Innovative	Basic process design, equipment design and supply	In-house process innovation, basic research	In-house product innovation, basic research	Turnkey capability, cooperative R&D, licensing own technology to others	

Table 2-3: TIC trajectory in a developing country as per Lall (1992)

2.8 TCs upgrading (management) in context of global value chains (GVCs)

Industrial development is the process of building TCs through learning and translating them into process and product innovations in the course of continuous technological change. A firm's existing TCs (TIC level) help it to assimilate, use, adapt, and change existing technologies and generate new TCs in response to the changing economic environment.

Technological learning performance depends on both the firm's capabilities to learn new knowledge and the nature of the technological knowledge. Kessler et al. in Bou-Wen Lin (Lin, 2003) distinguishes two types of organisation learning process in the context of technology management: internal learning and external learning. In developed countries, TCs are developed largely through 'learning by research' and 'learning by using' - internal learning.

However, in developing countries, in contrast, TCs is built primarily in the process of imitative 'learning by doing' and 'learning by training' – external learning as firms lack internal R&D, collaboration with R&D institutes (Kim, 2001, Caniels and Romijn, 2003).

Recently, manufacturing has been shifted to developing countries, thus providing firms in developing countries with learning opportunities to upgrade their TCs. Thus, being part of global value chains (GVCs) has become an important source of learning for firms in developing and of academic interests for researchers (Humphrey and Schmitz, 2002, Morrison et al., 2008, Pietrobelli and Rabellotti, 2011).

The GVC clusters are being studied at two levels: upgrading of clusters through local linkages, and upgrading of firms or clusters by being part of GVCs. Humphrey and Schmitz (2002) describe four types of TCs upgrading for GVC firms in a developing country cluster for sustained competitiveness:

- i. first is the process upgrading through better production techniques or new technology
- ii. second is the product upgrading involving better value-added products
- iii. third is functional upgrading: adopting new functions like moving into marketing, design in addition to manufacturing
- iv. and fourth is inter-sectorial upgrading, where knowledge acquired in one business could be used in another related business

Supporting Humphrey and Schmitz (2002), Morrison et al. (2008) stressed the need of moving beyond the concept of 'higher production efficiency' in industrial clusters to identify factors which increase the depth of technological capabilities of firms for technological upgrading and targeting higher value-added markets within the same sector. 'Technological upgrading' is

essentially to deepen the capabilities (increasing the level of TICs) within the same functions or in additional functions along the value chain (Morrison et al., 2008, p. 41).

The interviewed firms in this research are operating in a low-tech environment and manufacturing for the lower market-segment of the market. The aim of the research was therefore to understand how the existing TCs (and underlying TIC) of the firms / clusters could be upgraded for better value-added processes and products. Therefore, the TCs upgrading definition adopted in this research is: *Increasing/ deepening skill content of existing TCs and/ or adopting new TCs along the value chain for improved or new processes and products to target better value-added markets in the same sector.*

Technological upgrading would in turn also increase the technological competitiveness of the cluster and would help the firms to become part of GVCs (Humphrey and Schmitz, 2002).

2.9 Summary

The analysis of various TIC models show that they represent learning capabilities underlying TCs of firms; and the identification of factors affecting learning capabilities help in upgrading innovation capability level and thus TCs of firm. Generally, the scope of TIC models for developed countries is new knowledge generation and exploitation for sustained competition. However, in developing countries the scope of TIC models is more of measuring firm's ability to acquire TCs from abroad and then upgrading them for improved or new processes and products. A firm's innovation capability is affected by various internal and external factors, therefore in the next chapter when TCs management literature on SMEs is explored with special focus on Sialkot SMEs in Pakistan, the actors and factors which would impact their TCs upgrading are also analysed.

3. TCs management in manufacturing SMEs

3.1 Introduction

SMEs are an important source of job generation in all economies, whether developed or developing. The strategy of SME's and their operational attributes such as competitive priorities and capabilities are affected by a host of internal and external environment actors and factors. Therefore, section 3.2 describes SME characteristics and challenges facing them. Next, section 3.3 discusses TCs management literature in manufacturing SMEs which shows that most of the existing literature on capabilities management takes a cross-sectional view, a snapshot of the status of various capabilities in a firm. Therefore, researchers have recently called for complementing existing TCs management literature with more qualitative, longitudinal studies, which takes a broader view of innovation in SMEs. The longitudinal analysis would help to understand how innovation capabilities and thus TCs could be upgraded over time in firms for sustained competitiveness (Edwards et al., 2005, Pietrobelli and Rabellotti, 2011). Various factors which affect TCs management are discussed in section 3.4, while section 3.5 discusses TCs upgrading literature related to Pakistan, which provides further focus to this research. Section 3.6 details the research output at theoretical, managerial and policy levels, and section 3.7 summarises the chapter. Figure 3-1 presents a layout of the chapter.

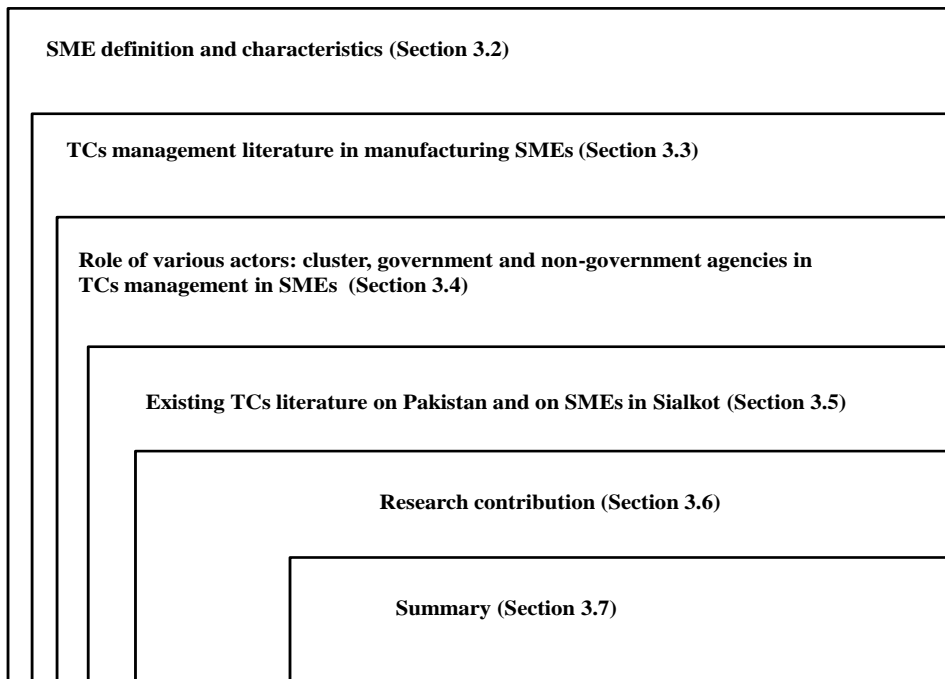


Figure 3-1: Chapter layout

3.2 SME definition and characteristics

SMEs are usually constrained by resources, are part of a supply chain, and have to adjust to market conditions. This section describes the general characteristics of SMEs, and different challenges facing SMEs which affect their technological capabilities management.

3.2.1 SME definition

The term SME covers a wide range of definitions and measures, varying from country to country and between the sources reporting SME statistics (Bos-Brouwers, 2010). Some of the commonly used criteria are the number of employees, total net assets, sales and investment level (Ayyagari et al., 2007). In the UK, SMEs are defined as firms with less than 250 employees (Daniel et al., 2002). In Switzerland, a medium-sized enterprise is defined to have around 500 employees (Savioz and Blum, 2002), while in Singapore SMEs as defined as companies with at least 30 per cent local ownership, with fixed assets investment of less than \$12m, and an employment size of less than 100 (Lim et al., 2006). In Turkey, the definition of a SME is a company which employs less than 250 employees and has less than \$50 million as turnover and annual balance sheet (Bulak and Turkyilmaz, 2014).

3.2.2 SMEs importance and their general characteristics

SMEs are generally considered the backbone of economic growth in all economies, both developed and developing. They contribute by providing jobs, and generally act as a supplier of goods and services to large organisations (Singh et al., 2008, Singh and Mahmood, 2014).

3.2.3 Competitive characteristics of SMEs

The general competitive characteristics for SMEs mentioned in the literature are flexibility, cost efficiency, customer loyalty and responsiveness and a short decision-making chain because of their simple hierarchy (Singh et al., 2008, Ates et al., 2013). SMEs act as specialist suppliers of components, parts, and sub-assemblies to larger companies because the items can be produced by SMEs at a cheaper price than the larger company could achieve in-house (Sureephong et al., 2007, Singh and Mahmood, 2014).

3.2.4 Major Challenges facing SMEs

In spite of the competitive characteristics of SMEs as mentioned above, they are under pressure to sustain their competitiveness in domestic as well as in global markets. Owing to global competition, technological advances and the changing needs of customers, competitive paradigms are continuously changing. These changes are driving firms to compete simultaneously along different dimensions such as design and development of products, manufacturing, distribution, communication, and marketing.

Major challenges facing SMEs have been detailed as technology management, supply chain management, collaborating with research centres and academic institutions. Some of the constraints in meeting these challenges are scarcity of resources, retention of skilled manpower, non-focused government policies (Singh et al., 2008, Bulak and Turkyilmaz, 2014).

3.3 TCs management literature in manufacturing SMEs

Various researchers have described SMEs ability to continuously deliver new products at competitive prices as a key driver for their long term competitive edge (O'Regan et al., 2006b, Madrid-Guijarro et al., 2009). Consequently, process and product innovations have become an important focus of technological capabilities (TCs) management in manufacturing SMEs (O'Regan et al., 2006b, Hanif and Manarvi, 2009, Pullen et al., 2012).

Correspondingly, a lot of quantitative and qualitative research has been done to find out which factors contribute to successful innovation in SMEs, in order to build a more thorough theoretical foundation for the mechanisms behind process and product innovations for practical interventions (Thorpe et al., 2006, Ayari, 2013). This section first describes quantitative literature and then complementing qualitative literature to better understand continuous innovation assimilation and exploitation process in SMEs.

3.3.1 Quantitative literature on TCs management

Birchall et al. (1996) emphasised that the function of TCs management in SMEs is to improve firm performance. However, they added that innovation is one aspect which helps it, but innovation per se should not be taken as a measure of firm performance. They (Ibid) challenged the notion of limiting TCs to the management of R&D for better innovation, and carried out an empirical study across three countries: the UK, France and Portugal to demonstrate the need for taking a more holistic view of factors affecting TCs. It was found that a holistic approach of factors affecting innovation such as internal firm capabilities, firm strategy, customers, suppliers, market feedback resulted in better innovation performance in terms of customer satisfaction, higher revenues and new processes. Similar conclusions have been drawn by other researchers (Soderquist et al., 1997, Raymond and Croteau, 2009) who advocate integrating technological innovation considerations with SMEs business strategy (Figure 2-2) for better firm performance in terms of revenue and satisfied customers.

Hoffman et al. also carried out a study on innovation management in SMEs and suggested: *since SMEs do not necessarily innovate in formally recognised ways, it is likely that they make much more use of external linkages and emphasise process innovation as much as product innovation-but with whom are these linkages formed, of what type, with what purpose, etc need to be answered (1998, p. 40)*. They pointed out that the current literature supports integrated

technology management guided by technology strategy and market feedback for successful innovations in SMEs. However, they stated a limitation of studies on SMEs in the UK as mostly been conducted on high-technology firms; the results lump the service and manufacturing sectors together, and the results do not measure innovative effort with firm performance in terms of profitability etc. As well as this, there are no benchmarks available for SMEs to compare their performance.

Studying TCs management and their impact on firm performance, O'Regan and Ghobadian (2004) quantitatively identified generic organisational capabilities and found them linked positively to both strategy and SME performance. However, the identified generic capabilities are similar to those identified by previous researchers (Cleveland et al., 1989, Vickery et al., 1993, Xu et al., 2012) labelled as 'production competence', which is at best competitive operational capabilities and could be achieved by any aspiring, efficient firm.

Vega-Jurado et al. (2008) investigated the effect of opportunities for innovation and technological capability on product innovation novelty and how this effect varies by industry. They found that TCs derived from in-house R&D were the main determinants of innovation. Yam et al. (2011) examined the impact of key suppliers and customers integration on product innovation. Their findings indicate a direct, positive relationship between supplier and customer integration and product performance.

Thus, various researchers studied the impact of different actors and found them positively related to technological innovation. However, generally, the innovation literature, as discussed above, is quantitative, cross-sectional and examines factors affecting innovation but not how innovation is brought about, assimilated and exploited in a firm. Further, the context in which innovation is brought about such as firm's existing strategy, capabilities, competitive advantage is not discussed. There is a mention of before and after innovation affects, but not how innovation was assimilated and exploited in the firm. Hence, there have recently been calls to complement the existing innovation literature with qualitative, longitudinal studies (McAdam et al., 2007).

3.3.2 Qualitative literature on TCs management

Recently, researchers have called for using a more broad-based approach to the process of innovation by paying attention to: *The constraining and enabling aspects of existing competences, dispositions, resources and firm's structures that include the strategic orientation and the core practices and techniques of managers* (Edwards et al., 2005, p. 1124).

This call (Edwards et al., 2005) has been supported elsewhere in the literature. Bell and Albu (1999) indicated that while previously interest had been on studying various aspects of the

comparative morphology of clusters for sustained competitiveness, now the need is to focus on technological capabilities which underpin competitiveness. They also pointed out that instead of taking snapshots, trajectories and stages of development of clusters capabilities should be chalked out, which would help to detail the rates and sources of change (both internal and external) in process and product capabilities. Bell and Albu (1999) emphasised that knowledge generation is important for sustained competitiveness and that links which promote knowledge generation and innovation should be identified and facilitated.

Also, supporting Edwards et al. (2005), Humphrey et al. (2005) also mentioned the paucity of studies on innovation implementation in SMEs and explored the innovation implementation process in an SME over a period of six years to understand innovation management. They found that innovation implementation in the SME requires a broad management perspective that is not restricted to that of technical innovation. Therefore, this strengthens the argument of Edwards et al (2005) of taking a broader view of innovation management in SMEs.

Again with the argument that there is a paucity of longitudinal studies on innovation interventions in SMEs, McAdam et al. (2007) evaluated the longitudinal effect of innovation programmes on improving the process of innovation in manufacturing SMEs. Following Edwards et al. (2005), they took the process of innovation in SMEs as involving people, process and technology. They conducted a multiple case study over eighteen months to evaluate the longitudinal effect of an innovation programme. They found that SMEs with high levels of innovation improvement adopted a broad process based approach to innovation rather than using a narrow technical definition of innovation, as also found by Humphrey et al. (2005).

Lately, Brophy et al. (2009, 2013) studied innovation keeping in view its multi-dimensional characteristic and temporal dynamic nature and the mutual simultaneous shaping of the process variables that occurs during the innovation process. They empirically studied innovations at different stages with different outcomes and overall innovation practices within targeted firms to construct innovation practices within manufacturing SMEs, so as to provide useful help to practitioners.

Further broadening the canvass on external factors affecting TCs management, Nieto and Santamaria (2010) studied the effect of improving TIC through inter-firm technological collaboration in Spanish SMEs. They surveyed 1,300 SMEs over a five year period for the innovations they took and found that technological collaboration is a useful mechanism for improving innovativeness. They also measured the different impact of collaborating with clients and/ or suppliers (vertical collaboration) versus collaborating with research organisations such as universities or technology institutes on innovation. Similarly, other researchers (Gronum et

al., 2012) conducted longitudinal studies as how SMEs can improve their innovation and performance through networks.

Thus, all of the above mentioned longitudinal studies support taking a broad based approach to the innovation process to help practical interventions for sustained innovation in SMEs. These studies, however, generally address hi-tech firms in developed countries where technologies change frequently and thus new/ improved processes and products are necessary for sustained competitiveness. Further, these studies do not address how each technological innovation affected the existing technological capability of the firm and whether these innovations initiatives were aligned with a firm's business and technology strategy. Therefore, this research involved low-tech SMEs in a developing country, and analysed individual innovation initiatives carried out over firm's operational life in the context of its existing TCs, business strategy, and markets and customers targeted.

A process approach has been taken to study TCs management (upgrading) in this research, as also suggested in the literature (Gronum et al., 2012). In this research the process definition is taken as defined by Van de Ven (1992) in (Pettigrew, 2007) : *Sequence of individual and collective events, actions, and activities unfolding over time in context*. Further, a processual analysis of TCs upgrading process is conducted, where processual analysis is the sequential analysis of processes (CDIs) in a firm in the context of its inner and external environment (Pettigrew, 2007). In the next section, various external factors which affect TCs management process in a firm are discussed.

3.4 Role of various actors: cluster, government and non-government agencies in TCs management in SMEs

As discussed in previous sections, SMEs need to cooperate with various external actors such as regional development agencies and other SMEs to manage their internal technological knowledge generation and exploitation capabilities for innovation in processes and products (Spithoven et al., 2011, Yam et al., 2011). These external actors help SMEs in scanning, selection and acquisition of required TCs for new or improved processes and products (Comacchio et al., 2012). Therefore, this section explores the role of various actors (Figure 3-2) which affect SMEs TCs management and competitiveness.

3.4.1 Potential clusters role in TCs management

3.4.1.1 Cluster definition

Clustering owes its origins to the work of Alfred Marshall who illustrated how small firms in the industrial heartlands of UK and Europe had acquired critical external economies of scale

and scope by locating themselves within geographically defined areas (Knorringa and Nadvi, 2014). Thus, industrial clusters are a concept defining territorial agglomerations of firms (Porter, 1998). In the case of clusters, it is important that the firms involved are not considered to be the only actors. In fact, local institutions and supporting organisations play a relevant role in cluster development. Clusters can be understood as a network of inter-organisational relationships between different actors, such as customers, competitors, suppliers, support organisations and local institutions and others (Belso-Martínez et al., 2011). Therefore, in this context geographical proximity and a strong feeling of belonging are primary elements in facilitating such relationships, based on norms and values such as trust, reciprocity among others. Prior research has also explained how industrial clusters represent local configurations that are high in social capital as they are characterised by mutual trust, cooperation, and entrepreneurial spirit as well as being a multitude of local firms with complementary specialised capabilities (Saxenian, 1996).

Traditionally, authors have focused on geographical proximity. Since Marshallian external economies, many different notions and conceptual developments have been proposed related to proximity. Among others, the most common are industrial cluster (Porter, 1998). Authors have, however, used a wide array of terms, such as physical, territorial, spatial or local proximity (Karaev et al., 2007). Some researchers have established proximity depending on the distance between actors, or the perception of distance taken by the actors, others have focused on the presence of groups of groups or agglomerations of firms in a specific place (Nadvi, 1999a).

The United Nations Industrial Development Organisation (UNIDO), a subsidiary of the United Nations, is working closely with developing countries to enhance the productivity of their industrial clusters. The UNIDO has defined industrial cluster, as quoted in the paper “The cluster approach and SME competitiveness: a review” by Karaev et al. (2007, p. 820) as : *Sectorial and geographical concentrations of enterprises that produce and sell a range of related or complementary products, and which also face common challenges and opportunities.*

The small and medium enterprise development authority (SMEDA) in Pakistan, a government of Pakistan institution, is actively involved with the UNIDO in helping the productivity of local clusters. The SMEDA (Small & Medium Enterprise Development Authority (SMEDA), 2015) has adopted the industrial definition as: *Clusters are geographical concentration of enterprises which produce and sell a range of related or complementary products and are, thus, faced with common challenges and opportunities.*

Above mentioned definition of cluster has been adopted by international and national researchers while working on clusters in Pakistan, especially in Sialkot (Caniels and Romijn,

2003, Nadvi and Halder, 2005, Lund-Thomsen et al., 2012), and this is the definition which has been accepted for this research at Sialkot, Pakistan.

3.4.1.2 Factors affecting cluster competitiveness

Recently it has been recognised that it is the knowledge of clusters, which provide the basis of differentiation and competitiveness, and which guides regions as how they cultivate, develop, and exploit resources and capabilities (Ismail et al., 2011). Asheim et al. (2003) recommend increasing external support and resources, which would help increasing the innovation capability and thus learning capabilities in SMEs, an argument which has been strengthened by other researchers (Bell and Albu, 1999, Nadvi and Halder, 2005, Kadarusman and Nadvi, 2013). This research deals with low-tech SMEs existing in clusters, are generally resource constrained and generally do not invest in R&D to generate new knowledge which could be quickly disseminated, thus eroding any competitive edge (Nadvi and Halder, 2005). Therefore, the role of resource leveraging institutions such as government institutions becomes even more important to support SMEs in knowledge generation and absorption from external sources in order to support TCs upgrading and thus innovation in processes and products.

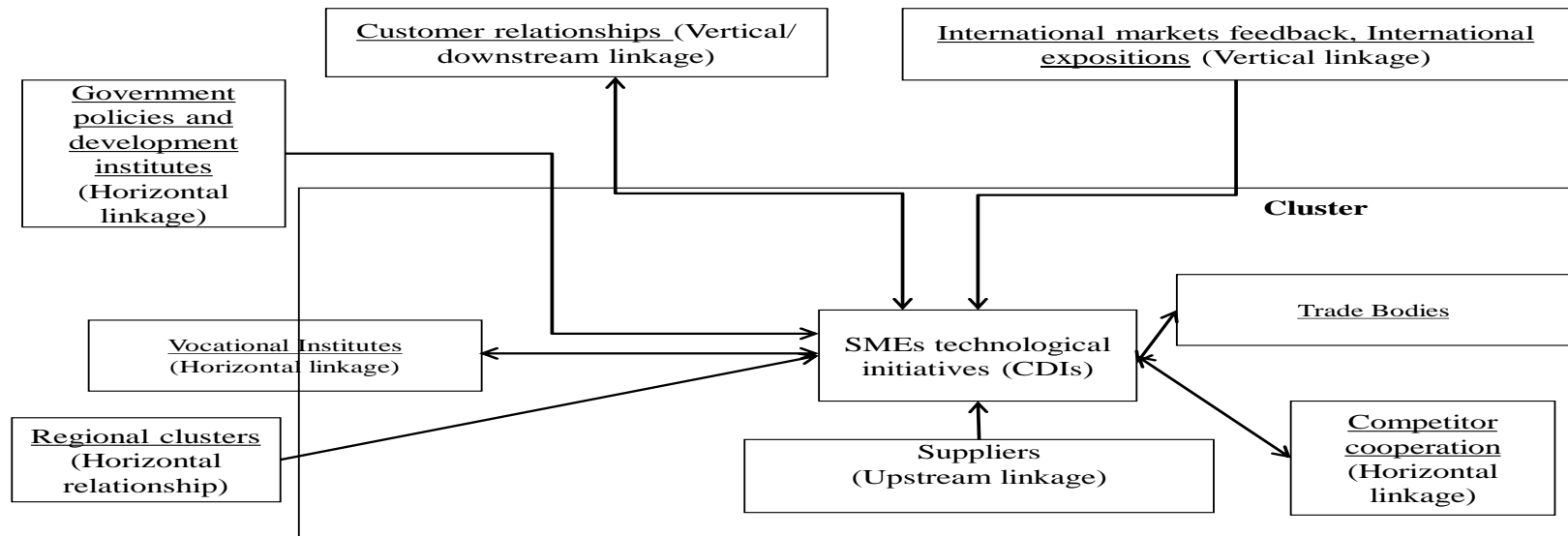


Figure 3-2: Various factors affecting TIC and thus TCs upgrading in export-oriented SMEs existing in a cluster. Source (Author)

3.4.2 Potential role of government and different development agencies in SMEs TCs management

Promoting SMEs and clusters, many European countries geared their policy making towards preferential treatment of hi-tech SMEs to promote entrepreneurship and innovation in them (Tödting and Tripl, 2005, Ismail et al., 2011). The areas of interest of policy making in the 2000s were a new knowledge-based economy, innovative activities, technology transfer, inter-firm cooperation and cooperation with academic institutions and regional development agencies. Government policies were generally focused on a linear model of innovation policy, financial innovation, infrastructure, best practices. However, these policies usually did not consider that each region differs from the other in needs, capabilities, performance requirements, and thus findings from one region or area cannot be transplanted to other region/country per se (Ismail et al., 2011). Also, most of the studies on clusters focused on economic benefits, while the technological factors which underpin these benefits were largely ignored (Caniels and Romijn, 2003, Morosini, 2004).

Therefore, recent literature (Asheim et al., 2003, Comacchio et al., 2012) suggests the development of autonomous, regionally oriented government agencies which are more tuned and tailored to regional needs, so as to preserve both competition and competitiveness in regional clusters. This approach allows flexibility to the differentiated needs of different local environments, allowing region specific roadmaps to be developed with the help of all local stakeholders. However, this approach may discourage a more centralised approach and creates difficulty in obtaining a standardised feedback. Therefore, there should be a provision of transferring experience from one cluster to another, exchange of information and practices among different clusters, and facilitation of cooperation between firms and academic institutions in a manner which leads to added value. Ultimately, government policy guides but also should be guided by regional clusters and SMEs.

3.5 Existing TCs upgrading literature on Pakistan and on SMEs in Sialkot

Marri et al. (2007) reports that Pakistani manufacturing SMEs lack the enthusiasm and capacity for absorbing advanced manufacturing technologies. However, the researcher did not discuss the reasons for the lack of enthusiasm for technology assimilation. Similarly, Fayyaz et al. (2009) point to the need for export oriented SMEs in Pakistan to be continually innovative to stay competitive, but how to promote said innovation is not addressed by the researchers.

Among the export-oriented clusters which constitute part of GVCs in Pakistan, Sialkot clusters are presently the focus of attention of international and local development agencies of Pakistan in order to increase their competitive advantage (Mansoor, 2010b, Lund-Thomsen et al., 2012).

More about Sialkot clusters has been discussed in chapter 5 regarding their TCs. However, a brief introduction to the Sialkot clusters is given below.

3.5.1 Existing literature on TCs upgrading on SMEs in Sialkot

Drawing upon the TCs management literature on developed countries, Caniels and Romijn (2003) applied the findings to an agricultural tool manufacturing cluster in Daska, Pakistan. They found that progressive farmers import machinery, which is reversed engineered by the local industry. They recommended increasing/ upgrading the capabilities of progressive firms in the cluster, with the premise that the skills from progressive firms would then disseminate in the cluster. However, the researchers do not propose a method for identifying TIC level and TCs of progressive firms and how to upgrade them.

Similarly, Nadvi and Halder (2005) concentrated on the historical role played by GVC linkage between Germany and Pakistan on the capabilities development of surgical instruments cluster of Sialkot, Pakistan. Stating the paucity of inter-cluster studies, they discussed the positive role of such external links on improving the competitiveness of a developing country cluster, in this case- Sialkot surgical instruments cluster, Pakistan. Although the researchers came up with a framework detailing interaction between clusters in Germany and Sialkot, they do not address how to identify and upgrade the existing TCs of the Sialkot surgical instruments cluster.

Nadvi's work has been referenced widely in literature relating to export-oriented clusters of Pakistan (Zafarullah et al., 1997, Humphrey and Schmitz, 2002, Steven et al., 2007, Fayyaz et al., 2009). However, Nadvi and other researchers concentrate on the concept of 'collective efficiency' i.e. external economies that accrue to producers operating in the clusters, and how this helped in cluster competitiveness, but does not address how technological capabilities of SMEs could be upgraded for targeting better value-added markets. This is a shortcoming which Nadvi also consistently mentions in his papers on Sialkot surgical instruments cluster (Nadvi, 1999b, Nadvi and Halder, 2005) i.e. cluster remains restricted to low technology end of the medical instruments sector. Nadvi's argument is supported elsewhere in the literature as well (Malik and Kotabe, 2009, Ahmad, 2014a). Similarly, general literature on export-oriented clusters in Pakistan concentrates on quality, productivity and efficiency (Bhutta et al., 2007, Fayyaz et al., 2009, Kureshi et al., 2009). Recent policy literature on Sialkot cluster points to the need of TCs upgrading but does not elucidate on how to achieve it (Pakistan, 2012, TRTA, 2014a). Therefore, this research was conducted to see how export-oriented SMEs have managed their capabilities to stay competitive and what further could be done to improve their cluster's performance.

3.5.2 General cluster culture existing in Sialkot

As per Nadvi and Halder (2005) and recent government Policy (Pakistan, 2012), there are loose vertical relationships between manufacturers and suppliers in Sialkot. Many firms sub-contract work outside their firm and retain only critical operations which directly affect the quality of the final product. There are no horizontal relationships among the interviewed SMEs and when the author asked one of the interviewed SME executive about the lack of inter-firm cooperation, he replied: *'This is the spirit of entrepreneurship.'* However, this lack of horizontal cooperation is not an encouraging sign for sustained competitiveness and existence of cluster, as also pointed out in the literature (Saxenian, 1996).

Also, there are no proper training facilities for apprentices in the local firms or much inter-firm cooperation. There is Ustad-shagird (teacher-apprentice) culture existing in firms, where new recruits are paired with 'old skilled hands' and the transfer of skills is then expected to take place over time (Nadvi and Halder, 2005). Some of the interviewed firms' SMEs complained local government vocational institutes have obsolete equipment and poorly trained instructors, which affected the availability of properly trained human resource. The lack of modern machines availability with local Pakistan industry has also been reported in the local media (Khan, 2012).

3.6 Research contribution

In case of Sialkot, Pakistan, there is a dearth of TCs upgrading literature on SMEs, most of which are low-tech. Further, most of the existing Sialkot cluster literature emphasises the achievement of 'economies of scale and scope' while recently some researchers have called for focusing on upgrading of technological capabilities without elaborating on ways and means of increasing the upgrading of technological capabilities for sustained growth (Pakistan, 2012). Therefore, this research contributes at three levels as described below.

3.6.1 Academic level

After the literature review, a TIC model is developed in chapter 4, which helped to operationalise a retrospective view of technological capabilities upgrading process in SMEs existing in clusters in Sialkot. The TIC model identified existing TIC levels of interviewed firms as per Lall's (1992) model. Further, the research data analysis eventually helped to further improve Lall's (1992) model in context of interviewed firms in Sialkot, Pakistan.

3.6.2 Managerial level

Competing firms in a cluster were interviewed for the research; therefore, behaviourally each firm is competing against the other to be different and competitive. The research findings could help the managers in Sialkot to benchmark their firm performance against the characteristics of

leader firms such as their competitive advantage, business and technology strategies, and what sort of technological capabilities underpin their competitive advantage.

3.6.3 Policy level

The research data analysis helped to identify the TIC level of interviewed firms and also categorised firms with various levels of TCs. Also, the research identified various factors which are affecting TCs upgrading of interviewed firms. Thus, the research results are an indicator that instead of taking a broad-brush policy for increasing the capabilities of clusters, the TCs requirements of individual firms should be determined and then policies defined accordingly. The TIC assessment model could also be used in other export-oriented clusters of Pakistan for assessing their technological needs, and the findings could be used as policy inputs for the researched/ targeted clusters.

3.7 Summary

Thus, as per the literature analysed on TCs management in manufacturing SMEs, the present emphasis is on developing new improving existing processes and products for sustained competitiveness. However, most of the literature on innovation management is cross-sectional. Therefore, researchers have recently called for taking a qualitative, longitudinal view of innovation accumulation process and the role of various actors and factors which affect the process in SMEs to give more robust policy level recommendations for continuous TCs upgrading of SMEs. Further, as discussed in chapter 2, the existing TIC models for developing countries generally delineate the TCs required for moving from the TCs acquisition to the innovation stage. However, these models do not address the identification of existing TIC level and the factors affecting it to help firms increase their TIC levels and thus TCs for better value-added processes and products.

Therefore, addressing the aforementioned research gap, the next chapter describes the development of a TIC assessment model and the methodology for research, which helped to analyse TCs upgrading process in the interviewed SMEs in Pakistan, a developing country, in chapter 6. The analysis in chapters 6 and 7 helped to identify interviewed firms' learning capabilities and their TIC levels, and factors affecting them, which helped to give policy recommendations for TCs upgrading of interviewed firms/ clusters in chapter 8 and answer research questions in chapter 9.

4. Research Methodology

4.1 Introduction

This chapter explores the methodological issues underlying the study, elaborates upon the decisions of the research design, and explains the data collection methods and the interpretation of the data. Recommendations from the literature (Voss et al., 2002, Rowley, 2012) have been considered, as appropriate, for operationalising this research such as choosing cases, devising instruments/ tools for data collection and analysis, and for research validity and reliability. The chapter starts with a discussion of the research philosophy that underlies the research. Subsequently, the research strategy and methodologies to be adopted are outlined. Subsequent sections describe the research instruments to be used and discuss both the sampling approach and ethical considerations. Figure 4-1 represents the layout of the chapter.

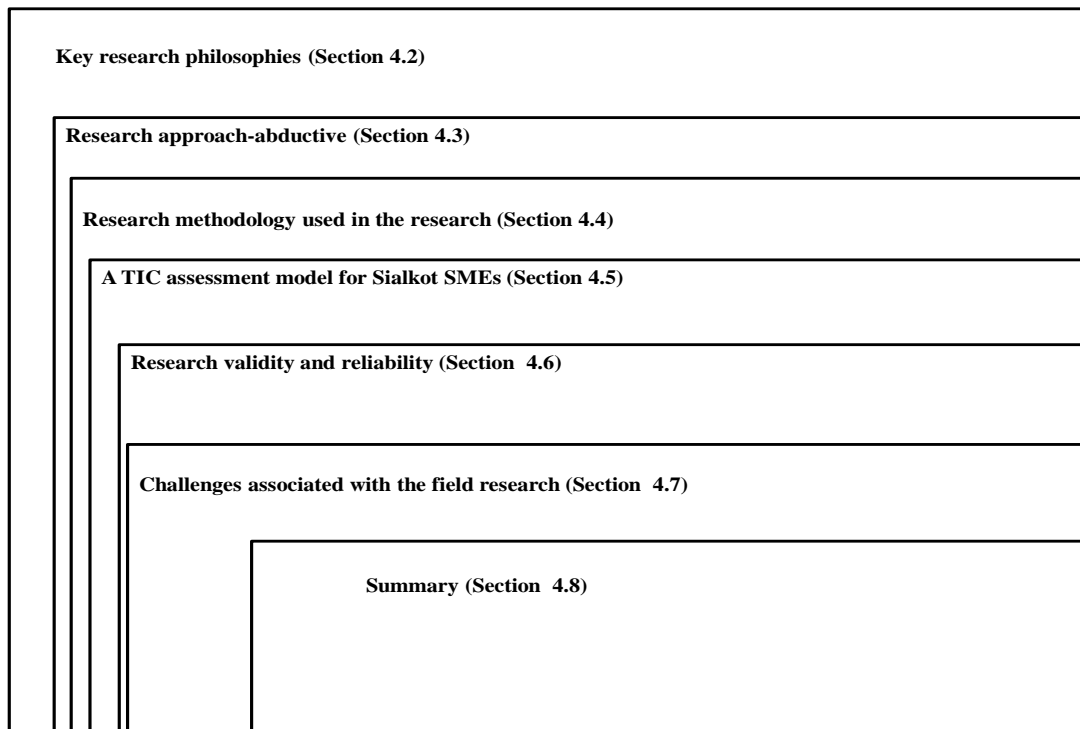


Figure 4-1: Chapter layout

4.2 Key research philosophies

Ritchie and Lewis (2003) note that “how researchers carry out [research] depends upon a range of factors including: their beliefs about the nature of the social world and what can be known about it (ontology), the nature of knowledge and how it can be acquired (epistemology), the

purpose(s) and goals of the research, the funders of the research, and the position and environment of the researchers themselves” (pg.1). Thus, one’s research philosophy is their belief about the way in which data should be collected, understood, investigated and exploited.

Different epistemological and research methodologies reveal the researchers’ varying epistemological views in research (Willig, 2013). According to Silverman (2010) as cited by Willig (2013), ‘methodology’ is the combination of techniques used to inquire into a specific, whereas ‘method’ refers to a specific research technique or techniques for data collection, coding, analysis, causal relationships. Thus, the epistemological position will lead the methodology, while not necessarily determining how the data are collected or the techniques to be used (p.8). Hence, it is vital for researchers to understand the assumptions and beliefs that underpin their research (Holloway and Todres, 2003).

Ontology is the philosophical assumptions about the nature of reality (Easterby-Smith et al., 2008). Reality can be explained either as an objective/ rational/ existential dimension which defines whether there is considered just one reality independent of the researcher, or whether this reality is subjective and socially constructed by the participants, researcher and any other relevant stakeholders. These different approaches can be explained through three dimensions: epistemology, methodology and methods/ techniques.

Epistemology is the general set of assumptions about the best ways of inquiring into the nature of different phenomena of the world, which can be objective or subjective (Easterby-Smith et al., 2008). Four key epistemologies are (Van de Ven, 2007):

4.2.1 Positivism

Positivism implicitly assumes an objective world independent of cognition. In other words, its core idea is that the social world exists externally, and that its characteristics should be measured through objective methods, rather than being deduced subjectively through sensation, reflection or intuition. In this approach, the researcher is considered independent of and neither affects nor is affected by the subject of the research.

A positivist works with an observable measurable social reality, and their end product of the research results in production of credible data. The positivist approach involves generating hypotheses from existing theory, which may be refuted or confirmed through field data, leading to further theory development, which may be tested in further research.

4.2.2 Pragmatism

Pragmatism supports that there are many different ways of interpreting the world and conducting research. This approach interests those researchers who want to avoid debates about

concepts such as truth and reality. Pragmatists argue that the most important factor of the research philosophy embraced is the research question - one research philosophy may be better than the other for answering different research questions (Saunders et al., 2012). This approach also supports that mixed methods, both qualitative and quantitative are possible in research. Thus, Pragmatism advocates using the method(s) which enable the most reliable, credible research data for the particular research area or question.

4.2.3 Relativism

Relativism is ontologically subjective, as it develops a socially constructed reality and adopts a subjective epistemology due to its denial of an objective and impartial representation of social constructs, as different actors and factors are seen to affect any process. In this approach, social scientists are not concerned with facts and measuring how often a pattern occurs, but try to appreciate the different constructions, causal relationships and meanings that people place upon their experience.

Positivism and relativism are extreme opposites, and their implications for the research practice are shown in Table 4-1:

	Positivism	Relativism
The observer	Must be independent	Is part of what is being observed
Human interests	Should be irrelevant	are the main drivers of science
Explanations	Must demonstrate causality	Aim to increase general understanding of the situation
Research progresses through	Hypothesis and deductions	Gathering rich data from which ideas are induced
Concepts	Need to be defined so that they can be measured	Should incorporate stakeholder perspectives
Units of analysis	Should be reduced to simplest	May include the complexity of 'whole' situations
Generalisation through	Statistical probability	Theoretical abstraction
Sampling requires	Large numbers selected randomly	Small numbers of cases chosen for specific reasons

Table 4-1: Positivism and relativism characteristics. Source (Easterby-Smith et al., 2008 p. 59)

4.2.4 Realism

This philosophy supports the argument that what we sense is reality, that objects have their own reality independent of the human mind. Like positivism, it undertakes a scientific approach to the development of knowledge, and this assumption supports the collection and understanding

of the data. Realism has been categorised into direct realism and critical realism. Direct realism is what you see (using five senses) is what you get.

Critical realism assumes that our knowledge of reality is a result of social conditioning and context, and cannot be understood independently of the social context involved in the knowledge derivation and development process. Realist philosophy considers objects have an existence independent of human mind and critical realism focuses on explaining within a setting or settings (Saunders et al., 2012).

4.2.5 A critical realist research perspective for this research

Business and management research is concerned with the social world we live in. The direct realist perspective takes the world as unchanging and does the analysis at one level which could be at the individual, group or organisational level i.e. what you see is what you get. However, a critical realist perspective is that a social phenomenon is changing and is influenced by the context of its social structures that give rise to a phenomenon (Saunders et al., 2012). Thus, critical realism supports multi-level analysis of a phenomenon or phenomena.

This research is concerned with understanding longitudinally the role of technological capabilities management for a firm's competitiveness and performance, a topic relating to business and management research. Capabilities management is a continuous process, and a firm has to be aware of its internal capabilities as well as external threats and opportunities for sustained competitiveness (Rush et al., 2007, Rush et al., 2013). Also, as shown in the literature review, numerous internal and external factors affect the technological capabilities management (upgrading) process of a SME existing in a cluster (Edwards et al., 2005, Singh et al., 2008).

In this research, the process definition is taken as defined by Van de Ven in (Pettigrew, 2007, p338) which is that a process is a : *Sequence of individual and collective events, actions, and activities unfolding over time in context*, while processual analysis is the sequential analysis of a process in a firm in the context of its inner and outer environment (Pettigrew, 2007). Therefore, the research perspective requires analysing the effect of different actors and factors on the capabilities management process in a firm at different levels such as firm, cluster, national and international level. The research perspective in this research is restricted to firm, cluster and regional level.

As mentioned above, critical realism recognises the existence of a variety of structures, procedures and processes at different levels and their capacity to interact with each other to affect a phenomenon (Easterby-Smith et al., 2008, Saunders et al., 2012). Therefore, the study of the capabilities management process sits well with the critical realism argument that the

social world is constantly changing and that a social phenomenon is affected by its social structures (Saunders et al., 2012).

4.3 Research approach -abductive

There are three general research approaches: deduction, induction, and abduction (Saunders et al., 2012), as shown in Table 4-2.

4.3.1 Deductive approach

Deductive approach involves the development of a theory that is then subjected to a rigorous test through a series of propositions. Sequential steps in the deductive approach can be described as:

- Put forward a hypothesis, idea, premises to form a theory.
- Using literature and delimiting the theory, deduce proposition(s) from it.
- Test the theory by collecting data.
- If the results of the data support the theory, theory is supported or if results fail to support the theory, then theory can either be rejected or modified and tested again.

Typically, quantitative data is collected to explain the causal relationships between concepts and variables, which need to be operationalised in a way that enables facts to be measured.

4.3.2 Inductive approach

In the inductive approach, the theory would follow data, rather than data following the theory as in deduction. This approach is concerned with the context in which such events are taking place. Therefore, inductive researchers typically use a variety of methods to collect qualitative data to establish different views of a phenomenon.

4.3.3 Abductive approach

The abductive approach uses both inductive and deductive approach. It usually begins with the observation of a 'surprising fact', and then a plausible theory is worked out. There are two advantages of the abductive approach (van Hoek et al., 2005, Visconti, 2010, Kovács, 2014) . First, the researcher does not claim to be free from the influence of prior knowledge. Second, the approach recognises that the researcher's understanding develops over time as phenomenon is further explored. In contrast to the conventional logics of induction and deduction, abductive reasoning implies that the researcher should start from the particular. The researcher recognizes a specific phenomenon - a surprising or anomalous finding, perhaps and then tries to interpret that phenomenon by connecting it to wider concepts. This is done so by reviewing one's own experience, our own stock of knowledge of comparable, analogous phenomena, to the

comparable stock of ideas that can be included from within our disciplines (including theories and frameworks) and adjoining fields (Montgomery et al., 1989 p.156).

The existing TCs literature on Pakistan in general and on Sialkot SMEs in particular speaks of improving innovation among manufacturing firms. A general approach among the researchers has been to customise TIC models, discussed in Section 2.6, for their specific firms and countries (Al-Fahhad, 2004, Abeysinghe and Paul, 2005). However, no method or model for identifying firms TCs level and factors affecting them have been generally developed or customised to assess TCs of SMEs at Sialkot (TRTA, 2014b, TRTA, 2014a). I, the author, instead of taking this well beaten path of customising an existing model decided to develop a TIC model specifically for low-tech manufacturing SMEs existing in a cluster, in a developing country. Thus, an abductive approach was most suitable for this research, which helped to develop a TIC model proposed by synthesising extant literature and field research results. The research results have been validated by comparing them with the extant literature on Sialkot clusters.

	Deduction	Induction	Abduction
Logic	In a deductive inference, when the premises are true, the conclusion must be true	In an inductive inference, known premises are used to generate untested conclusions	In an abductive inference, known premises are used to generate testable conclusions
Generalisability	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory falsification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory

Table 4-2: Characteristics of different research approaches. Source (Easterby-Smith et al., 2008)

4.4 Research methodology used in the research

Denzin and Lincoln (1998) state that “a research design describes a flexible set of guidelines that connect theoretical paradigms to strategies of inquiry and methods for collecting empirical material” (p.28). Thus, a proper research design sets up paradigms of interpretation and

connects the researcher to suitable methods of collecting and analysing data (Yin, 2003). Silverman (2010) states the importance of choosing a methodology for research on the basis of the research questions (RQs) being asked. Based upon the nature of research, case study has been selected as research strategy. This section explains the case study design, unit of analysis, data collection tools, interview protocol, pilot interviews and secondary data sources exploited to collect right data in the field to answer the research questions.

4.4.1 Case study approach

A case study, as defined by Yin (2009) is “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clear” (p. 18). Further, case studies are typically suitable for situations dealing with real management situations and generating managerial and policy knowledge (Gibbert et al., 2008). Therefore, in the present research, a case study approach was adopted as research strategy.

This research relates to ‘how’ questions about capabilities development initiatives (CDIs) which a firm has initiated in the past, for which case study method is ideal. The case study approach is particularly useful when the researcher is trying to uncover a relationship between a phenomenon and the context in which it is occurring (Yin, 2003). This research focuses on gaining an understanding of how firm’s existing capabilities and local and foreign accessible capabilities help in making a CDI successful, for which the case study method is suitable

Further, case studies benefit from the prior development of a theoretical position to help direct the data collection and analysis process, and the creation of a defined focus through an initial definition of a research question (Eisenhardt, 1989). Thus, a case study sits well with my abductive approach, where I define a model through a literature review of how SMEs in Sialkot, Pakistan could be building their TCs.

4.4.1.1 Unit of analysis

Unit of analysis may be a person, thing or an event about which we collect information in the context of its environment such as the process by which it was made, the participants, the consequences (de Vaus, 2001). CDI forms the ‘unit of analysis’ in this research, which is informed by factors prevailing inside and outside a firm.

4.4.1.2 Method-embedded/ multiple case study design

Yin (2014) defines multiple case studies as a case study organized around two or more cases. Multiple case studies are also commonly referred to as collective case studies, cross case studies, multi-case or multisite studies, or comparative studies (Merriam, 1998, Baxter and Jack, 2008). According to Yin (2003) and Voss et al. (2002) when theory building is an aim, replication logic is used: cases are selected so they predict similar results (literal replication) or produce contrary results for predictable reasons (theoretical replication). Further, according to Voss et al. (2002) multiple cases help to reduce bias while augmenting external validity.

The research calls for studying CDIs carried out by a firm, over its operational time, using a retrospective, longitudinal study. Four firms each from three clusters (surgical instruments, sports goods and leather goods) were selected for interviewing. Multiple CDIs in each firm were studied. Next, the results of data analysis from a firm were compared with other firms from the same cluster (Chapter 6). Further, at macro level, data from all the interviewed firms was cross compared to validate the results (Chapter 7), which is the norm of multiple case studies. In sum, data was analysed at the following levels (Figure 4-2):

- i. CDI level: At this level, the CDI driver, innovation, its outcome and its effect on firm technological competitiveness is analysed.
- ii. Firm level: At the firm level, data about the firm's competitive edge, capabilities and CDIs and their link to firm performance were gathered. CDIs are compared with each other to view any commonalities, patterns of repetition.
- iii. Cluster level: Again, firms in a cluster are compared for their competitive edge, business strategy, capabilities and types of CDIs taken.
- iv. Cross-cluster level: helps to generalise the results and thus help in external validation

Thus, the research design is an embedded, multiple case type, which helps in replication and validation of the research data (Yin, 2014).

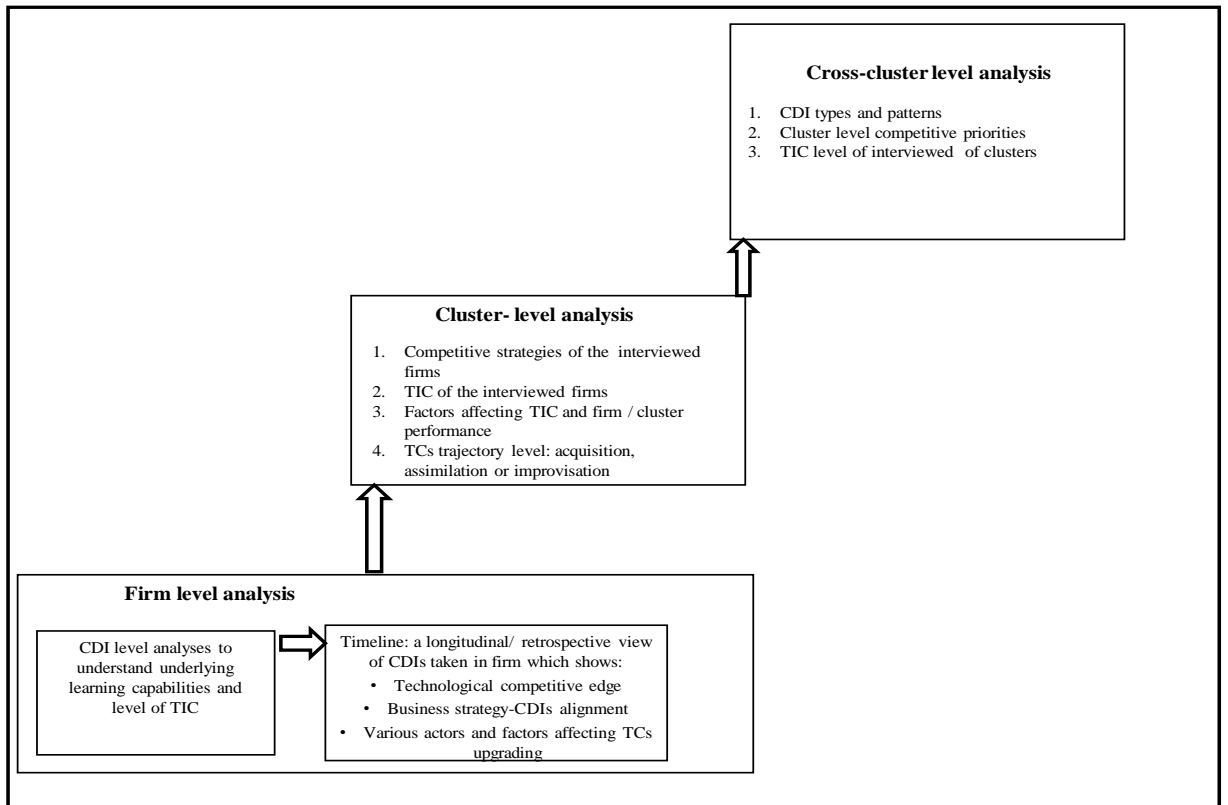


Figure 4-2: Data analysis pattern

4.4.1.3 Critique of the case study approach

The main issue of case study methodology is that it is often claimed to lack rigorously scientific data collection and validation (Noor, 2008). This may include unsystematic procedures, confusing evidence, or biased judgement (Yin, 2009). These shortcomings may possibly be due to improper data analysis of evidence or from having multiple tools, which affects the validity of the case study. Therefore, for validation and reliability, a case study protocol was developed which includes: case study design (Figure 4-2), data collection tools (4.4.2), interview protocol design (4.4.3), data analysis techniques (part of interview protocol) and pilot interviews (4.4.4). Further, for research data validation, the research results were compared with extant literature on Sialkot clusters- which is discussed in chapter 5. A summary of the steps taken for research validation and reliability is also discussed in section 4.6 (Table 4-9).

4.4.1.4 Sampling, sample size and sample selection criteria

Merriam (1998) and Robson (2011) state that the two common basic types of sampling are probability and non-probability sampling. Probability sampling takes samples from a whole population, assuming that the result can be generalised, whereas non-probability sampling does

not represent the whole population. Probability sampling also involves the random selection of samples. Thus, Bryman (2012) adds that purposive sampling is a form of non-probability sampling, since the researcher does not seek such samples at random. In addition, Robson (2011) adds that purposive sample normally involves small numbers in order to achieve a particular purpose.

Voss et al. (2002) have recommended multiple case studies involving anywhere from three to thirty cases. Eisenhardt (1989) suggests a that a typical study should conduct between four to ten case studies. Further, with multiple case research, the sample of cases is selected using some set criteria and not sampling (Yin, 2003). Thus, four cases each in three clusters: leather, surgical instruments and sports goods were selected, with each case having multiple CDIs, the unit of analysis.

Most SMEs disappear (fail) in first five to ten years of operation (Toftoy and Chatterjee, 2004, O'Regan and Ghobadian, 2005, Terziovski, 2010). Thus, SMEs which had been in the business for a minimum of 15-20 years were targeted assuming that firms which have been operating for this length of time must be doing something right. Also, it was assumed that the more mature a firm is, better are the chances of finding increasing number of CDIs taken in a firm. Also, those SMEs were selected which were operating under their own name, as a sampling control parameter. Further, Firm A interviewee asked to see the list of SMEs which I was interviewing and commented that they are among the most notable (competitive) firms of Sialkot. Similarly, firm H executive asked for the list of SMEs to be interviewed and approved of the list as consisting of SMEs which are competitive.

4.4.2 Interview data collection and triangulation

Triangulation is the use of more than one method or source of data in the study of a social phenomenon so that findings may be cross-checked. In relation to the case study design, Yin (2009) argues that data collection and triangulation is likely to be much more convincing and accurate if the data derives from several different sources of information. Thus, it is important to select the correct instruments for gathering information and data in order to create accurate research findings. Also, collecting data from multiple sources provides a convergence of data that is useful for data triangulation and validation (de Vaus, 2001).

In this research a broad view on innovation process is taken, which includes firm's internal and external environment, as detailed in Figure 4-3. Therefore, semi-structured interviews yielding qualitative data along with direct observations and document analysis were used as data collection and triangulation methods. Multiple data collection tools help to off-set the weaknesses associated with the individual tools (Table 4-4). Since this was a retrospective study, therefore participant-observation method of data collection was not possible.

4.4.2.1 Interviews

This research generally focused on events (CDIs) which happened in the past, and which could only be articulated by interviewing people who participated in those CDIs, by studying firm archives and visiting shop floors. Consequently, the interview method was selected as primary source of data collection. SMEs are mostly headed by their owners who supervise all the operations in their firm (Oyelaran-Oyeyinka and Lal, 2006, Hsu et al., 2013). Therefore, the point of contact for the field research were the owner/ executive heads of the firm, who make the decisions about technology purchase, marketing, purchasing, hiring, incentive schemes, day-to-day management, and any other innovation in the firm.

Two common forms of interview which have been used in research are person-to-person interviews and group formats (Merriam, 1998). In this research, person-to-person interview, also known as individual interviews, was adopted, which follows an interview process where one person (interviewer) obtains information from the other (interviewee(s)) (Rowley, 2012).

An interview involves the researcher addressing the respondent directly. There are three forms of interviews: structured, semi-structured and unstructured (Merriam, 1998, Cohen et al., 2011). For structured interviews, the interviewer uses an interview sequence with predetermined open-ended questions. The same sequence is followed in all the interviews to avoid bias and the practice aims to ensure that responses are comparable between interviews. In contrast, unstructured interviews have no pre-determined specific direction and are usually conducted in an informal and conversational manner (Merriam, 1998). But, from the research perspective this type of interview lacks reliability. Semi-structured interview format, adopted in this research, however includes elements of both structured and unstructured interviews; here the interview is guided by a set of questions and issue to be explored, but neither the exact wording nor the order of questions is predetermined (Merriam, 1998). Additional unplanned questions may be asked in such interviews in order to clarify individual points (Bryman, 2012).

For data triangulation purposes, another suitable interviewee (probably a production manager) in each firm would have been ideal. However, the field research showed that interviewed firm executives or their family members occupied all the managerial positions, with the family patriarch holding all the executive powers. This problem of finding suitable interviewees for data triangulation in SMEs has also been identified in the literature on SMEs in Pakistan (Marri et al., 2007). There is a criticism of recall with interviews; therefore field observations and documentation analysis were used to mitigate the criticism associated with interviews.

4.4.2.2 Observations

Observations are some of the best data collection methods for field work settings. Observational data is primarily descriptive of settings, people, events and the meanings that participants ascribe them. Observations are of two types: direct and covert (Creswell, 2013, Gray, 2013). This research deals with analysing a firm's CDIs obtained through semi-structured interviews. However, to validate interview data, each interviewee was asked to organise a shop floor visit-direct observation, to help validate the CDIs mentioned in the interview. The visit also helped in assessing the firm's resources (Yin, 2003). A table (Table 4-7) explained in sub-section 0 was designed to record each interviewed firm's resources, which helped in categorising firms as either leader, follower or reactor type. Further, all interviews, except one, were held in SME's executives rooms located inside the firms' premises. Thus, the interviews allowed the researcher to observe the general resources of firm such as the condition of the building, whether it has fire extinguishers, proper lighting or whether the premises were kept neat and clean, as mentioned by Yin (2003).

4.4.2.3 Documentation

Documents such as firm brochures, performance reports and written reports of events play an important role in any data collection in doing case studies (Yin, 2003). Therefore while visiting firms, their performance reports and brochures were requested. Also, their websites were visited to corroborate or otherwise firm data. Finally, interview data was supported with extant academic literature, technical and policy reports available on Sialkot and other industrial clusters of Pakistan mentioned in 4.4.5 and discussed in detail in chapter 5.

Source of evidence	Strengths	Weaknesses
Interviews	<ul style="list-style-type: none"> • Targeted-focuses directly on case study topic • Insightful-provides perceived causal inferences 	<ul style="list-style-type: none"> • Response bias • Inaccuracies due to poor recall • Reflexivity-interviewer gives what interviewer wants to hear
Direct observations	<ul style="list-style-type: none"> • Reality-covers events in real time • Contextual-covers context of event 	<ul style="list-style-type: none"> • Time consuming • Cost-hours needed by human observers • Access may not be provided to all of the facility
Documentation	Stable-can be reviewed repeatedly Unobtrusive-not created as a result of the case study Broad coverage-long span of time, many events, and many settings	<ul style="list-style-type: none"> • Reporting bias • Access-may be deliberately blocked

Table 4-3: Strengths and weaknesses of chosen data collection tools. Source (Yin, 2003)

Further, to mitigate weaknesses in data collection tools, there was an in-built mechanism in the interview questions to help validate interview data. At the start of interview, interviewee was asked about firm's competitive edge and then time line of CDIs showed whether CDIs added up to the competitive edge as mentioned by the interviewee at the start of the interview. Multiple/embedded style case study method also helped in data validation and replication.

4.4.3 Interview protocol

As defined by Yin (2003) in Voss et al. (2005), the reliability and validity of case research data is enhanced by a well-designed field research protocol. An interview protocol was developed to create uniformity among all the interviews conducted.

4.4.3.1 Interview design

The structure of the interview should outline the subjects to be covered during the interview, questions to be asked and data to be gathered (Voss et al., 2002). The aim of the research is to design a TIC assessment model for manufacturing SMEs taking a broad view of factors affecting innovation described in chapters 2 and 3, and developed in section 4.5. The main unit of analysis is capability development initiative (CDI). Therefore, the semi-structured interview questions were designed by the researcher from the literature review, and consisted of open-ended questions, which identified CDIs carried out by the firm in context of its inner and outer

environment (Appendix A). The interview was divided into four parts (Robson, 2011, Rowley, 2012) to help develop and use the TIC assessment model.

i. Introduction

First, the interviewer introduced himself, explained the details of the interview, and assured the interviewee of the confidentiality of the interview process and requested permission to record the interview or make notes.

ii. Warm-up

The initial questions had to be easy to answer and non-threatening in order to settle the respondent and gain enough trust for an in-depth interview. The questions were designed to enable the interviewer to understand the business environment, business strategy and competitive priorities of each firm.¹First, each interviewee (usually a SME executive) was asked about the firm's product range, its history, and organisational structure. Second, the interviewee was asked about the firm's business strategy and business environment. Third, the interviewee was asked about the factors which influence business strategy of the firm. Fourth, the interviewee was asked about the firm performance measurement parameters.

iii. Main body of the interview

After establishing context which related to the general firm characteristics and developing some understanding with the executive, the interviewer came to the crux of the interview, CDIs. The CDIs represent 'Critical incidents' (Langley, 1999) in a firm's history, which helped to upgrade firm's technological capabilities. To investigate CDIs, three questions were developed with each question having its pointers. The interviewee was asked why customers prefer the interviewee's firm's products, how the interviewee's firm is better than its competitors based on factors such as quality, improvement, reverse engineering new product development. Next, the interviewee was asked how these capabilities (quality, reverse engineering, new product development) came about for instance whether through the import of new technology, improving existing technology, greater collaboration with supplier and customers. After this, the interviewee was asked if s/he could narrate how individual capability (CDI) was achieved such as: what were its drivers? How it add to the firm's competitiveness? How did the firm mobilise its resources?

iv. Cool-off

¹ To standardise the interviews and remove bias, certain pointers were provided with each question to each interviewee. These pointers were drawn from the literature review and vetted during the pilot interviews so that they are easy to understand and free from academic jargon. The interviewees were also asked if they could rate the pointers in term of importance, if possible.

Finally, towards the end of the interview, the interviewee was asked about any academic cooperation, and socio-economic conditions affecting firm performance.

From the interviews, it also appeared that firms considered their infrastructure (machines, raw material accessibility, market accessibility etc) as part of their capability and competitive edge. Therefore, in data gathering CDIs involving infrastructure build-up were also included. The questions of the semi-structured interview were vetted with supervisors to check for their alignment with the research aim and objectives, and to attempt to reduce bias in the semi-structured interview.

4.4.3.2 Conducting interviews

The author had to negotiate with, in as friendly atmosphere as possible, the people surrounding the executive. Once in front of the interviewee, the author had to rapidly demonstrate the credibility of the research and build rapport with the interviewee (Gray, 2013). The author would present his university card and university letter proving authenticity of both the author and the research. A serious but smiling face, ironed clothes, interview tools such as dicta-phone and laptop complemented the author's efforts to establish a rapport with the interviewee (Rowley, 2012).

Following the interview structure (Annex-A), the purpose of the research was told to each interviewee and it was explained to the interviewee that the author would like to ask few questions and then terminologies used in the interview questions were read out to interviewee. Finally, permission to record the interview was asked in each interview.

At times, executives agreed to the questions and at other times they would insist on a monologue, at the end of which the author would ask questions about any missing information. So it was all a calculation before, during and after the interview as to get the most information from the interviewee. Also, a keen sense of observation was required to observe when the interviewee is losing his interest in the discussion, or has some other problems to attend to. This was the time to wrap up the interview and gather essential information without which the interview would not be complete.

4.4.3.3 Data recording, storage and management

A good and accurate record of interviews helps in data analysis. Three possible methods of recording interviews for documentation purposes are by digital audio, video recording or note taking (Rubin and Rubin, 2012). The most common way to record interviews is to use a tape recorder. This practice ensures that everything said is preserved for analysis as well as more accurate than note taking (Merriam, 1998, Opendakker, 2006). Using a tape recorder helps the

interviewer to avoid extensive note taking while interviewing, which impedes the flow of the conversation.

A digital recorder was used during interviews, with the permission of the interviewees (Appendix-A). As the interview was being recorded, the researcher could concentrate on the answers of the interviewee, constantly matching them with his semi-structured questionnaire. Also, during data analysis, the researcher could always come back to the original data to remove any doubts. After every interview, the digital file data was transferred to a personal laptop as a backup, and also uploaded to University's data storage space through a Virtual Private Network.

Moreover, not all interviews were conducted in one go. Interviews were conducted cluster wise. Further, depending upon the executive's availability, firm interviews were conducted on separate days, and if on the same day due to some constraint, then in mornings and afternoon sessions, so as to give some time of reflection upon the data gathered (Table 6-1). All firms with the exception of one firm gave permission to record interviews. Also, at the start of the interviews, interviewees were requested to respond to a set of questions. However, a few interviewees listened to the questions and then said that they would prefer to speak, rather than be directly questioned, and if at the end something was remaining, it could be inquired about- a situation to which researcher acquiesced (Table 4-4). Therefore in Appendix-B, Appendix-C and Appendix-D, some interview transcripts show the questionnaire being explicitly followed while others show a monologue from which relevant points were identified by the author.

	Interview recorded	Semi-structured questionnaire followed
Leather Goods cluster		
Firm A	Yes	Yes
Firm B	Yes	Yes
Firm C	Yes	Yes
Firm D	Yes	Yes
Sports Goods cluster		
Firm E	Yes	No
Firm F	Yes	No
Firm G	Yes	No
Firm H	Yes	No
Surgical instruments cluster		
Firm I	Yes	No
Firm J	Yes	Yes
Firm K	Yes	Yes
Firm L	No	Yes

Table 4-4: Interviewed firms' consent to semi-structured interviews

4.4.3.4 Steps taken for interview data triangulation

Already discussed in sub-section 4.4.2.

4.4.3.5 Data analysis techniques

i. Critical incidents

The relevant literature (Langley, 1999, Gray, 2013) describes seven strategies for analysing process data: Narrative strategy, quantification strategy, alternate templates strategy, grounded theory strategy, visual mapping strategy, temporal bracketing strategy and synthetic strategy. Langley has discussed the strengths and weaknesses of the strategies and recommended that process data may be analysed using multiple strategies. A narrative strategy involves developing a detailed chronological story from the raw data for subsequent analysis. A quantification strategy involves developing coding of incidents from the collected data, followed by descriptive patterns in the sequence of events, which leads to vigorous theory testing. In an alternate templates strategy, several alternative explanations of the same events are based on diverse but internally coherent sets of a priori theoretical premises. A grounded theory strategy is an inductive way of developing theory from raw data. A visual mapping

strategy involves manipulation of words, of numbers or of matrix and graphical forms. A visual graphic representation allows simultaneous representation of a large number of dimensions, precedence, parallel processes, and the passage of time. This research investigated CDIs (critical incidents) carried out over the operational life of a firm and different actors and factors which affected innovation in a CDI. According to Flanagan (Flanagan, 1954) in (Chell, 2014), the critical incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer along with the consequences. Therefore, a CDI table was developed showing both purpose and consequence of the incident (Table 4-5). Using visual graphic representation, CDIs were arranged chronologically to develop a time line- a temporal bracketing strategy, to understand the commonalities among the CDIs carried out at firm level; and if and how actions of one CDI affected the next CDI. The time line also helped to validate interview data i.e. individual CDIs add up to technical competitive advantage as stated by firm executive in the interview.

ii. Thematic categorisation

Thematic analysis is a method for identifying and analysing patterns (themes) within qualitative data, and is a form of pattern recognition within the data (Bryman, 2012, Gray, 2013, Yin, 2014). The time lines were analysed for any patterns emerging from the CDIs at firm and cross-firm level, and it emerged that the firms were involved in different types of CDIs which helped to finalise the CDI categories' table (Table 4-6). Further, in the literature review (2.6), three levels of TIC in a firm have been described by Lall (1992). Since the research technique was abductive, so the patterns emerging from time lines were compared with Lall's TIC levels, which first helped to identify interviewed firms' TIC levels, whether acquisition, assimilation or innovation. Second, data analysis helped to identify category of the interviewed firms, whether leader, follower or reactor. Thus, the thematic categorisation helped in data analysis and literal replication.

4.4.4 Pilot interviews

The literature recommends one or two pilot cases for any new findings or modifications, which might be added to the protocol of the research (Yin, 2003). Four pilot case studies were conducted:

- i. The first was conducted with an employee of an international automobile manufacturer at Lahore, Pakistan.
- ii. The second was again conducted with a production manager of one of the largest Paper and Board Mills of Pakistan, at Lahore.
- iii. The third was conducted with a research officer in an international non-government organisation involved in the capacity building of SMEs at Islamabad, Pakistan.

- iv. The fourth interview was conducted with an official of SMEDA in Sialkot, Pakistan. The interview questionnaire and the research purpose were discussed with him, which then helped to produce a list of SMEs which could be interviewed to achieve research objectives.

These pilot studies helped the researcher:

- i. To pace himself through the interview and practice the protocol.
- ii. To simplify a few pieces of academic jargon in the interview questions, which were difficult to communicate
- iii. Pilot case studies showed that firms were not willing to share their 'hard' financial performance data, as discussed in a previous section, thus making the researcher to look for alternate measures to identify competitive firms.

The findings of the pilot studies were not used in the data analysis.

4.4.5 Secondary data sources for research data triangulation

For data triangulation purposes, it is also recommended that secondary sources of data be also mined (Rowley, 2002, Voss et al., 2002, Eisenhardt and Graebner, 2007). In this research, various secondary data sources were consulted to inform research analysis, which are discussed below. However, it must be kept in mind that authenticity of some of these resources are more credible than the others such as government reports may be considered more credible than firms' marketing materials.

4.4.5.1 Information available from interviewed firms' websites, their brochures and government websites

Before and after visiting firms, their websites were visited. Similarly, various government websites were also looked at which helped to give a general idea about the products being manufactured in the interviewed clusters (Table 5-1).

4.4.5.2 Technical reports

Several reports have been commissioned by the United Nations International Development Organisation (UNIDO) to analyse the strengths and weaknesses of the Sialkot clusters (Zaidi, 2006, UNIDO, 2010) and have been discussed in chapter 5 to have an idea of general strengths and weaknesses of the interviewed clusters. Similarly, the Government of Pakistan (GOP) has announced its innovation policy (Pakistan, 2012) which was also compared with the research results to give inputs for policy making in chapter 8.

Trade Related Technical Assistance (TRTA) (<http://trtapakistan.org/background>) has been initiated in Pakistan by European Union and UNIDO to increase the competitiveness and productivity of export-oriented clusters of Pakistan. The policy reports of TRTA on surgical, leather and sports goods cluster of Sialkot (TRTA, 2014a, TRTA, 2014b) have also been discussed in chapter 5, and used to support the research findings and policy recommendations in chapters 8 and 9.

4.4.5.3 Newspaper articles

SME clusters are a continuous source of interest for the government and Sialkot Chamber of Commerce and Industries (SCCI) continuously host media, government ministries, and ambassadors of foreign countries to further their interest (Mansoor, 2010b, Mansoor, 2011a). Thus, regular information about the SCCI appears in the print media, which have been used to support data analysis and results.

4.4.5.4 Extant academic literature on Sialkot clusters

The clusters researched in this thesis are the focus of extensive local and international research, and the extant literature has been extensively used in creating a context for the research and supporting the results or otherwise. Most notable among the literature consulted were : (Nadvi, 1996, Nadvi, 1999b, Nadvi, 1999a, Nadvi and Halder, 2005, Knorrington and Nadvi, 2014), (Humphrey and Schmitz, 2002) and (Bhutta et al., 2007). Additional Sialkot related literature has been elaborated upon in section 3.5.

4.4.5.5 Key words used for the research

Firm resources, capabilities, technological innovation and innovation models and TM and were the key words used in the research.

4.5 A TIC assessment model for Sialkot SMEs

Having decided upon research method for data collection, Voss et al (2002) lists the following issues to be addressed while conducting research:

- i. Develop the research model, constructs and questions
- ii. Develop the research instruments
- iii. Conduct the field research
- iv. Carry out the data documentation and analysis

4.5.1 Research aim and objectives

According to Voss et al. (2002), the starting point for research is a research model and questions. The model explains, either graphically or in narrative form, the main things that are

to be studied, the key factors, constructs or variables-and the presumed relationships amongst them. The research question and objectives meshed with the research model provide a focus to the research and help data collection.

The focal issue in this study is to analyse CDIs in low-tech SMEs to understand how firms could upgrade their TCs. The research aim is supported by three research objectives. The main aim of research is to:

Research aim

“To develop a technological innovation capability (TIC) assessment model to investigate the technological capability level of manufacturing SMEs existing in clusters in Sialkot, Pakistan, to help practical interventions for their technological capabilities upgrading for sustained competitiveness”

Objectives

- i. Conduct a literature review to understand the relationship between TCs and TIC, resulting in innovation in processes and products.
- ii. Conduct a literature review on various firm level TIC models to understand their strengths and weaknesses.
- iii. Develop a TICs assessment model to help analyse TIC level of the interviewed Sialkot SMEs.

To assist aim and objectives, a research question was developed as mentioned below:

Research Question

How can the technological capabilities for sustained competitiveness of manufacturing Sialkot SMEs, Pakistan be better understood?

Further, the research question was assisted by the following sub-questions arising from a careful review of the literature. The sub-questions helped to define the context of the semi-structured interviews carried out in the field:

Sub-questions

RQ1: What are the competitive characteristics and the level of technological capabilities of the interviewed manufacturing SMEs at Sialkot?

RQ2: What’s the role of cluster(s) in supporting interviewed Sialkot firms’ competitive characteristics and technological capabilities?

RQ3: What *types of CDIs and resultant technological upgrading occurred in the interviewed Sialkot SMEs to sustain/ improve/ diversify their technological competitiveness?*

RQ4: *What are the internal factors and external actors which influenced or could influence interviewed Sialkot firms' technological capabilities upgrading?*

4.5.2 TIC model

As discussed in sections 3.2 and 3.4 in chapter three, SME's internal factors such as strategy, existing capabilities, and external actors such as suppliers, customers and competitors are important for the acquisition, assimilation and exploitation of new technical knowledge. Therefore, drawing upon the literature in chapters 2 and 3, four constructs were operationalised (Figure 4-3) to represent the environment which affects SMEs TIC upgrading process from acquisition, assimilation to innovation:

- i. Capabilities Development Initiatives (CDIs): These represent the TCs upgrading initiatives which a firm takes over its period of existence to sustain and upgrade its technical competitive advantage (Li-Hua and Khalil, 2006b, Brophy et al., 2013).
- ii. Internal firm environment: A firm's internal environment constitutes its structure, resources, capabilities, and business strategy (Oyelaran-Oyeyinka and Lal, 2006, Rosenbusch et al., 2011).
- iii. Local external firm environment (cluster): Among other things, the external environment consists of competitors, suppliers, cluster constraints, government organisations (Hadjimanolis, 2000, Ismail et al., 2011).
- iv. Foreign environment: The foreign environment consists of customer requirements, technology and expertise availability, market accessibility (Oyelaran-Oyeyinka and Lal, 2006, Cetindamar et al., 2009a, Khan, 2012). The foreign environment layer is added because the field research focused on export-oriented SMEs.

These various actors and factors constitute the culture in which firms are operating. (O'Regan et al., 2006a, O'Regan et al., 2006b, Hervas-Oliver et al., 2011).

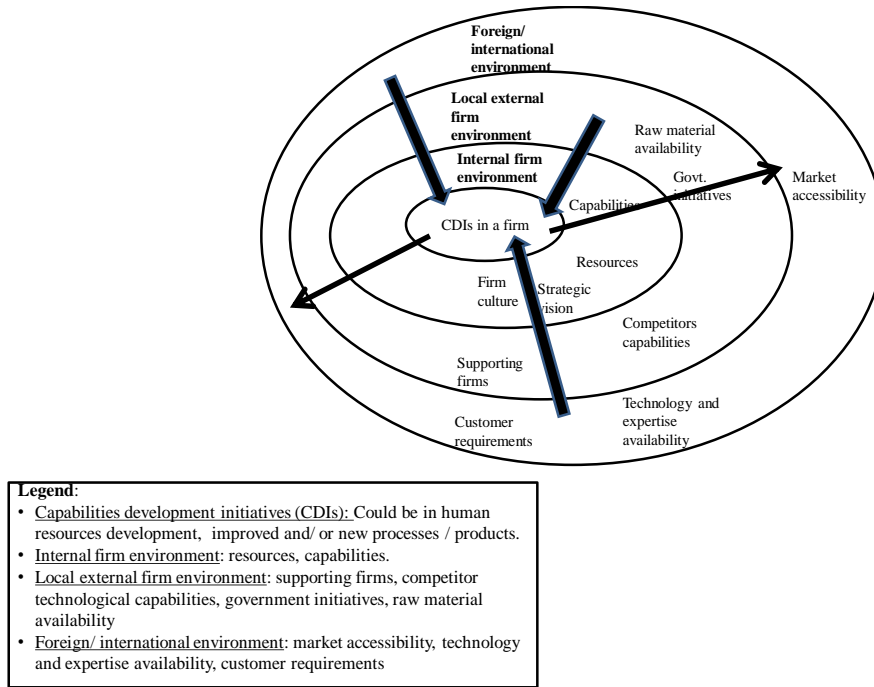


Figure 4-3: Four constructs of the TIC model. Source (Author)

4.5.2.1 Relationship between the constructs of the TIC model

The unit of analysis in this research is CDI, which needs to be understood in its context. At the heart of the model are CDIs, which are enveloped by three layers: internal firm environment, external firm environment, and foreign/ international environment.

The arrows indicate the influences of SME's internal and external environment on CDIs. SMEs usually follow market trends and customer needs and are part of value chains, and thus are influenced by their environment, already discussed in sections 3.2 and 3.4. Consequently, larger arrows indicate greater external environment's influence on a firm's CDI such that firms try to improve their capabilities according to customers and markets targeted. While smaller arrows indicate lesser capability of a SME's CDI to influence its surrounding environment-customers, markets. This is something also observed in our data analysis in chapter 6. The firms introduced CDIs to retain their existing customers or cultivate new customers in existing markets.

Although the model might appear as a cross-sectional view of firm's TCs at any given time, however, when CDIs are stacked in a chronological manner, it gives a retrospective, longitudinal view of TCs upgrading process in a firm. Further, the model represents that a competitive and growth-oriented firm would identify, select and assimilate or internally develop technological capability keeping in view of its existing TCs and external business environment as argued in the literature (Brophey and Brown, 2009, Brophey et al., 2013).

4.5.3 Tools for operationalising TIC assessment model

The TIC model is operationalised through a CDI table, a criterion for CDI categorisation, a criterion for interviewed firms' categorisation based on their TIC and resources, and a semi-structured interview to collect the field data. These tools try to identify, qualitatively, the underlying type of learning capability developed or displayed in a CDI, which helps to classify:

- i. the TIC level of a firm: whether acquisitive, assimilative or innovative as per Lall's model (Table 2-3). A schematic of the step-by-step assessment of TIC level of firm is shown in Figure 4-4, which is discussed below

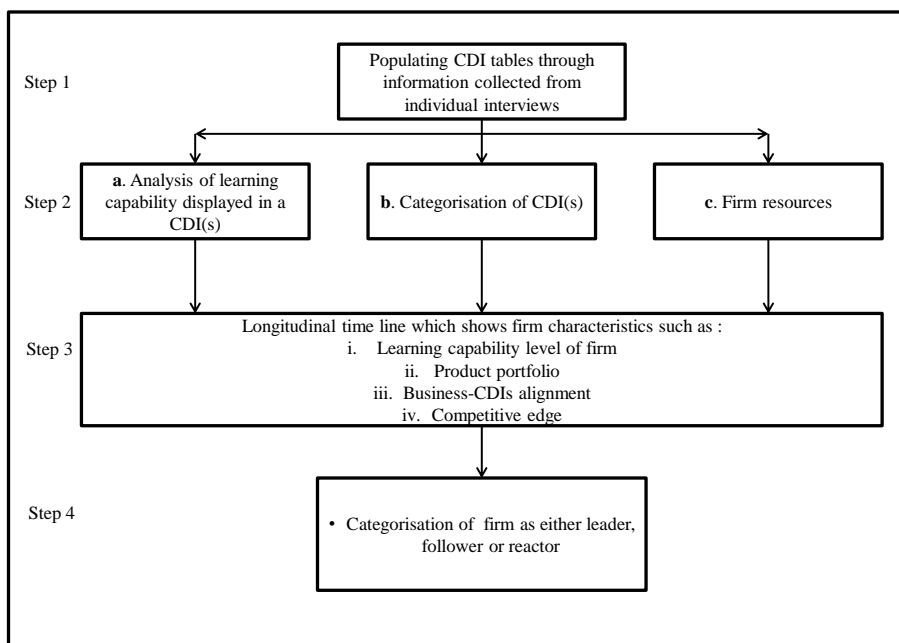


Figure 4-4: Schematic of the TIC assessment model. Source (Author)

- ii. Type of CDIs introduced, existing firm TIC level along with its resources, competitive strengths are used for firm categorisation: whether leader, follower or reactor as shown in Figure 4-5 and demonstrated in Table 4-8

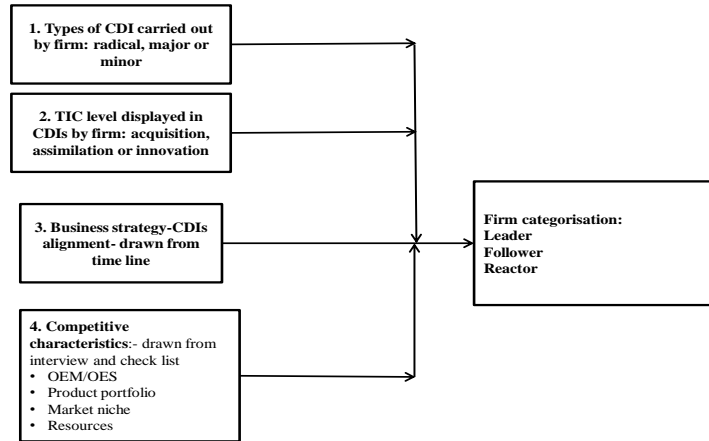


Figure 4-5: Algorithm for firm categorisation criteria

4.5.3.1 Step 1: Capabilities development initiative (CDI) table

Drawing upon the literature (Tidd, 2005, Brophy et al., 2013), a CDI summary table was developed (Table 4-5), which details each CDI's driver, its upgrading, its outcome and its effect on firm performance (Chell, 2014). According to Bell (1984) in Caniels and Romijn (Caniels and Romijn, 2003), manufacturing SMEs in developing countries may undertake four different types of technological initiatives for upgrading firm's TIC:

- Staff training
- Staff hiring
- In-house technological improvement (including R&D)
- External search for information about new technologies and markets.

And the upgrading outcome might be measured in terms of increased sales, more customers, improved productivity, or better quality (Ibid). Accordingly, specific questions were developed in the semi-structured interview to populate the CDI table.

CDI elements	
Operational performance (CDI outcome)	improved productivity, better quality, increased sales, customers retained
Upgrading (Action)	It could be existing process/ product improvement or new process/product acquisition etc
Drivers for CDI	They could be customer cooperation , tacit knowledge available in the firm, new market trends, new capability introduction in the cluster
Firm capabilities at the time of CDI-internal environment	Every firm has certain internal technological capabilities and resources representing its learning capabilities, which help in TCs upgrading
Cluster/ foreign capabilities at the time of CDI-external environment	Cluster capabilities and resources represent cluster's learning capability, on which help a firm can draw upon to carry out a CDI.
CDI type	It could be radical, major or minor.

Table 4-5: Layout of the CDI table. Source (Author)

4.5.3.2 Step 2: Identifying learning capabilities, CDIs categorisation and observational checklist

Step 2 a: Identifying learning capability associated with upgrading

Following Bell (1984) in Caniels and Romijn (2003), a firm's initiatives may result in upgrading such as:

- Operational improvement-improved productivity for a given production process
- modifications in the scale and organisation of the production process
- Horizontal product differentiation where firms aim to change the characteristics of a product in order to reach a new market segment or a new group of customers.
- Vertical product differentiation where firms may aim to improve the quality, change the physical properties or increases the reliability, performance or integration (compatibility) of their products.

The upgrading is analysed to those outlined by Lall (Table 2-3) which helps to identify whether CDI is from acquisition, assimilation or innovation stage. For instance, according to the interviewee of firm G the hiring of a German trainer to train its workforce resulted in better quality and productivity, and resulted in a German firm diverting all of its orders from Sialkot to the firm. Thus, the firm upgraded its TC through a foreign customer (external to the cluster)

through ‘learning by training’, which helped in operational improvement, and resulted in increased orders for the firm (Figure 6-8).

Step 2 b: CDIs categorisation: radical, major and minor

Further as per Amara et al. (Amara et al., 2008), the novelty of upgrading in process or product is explained by adopting either a firm’s perspective or a customer’s perspective. Thus, drawing from the Amara et al., Bell (1984) and from empirical data analysis in chapter 6, a new way of categorising CDIs was devised by the researcher (Table 4-6). A CDI which was new both to the cluster and the firm and assimilated from abroad was treated as radical, while a CDI which was new to the firm and the cluster but assimilated from a regional cluster was classified as major. If a firm copies a CDI which already exists in the cluster, such a CDI was categorised as minor. Thus, firm A’s CDI of hiring foreign experts has been categorised as radical since it was the first firm to do so in the cluster.

CDI categorisation	Description Amara et al. (2008), Bell (1984) as in Caniels and Romijn (2003)
Radical CDI	<ul style="list-style-type: none"> • which is new both to the cluster and firm, assimilated from abroad • which involves major modifications in the scale and organisation of the production process • Vertical product differentiation
Major CDI	<ul style="list-style-type: none"> • CDI which is new both to the cluster and firm, assimilated from regional clusters • Minor modifications in the scale and organisation of the production process • Horizontal product differentiation
Minor CDI	<ul style="list-style-type: none"> • CDI which is assimilated from the cluster • Improved productivity

Table 4-6: CDI categorisation table. Source (Author)

Step 2 c: Observational checklist for interview data triangulation

When pilot interviews were conducted the interviewees refused to share any financial information. Similarly, to measure firm performance through financial measures, the first interviewed firm in the leather cluster was asked about any financial figures to back up its firm’s financial performance claims. The interviewee was clearly not willing to divulge ‘hard facts’ about his firm’s performance. Malik and Kotabe (2009) developed subjective measures on general firm performance, citing difficulties in gathering factual performance data in the cases of SMEs operating in developing countries (India and Pakistan). They quote Chandler and Hanks (1993) who argued that in such situations managerial responses on firm performance are

acceptable proxies. They asked the interviewed firm managers about their firm performance and compared the answers to those given by their competitors.

Recently, corporate social responsibilities, being part of GVCs, and access to international customers and accreditations have become important elements in accessing foreign markets and TCs upgrading (Humphrey and Schmitz, 2002, Nadvi and Halder, 2005, Lund-Thomsen et al., 2012). Firm I's interviewee specifically mentioned that achieving 510 K accreditation helped the firm tap into a particular part of the USA surgical instruments sector. Therefore, greater functional integration, marketing under own brand name, international accreditations, being part of supply chain of an international manufacturer such as Nike, Adidas, Puma were all taken as indicators of firm performance in this research, as mentioned in Table 4-7. Further, as per Yin (2003) the condition of buildings, work spaces indicate something about the climate or impoverishment of an organisation. Further, the location or the furnishings of the interviewee's office (in this case owner of the SME) was also taken as an indicator of the financial robustness of the firm. For example while visiting firm J it was noted that there were expensive vehicles parked in the firm premises, which were well maintained. Also, interviewee was wearing an expensive business suit and a Rolex watch.

	<u>Observations</u>	
Layout of the shop floor	*Is the shop floor properly lit?	
	Are the work instructions/ SOPs prominently displayed?	
	Are safety signs properly displayed and emergency exits defined?	
	Are fire extinguishers provided and working?	
	Is the work place airy and well ventilated?	
	Is the shop floor is cleaned such as free from oil, grease	
Facilities provided to the workforce	Is Air conditioning provided to the workforce?	
	Are medical/ housing facilities provided to the workforce?	
	Are the families of work force facilitated in any way such as providing education scholarships, recreational trips?	
Machines	Make of the machines such as Japanese, Korean	
	Conditions of the machines such as newly purchased or second hand	
	Maintenance of the machines such as if they are properly cleaned?	
Firm characteristics	Does the firm has international accreditations? (from websites, brochures, executive's room)	
	Is the firm manufacturing for customers?	
	Has the firm its own brand name?	
	Is the firm marketing directly into the markets?	
	If any multinational is regular customer of the interviewed firm	

Table 4-7: Observational checklist for the interviewed firms. Source (Author)

4.5.3.3 Step 3: Time line of CDIs

As discussed in sub-section 4.4.3 (data analysis techniques), all the CDIs of a firm when plotted together gave a longitudinal view- time line (such as Figure 6-3), which shows as how respective CDI added to firm's technological sustainability and competitiveness. Further, cumulatively, CDIs carried out over the period of operation of a firm helped to chart the nature of capabilities acquired, developed and exploited by a firm: whether manufacturing, design or marketing.

4.5.3.4 Step 4: Firm categorisation tool

The final step of the research was categorising interviewed firms as per their TIC level and firm resources.

A summary of firm's categorisation criteria is shown in Table 4-8. The first column of the table describes the CDIs identified in the firm, the second column identifies the learning capability and knowledge capability displayed or acquired in the CDI. The third column identifies the type of technological upgrading as result of CDI, which could be improving existing processes and products or introducing new processes and products (Humphrey and Schmitz, 2002). Based upon the upgrading achieved (column 3) and capability level displayed (column 2), it was assessed whether the CDI is in the acquisition, assimilation or innovation phase (column 4). A cumulative account of CDIs (time line) show, qualitatively, their TIC level: whether firm is acquiring TCs, improving existing TCs or innovating.

Further, column five categorises the CDI i.e. if it is radical, major or minor (Table 4-6), while column 6 describes the resources of the interviewed firm, derived from Table 4-7. Interviewed firms which generally adopted radical or major CDIs and visibly displayed better resources were classified as leader firms. Also, from the data analysis it was found that some interviewed firms generally copied CDIs already existing in the cluster (such as firm B) and had optimised their operational resources, they were classified as followers. Finally, there were firms which only reacted when problems surfaced in their operations (such as firm C) and were thus classified as reactors. The last column integrates the information in previous columns to classify whether a firm is a leader, follower or a reactor type.

Types of CDIs: Cohen and Levinthal (1990)	Learning capability and associated knowledge capability (Amara et al., 2008)		Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	Level of TIC acquired/ displayed in the CDI (Lall, 1992)	Categorisation of CDIs	Firm resources : (observational frame work Table)	Firm categorisation
Types include: <ul style="list-style-type: none"> • Human resource development • Improved process/ product • New process/ product • New machine acquired 	Learning capability could be learning by training/ interaction/ doing/ searching	Knowledge capability: It could be know-how, know-why or know-what	In this research, firm's perspective of novelty of innovation is taken		Based on the firm's perspective of novelty of innovation, CDIs are categorised along three: <ul style="list-style-type: none"> • <u>Radical CDI</u>, which is introduced for the first time in the interviewed cluster • <u>Major CDI</u>: which is copied from other regional clusters • <u>Minor CDI</u>: which is copied from the cluster within 	They include: Infrastructure, workforce employed, product portfolio, markets targeted, finances, association with international brands, international accreditations, brand name	Firms categorised as: <u>Leader firms</u> : which generally mentioned radical CDIs and demonstrated visible resources during shop floor visit <u>Follower firms</u> : which generally mentioned major or minor CDIs, and demonstrated resources on shop floor visit <u>Reactor firms</u> : Generally carried out minor CDIs and showed limited resources

Table 4-8: Firm categorisation criteria. Source (Created by author using different citations)

4.5.3.5 Semi-structured interview

This data collection tool has been discussed previously in sub-section 4.4.2. In the Figure 4-4, the four steps mentioned draw their data from the interviews along with the literature review in chapters 2 and 3.

4.6 Research validity and reliability

Validity, reliability and generalisability have different meanings in different research philosophies. According to Yin (2003) and Rowley (2002), reliability and validity for a qualitative research have a number of dimensions. Table 4-9 shows the definitions of validity and reliability, and how they have been achieved in the chosen case study methodology.

The validity types are not independent of each other. Without a clear theoretical and causal logic (internal validity), and without a careful link between the theoretical conjecture and the empirical observations (construct validity), there can be no external validity in the first place (Gibbert et al., 2008). Thus, there is a hierarchical relationship of validity types, with construct and internal validity acting as condition sine qua non for external validity.

Construct validity relates to establishing correct operational measures for the concepts being studied and reviewed at the time of data collection. Construct validity needs to be considered during the data collection phase so that data collection leads to an accurate observation of

reality. Internal validity is the extent to which causal relationships could be established, whereby certain conditions are shown to lead to other conditions. External validity relates to whether a study's finding could be generalised beyond the immediate case study.

Construct validity: To achieve construct validity, first a conceptual research model and its constructs were defined from the literature in line with research aim and objectives. The constructs were: internal firm environment, external firm environment and international firm environment. Each was defined from the literature review conducted and the tentative relations between them were also described. Since the research approach is abductive, therefore research constructs were further refined from research data analysis, which again helped in construct validity.

Internal validity: During the interviews, continuous reference was made to the information required in order to stay focused, and the CDI table was populated with information from the interview for each firm. The data analysis pattern defined to compare firms at cluster and cross-cluster level for common themes and patterns (Figure 4-2) also helped in internal validity. The data was used to populate timelines for each firm. Efforts were made to establish relationships between CDIs, build-up of technological capabilities and developing of competitive edge. The literature was also used to measure albeit indirectly the link between CDIs and competitive edge with firm performance. Inferences and conclusions have been supported with the quotations from interviews with SME executives and literature review conducted.

Inter-linkage of different elements of a CDI summary table helped to establish how an innovation was incorporated and exploited in the firm. Next, the time line showed causal relationship of each CDI to capabilities build-up and firm performance for firms from information available through interview data, firm websites, and local chamber of commerce documents. A longitudinal evaluation of CDIs shows how they built a firm's competitive edge and contributed to firm performance.

External validity: The present research aimed at analytical generalisation (external validity) to explore capabilities management in low-tech, manufacturing SMEs existing in clusters. Case study reports discussing CDIs were generated for individual firms. Analysis of case studies of firms at cluster level and cross-cluster level helped to establish external validity (7.2). Common competitive characteristics, capabilities development pattern were identified across the firms. Research findings were compared and found compatible with the cluster findings on Daska farm equipment manufacturing cluster (Caniels and Romijn, 2003), and Gujrat fan manufacturing cluster (Rana and Ghani, 2004) (7.3).

Reliability: It is often defined as the extent to which a study's operations can be repeated with the same results. For reliability, a case study research protocol was defined, which included: research design, research model, data collection tools, interview protocol, data analysis techniques, and case study format.

Finally, Eisenhardt establishes the importance of enfolding literature by saying that, “an essential feature of theory building is comparison of concepts, theory, or hypothesis with the extant literature. This involves asking what is this similar to, what does it contradict, and why (Eisenhardt, 1989, p.544)?”

Eisenhardt asserts that not to do this reduces confidence in findings, whereas if performed effectively, it increases validity. Efforts were made to include this important point in the research. Therefore, as the theory emerged in the data analysis and conclusion chapters, it was compared with existing literature to show similarities, difference, and how it builds upon the previous literature.

Research quality criteria	Case study tactic	Theoretical steps taken	Field tools adopted for the research quality criteria	Where addressed in the thesis
Construct validity	<ul style="list-style-type: none"> i. Data triangulation (use multiple sources of evidence) ii. Establish chain of evidence iii. Correct operational measures for phenomenon to be studied iv. Abductive research approach 	<ul style="list-style-type: none"> i. RQs ii. Conducted a literature review to identified the research gap iii. Defined a research model, its constructs and their constituents from the literature to address the research gap iv. Established relationship among the constructs from the literature review and data analysis 	Field tools developed from literature review and refined from field data: <ul style="list-style-type: none"> i. Semi-structured interview, direct observations, documents analyses ii. CDI table for collecting interview data iii. CDI categorisation/ firm categorisation iv. Time line for each firm v. Common case study report format for ease of cross-comparison 	Chapters 2,3,4
Internal validity	<ul style="list-style-type: none"> i. Establish a causal relationship among the constructs through pattern-matching and explanation building 	<ul style="list-style-type: none"> i. Critical incidents ii. Pattern matching 	<ul style="list-style-type: none"> i. Time line chart for each interviewed firm ii. Cluster/cross-cluster comparison of case studies iii. Shop floor visit iv. Cumulatively, time lines help to establish causal relationships among the CDIs, capabilities, competitiveness and strategy at firm level v. Chapter 7 designed to answer RQs, draws from chapter 6 	Chapters 4,6,7
External validity	<ul style="list-style-type: none"> i. Replication logic in multiple-case studies 	<ul style="list-style-type: none"> i. Multiple/ embedded case study method for analyses at cluster and cross-cluster level to check for common characteristics, capabilities, CDI types across firms and clusters respectively 	<ul style="list-style-type: none"> i. Identified common characteristics, CDIs taken and firm categories at cluster and cross-cluster level of the interviewed firms. ii. Compared the findings with existing literature on Sialkot clusters iii. Compared the findings with extant literature adjoining Sialkot clusters iv. Also made a limited comparison of the findings with literature on manufacturing SMEs capabilities in UK 	Chapters 5,6,7
Reliability	<ul style="list-style-type: none"> i. Will similar observations be reached by other researchers? 	<ul style="list-style-type: none"> i. Defined case study protocol 	<ul style="list-style-type: none"> i. RQs, case-study design, unit of analysis, interview protocol, data collection tools, data analysis techniques, case study reports 	Chapter 4

Table 4-9: Research validity and reliability. Source (Yin, 2003)

4.7 Challenges associated with the field research

The research interest was in low-tech manufacturing SMEs, where more academic terminologies and phrases are usually not part of daily business language. Thus, first priority of the research especially for the field was to speak a language which could be understood on both

sides of the threshold i.e. academia and SME industry. Therefore, while devising field research tools, effort was made to use the terms and terminologies which could be easily understood by the industry. One of the objectives of pilot case studies was to specifically ask the interviewees if they understood the terms and terminologies used in different questions. Depending upon the feedback and literature review, more interviewee friendly definitions and pointers were used.

Second, there are no up-to-date official statistics, no published SMEs performance reports in the country of research, Pakistan. The author visited governmental developmental agencies websites of Pakistan, but the websites display neither list of local firms nor performance indicators of local clusters. In most of the literature reviewed on SMEs in developed countries, academic researchers usually tapped from a reservoir of contacts available either through local chamber of commerce or concerned research institutes for contacting the firms (Sum et al., 2004, Oke et al., 2007). However, such a facility was not available to the researcher/ author.

Therefore, identifying and contacting the firms was an informal process, through personal networking. The author has an engineering degree and worked in the field for more than thirteen (13) years. The researcher contacted his university colleagues to identify contacts which could be useful in approaching SMEs at Sialkot. Thus, relevant contacts for the research were identified in the government departments dealing with SMEs. They helped the researcher to identify and introduce to executives of SMEs. Small and medium enterprise development authority (SMEDA) is the premier government organisation tasked with promoting the interests of SMEs in Pakistan. When the researcher approached a number of personnel at SMEDA headquarter (HQ) in Lahore, Pakistan, there was initially no response. Later, it became apparent that there was a concern that this research might impact their jobs. Assurances were given that this was not the case which included showing my Organisation's employment card to the contacts at SMEDA.

The researcher was introduced to the Manager of SMEDA's regional headquarter at Sialkot, Mr Fouzan, who is actively involved in SMEDA operations in Sialkot. He knows everyone who matters in the local industrial cluster. The researcher discussed his requirements with him and he gave an overview of the different clusters in Sialkot. However, he pointed out the lack of a database which could be consulted but provided a list of firms and their executives' phone numbers who were considered influential in the local cluster and have been in the business for generations. The researcher followed the list and called the executives for interview appointments. The reference of Mr Fouzan provided immediate access. Therefore, the researcher is indebted to Mr Fouzan and other colleagues for making the field research possible.

However, even after interview date and time had been decided, getting an access to the interviewee required some social skills. The researcher had to negotiate, in an as friendly

atmosphere as possible, with the people surrounding the executive such as his secretary. Once in front of the interviewee, it was reading the body language of the SME executive. Researcher would enter the office of SME executive and try to assess from first five minutes how much the researcher was welcome, what sort of discussion would be held and amount of time to be spared by the executive. The cultural nuances gave tell-tale signs. If tea or coffee was served, or if the executive told the usher not to be disturbed, then researcher knew it was a good beginning.

Next, researcher had to rapidly demonstrate the credibility of the research. Researcher would present his university card and university letter proving authenticity of the researcher and the research. Researcher experienced that personal appearance also mattered for maintaining the creditability of the research and the researcher. A serious but smiling face, pressed clothes, interview tools such as dicta-phone and laptop complemented researcher's efforts to establish a rapport with the interviewee.

Also, the permission to record the interview would be asked in each interview, and interviewee was told that interviewer has a few questions which would not take much time. At times, executives agreed to the questions and at other times they would insist on a monologue, at the end of which the researcher would ask questions about any missing information. So it was all a calculation before, during and after the interview to get the maximum information from the interviewee.

Generally, researcher found SME executives were confident with giving interviews and articulating themselves well. There could be various reasons for it such as few interviewees remarked that people do come to them for interviews from time to time. Some other executives had been the President of Sialkot Chamber of Commerce, where they had to routinely go to national and international seminars, play host to national and foreign dignitaries, and visit abroad for promoting clusters interests.

Finally, doing interviews is a costly matter, which the researcher did not know at the beginning of the research. Boarding, lodging, transport greatly increase the financial impact of the research, especially when multiple trips have to be carried out to the area of interest.

4.8 Summary

This research deals with assessing the TIC level of the interviewed firms and identifying various factors which affect the TIC level upgrading for better value-added processes and products. Therefore, using an abductive approach a TIC assessment model and its constructs have been devised in this chapter from the literature review conducted in chapters 2 and 3, and data analysed in chapter 6. To help establish the validity and reliability of the research various steps have been taken which includes developing a case study protocol. The protocol includes

multi-level data analysis design, multiple data collection tools to gather information on critical incidents-CDIs in interviewed firms. Visual mapping technique and temporal bracketing strategy technique (Langley, 1999) was used for data analysis. Following data analysis design, the CDI, firm and cluster level analysis is done in chapter 6, while the cross-cluster level analysis is done in chapter 7. These analyses lead to this research's conclusions and contribution in chapter 8.

However, the number of firms interviewed in this research is limited and the research is constrained to a specific region of a specific country. Also, for interview data triangulation, it is recommended that more than one person from a firm should be interviewed. However, again it was not possible for reasons already mentioned in this chapter. To increase the depth of analysis and help increasing research's analytical generalisation, secondary data sources have been used such as technical and policy reports of GoP, UNIDO and TRTA for export-oriented SME clusters in Pakistan, along with newspaper clippings from print media.

5. Manufacturing Clusters of Sialkot, Pakistan

This chapter introduces the country of research, Pakistan and the capabilities level of its manufacturing SMEs in general. More specifically, the chapter introduces leather goods, sports goods and surgical instruments clusters in Sialkot, the focus of this research. Thus, this chapter introduces the external environment in which interviewed firms are operating.

Section 5.1 provides general information about different industrial clusters, and government policies towards manufacturing SMEs in Pakistan. It also introduces SMEs problems as identified in the existing academic literature, and the role and scope of different government agencies involved in capacity development of SMEs. Section 5.2 generally discusses various important SMEs clusters of Pakistan. Section 5.3 describes different government and non-governmental organisations involved in the development of SMEs and their clusters. Various initiatives taken by these organisations for SME development are also discussed.

Section 5.4 discusses academic and policy literature on the Sialkot clusters. Section 5.5 specifically describes the interviewed industrial clusters: the leather goods cluster, the sports goods cluster and the surgical instruments cluster, which are the focus of research. This section describes general products manufactured by the clusters, their export markets, and specific government initiatives to increase their competitiveness.

Thus, this chapter familiarises the reader with the general characteristics of Sialkot clusters in the context of which the interviewed firms' data are analysed in chapters 6 and 7. Figure 5-1 provides the layout of the chapter.

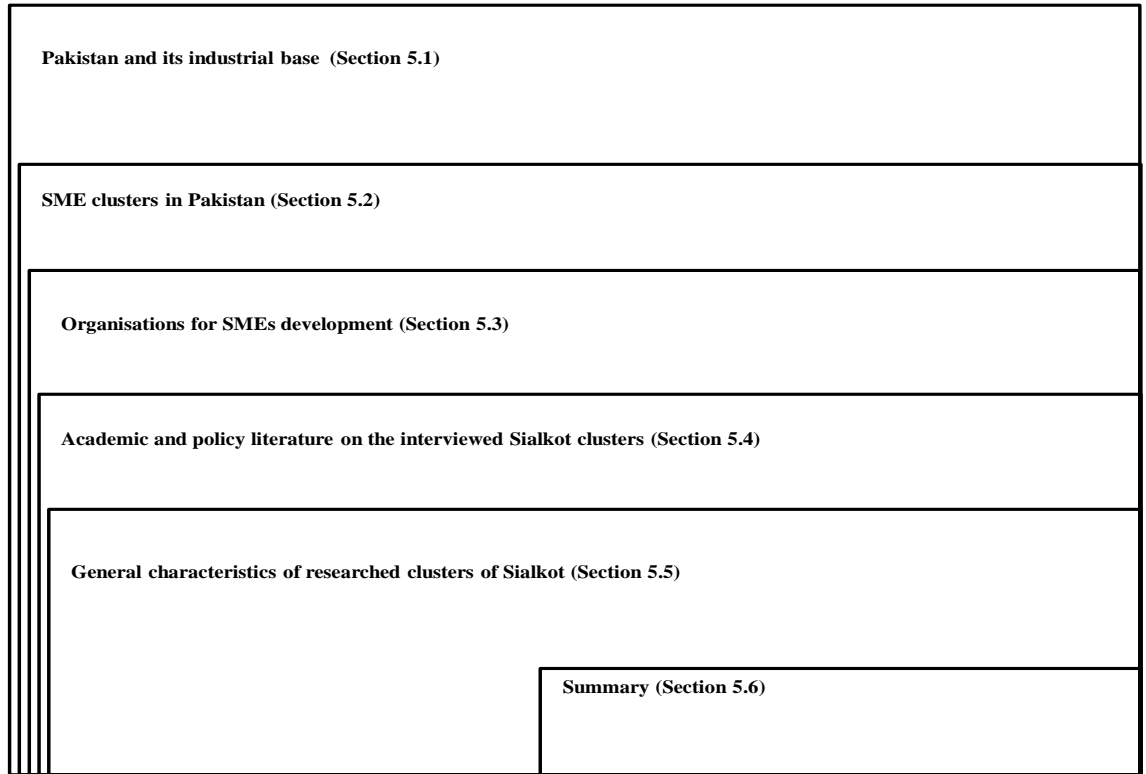


Figure 5-1: Chapter layout

5.1 Pakistan and its industrial base

The Islamic Republic of Pakistan with a population of more than 160 million people is located in the northern hemisphere in South-East Asia. It is bordered by Afghanistan and Iran in the west, India in the east and China in the far northeast, as shown in Figure 5-2. The Pakistani state was created from the partition of India, as a homeland for Muslims of the subcontinent. Pakistan consists of four provinces: Baluchistan, Khyber Puktoonkhawa, Punjab, and Sindh.

Despite being a poor country at the time of partition in 1947, Pakistan's economic growth rate was better than the global average during its first four decades. The growth of non-agricultural sectors has changed the composition of the economy. Agriculture accounted for 20% of the GDP in the year 2006-2007. The service sector was 53% of the country's GDP with wholesale and retail trade sharing 30% of this sector (Fayyaz et al., 2009).

The manufacturing industry in Pakistan is mostly labour intensive with a low level of automation, a minimum of skills training, which results in high defect rates and low efficiency levels. As a result, it is facing serious problems in increasing, or even sustaining its share of the global market, causing unemployment in different major industrial sectors (Ahmad, 2012a). The

situation is worsening due to current energy shortages. Increasing input costs and decreasing profit margins are threat to manufacturing; thus, the survival of Small and Medium Enterprises (SMEs) is becoming more difficult day by day (Ahmad, 2013b).

Since the time of independence, the Government of Pakistan (GoP) favoured a state-centric and large-scale manufacturing driven industrialization model, which resulted in the state's infrastructural and industrial development policy for SMEs being termed as benign neglect (Steven et al., 2007, Anwar, 2010, Dasanayaka and Sardana, 2010a). There is a lack of basic infrastructure such as roads, electricity, communication, rail net-work, warehousing in the SME clusters, which affect their competitiveness indirectly.

The section of Pakistan's population from 18-25 is increasing and this means that the country will need to create jobs for them in the coming years. The manufacturing industry, especially SMEs, could be a major source of employment for the burgeoning population, given the right incentives by the government (Ahmad, 2013b). The government has set up special SME banks and is trying to provide soft term loans and credits to SMEs in order to help in infrastructure upgrading, export promotion.

5.2 SME clusters in Pakistan

Small and Medium Enterprises (SMEs) form more than 99 percent of the total businesses in Pakistan (Pakistan, 2007). They have a sizeable share in the country's industrial employment, and in manufacturing exports. In manufacturing and other sectors, 87 percent of SME employ fewer than five people while 98 percent employ fewer than 10 persons. The SME sector accounts for 25 percent of manufacturing exports in Pakistan, while its share in value addition is 28 percent (Dasanayaka and Sardana, 2010a).

There are different types of SME clusters in different parts of the country, but most are located around Lahore, in Punjab province and around Karachi, in Sindh province. This section first provides some information about the general technical issues faced by SMEs in Pakistan, and then explains different government organisations which have been set up to try and make SMEs more competitive. An introduction to the scope of these organisations helps the reader put into perspective the gap between what the existing literature on SMEs emphasises, and what these organisations are presently focusing on.



Figure 5-2: Map of Pakistan. Source (Google maps)

Being the primary suppliers to most exporting firms or being exporters themselves, the performance of SMEs is a significant determinant of the overall performance of any economy. Developed economies, such as the members of the Organisation for Economic Co-operation and Development (OECD) have noticeably robust and vibrant SME sectors, while developing and underdeveloped economies have weak and fragile SME sectors. Since the SME sector also provides a major share of total value addition and industrial employment in almost all economies, its contribution to industrial development and growth remains unarguable (Kureshi

et al., 2009). The quality of SMEs products also affects the performance of large businesses, which sub-contract a significant portion of their final products to smaller businesses. The SME sector of Pakistan thus needs particular focus of policymakers and larger businesses in order to affect any sustainable and realistic growth in Pakistan's economy.

Only recently, the Government of Pakistan (GoP) realised the importance of SMEs to the country's economy and an SME policy has been announced (Pakistan, 2007), which states:

“There are approximately 3.2 million business enterprises in Pakistan. Enterprises employing up to 99 persons constitute over 90 percent of all private enterprises in the industrial sector and employ nearly 78 percent of the non-agriculture labour force. They contribute over 30 percent to the GDP and account 25 percent of exports of manufactured goods besides sharing 35 percent in manufacturing value added.”

A SME was defined by the Government of Pakistan in its ‘SME policy 2007’ as any firm employing up to 250 people, with a paid up capital of up to 250 million Pakistan rupees (2.5 million USD) and annual sales of up to 250 million Pakistan rupees (2.5 million USD). SMEs in Pakistan face many problems on both business and technical fronts. The Government of Pakistan (GoP) has set up various organisations for the promotion of SMEs such as the Small and Medium Enterprise Development Authority (SMEDA) and the Technology Upgradation and Skill Development Company (TUSDEC). Both organisations are taking various initiatives for the better performance of SMEs.

Karachi, the provincial capital of Sindh, is a cosmopolitan city and the industrial hub of both the province and the country. Karachi has the largest seaport of the country, while another deep seaport is being developed at Hub, Baluchistan. Karachi has both large multi-national firms and SMEs.

Lahore, Faisalabad, Gujranwala, Sialkot and Gujarat, are five neighbouring cities which form the industrial hub in Punjab. They have been the focus of various academic research projects analysing clusters performance existing in the region (Rana and Ghani, 2004, Bhutta et al., 2008). Lahore, the provincial capital of Punjab, has both large firms and SMEs. Faisalabad is the hub of the textile industry in the country. Gujranwala and Gujarat are famous for SMEs manufacturing electric fans, diesel generators and cutlery. Sialkot is famous for its export-oriented SMEs (Shafique, 2012).

5.3 Organisations for SMEs development

The GOP has set up various organisations to try to increase the capacity and competitiveness of SMEs. However, most notable among them are SMEDA and TUSDEC, which will be discussed in this section. This part expands on the scope and objectives of SMEDA and

TUSDEC, and the different initiatives undertaken by these organisations for the capacity building of SMEs and clusters in Pakistan.

5.3.1 SMEDA

² SMEDA was established in October 1998 to take on the challenge of developing Small & Medium Enterprises (SMEs) in Pakistan. It focuses on providing an enabling environment and business development services to small and medium enterprises. SMEDA is not only an SME policy-advisory body for the government of Pakistan but also facilitates other stakeholders in addressing their SME development agendas.

Its scope includes: facilitating SME representative bodies, conducting sector studies and analysis for sector development strategies, conduct seminars, workshops and training programmes on latest technologies, analysing market trends, and ideas to create awareness among SME executives (Small & Medium Enterprise Development Authority (SMEDA), 2015). It is also tasked with identifying the needs of SMEs and linking with different donor agencies to address them financially (Reporter, 2012). SMEDA initiated an Industry Support Programme (ISP) in 2004 with the objective to transfer technical expertise and knowledge to local industry through the involvement of international and local experts.

SMEDA in collaboration with UNIDO started the “Cluster Development Program for SMEs in Punjab”. The objective of this program was to help develop seven different SME clusters in Punjab. The diagnostic study of these seven clusters has been completed (Zaidi, 2006) . The objectives of the studies were to understand cluster dynamics, their strengths and weaknesses, capabilities, and major problems faced by them.

5.3.2 TUSDEC

TUSDEC was established in 2005. It establishes technology upgradation centres (TUCs) to help firms and clusters familiarise themselves with and use the latest technology to their advantage. It manages these centres in collaboration with public/ private partnerships. SMEDA has also proposed TUCs in other clusters of Punjab, thus it appears there is a duplication of responsibilities between SMEDA and TUSDEC.

5.3.3 United Nations International Development Organisation (UNIDO) cooperation with governmental organisations for clusters’ development in Pakistan

As mentioned above, UNIDO is in active collaboration with SMEDA and TUSDEC to improve the performance of different industrial clusters all over Pakistan. The UNIDO’s website on

² Source: SMEDA website: www.smeda.org.pk

Pakistan (UNIDO, 2011) details the reports of the work carried out in different industrial clusters of Pakistan.

UNIDO acknowledges that SMEs have to play a major role in Pakistan's economy and poverty alleviation through job generation for skilled and semi-skilled workers in both urban and rural areas. UNIDO has set enhanced productivity, competitiveness and international market penetration as an agenda of SMEs. UNIDO also underscores its support for cluster and network development approach as a major tool for the promotion of SMEs (Khan, 2012).

Foreign development agencies such as UNIDO are more involved with increasing the productivity and efficiency of different clusters. However, efforts should be more focused on increasing the technological upgrading of the clusters for better-value added products, which is an important factor for sustained international competitiveness (Morrison et al., 2008, Pietrobelli and Rabellotti, 2011).

5.4 Academic and policy literature on the interviewed Sialkot clusters

In the previous sections, the general industrial infrastructure of Pakistan was introduced as well as the scope of various government institutions set up to assist SMEs. This section particularly focuses on the Sialkot industrial clusters general characteristics, and their strengths and weaknesses highlighted through journal, technical and policy literature. The secondary data sources discussed in sections 3.5 and 4.4.5, and in this section help to validate the research findings in chapter 6 and chapter 7.

5.4.1 The importance of the Sialkot clusters

With a population of 3 million, the district of Sialkot lays in the north-eastern region of Punjab, close to the Indian Jammu-Kashmir border. It is 829 feet above sea level, and is 3000 km from the sea port of Karachi and, until Sialkot international airport was built, was nearly three hours by road from the nearest Lahore international airport. The city of Sialkot has an area of 3,016 Sq. km with a population density of around 1000 person/ sq. km. It has four districts: Sialkot, Daska, Pasroor, and Sambrial.

After Karachi, Sialkot is considered Pakistan's second largest source of foreign exchange earnings, generated mainly through its SMEs dominated, export-oriented industries (Akhtar, 2010, Dasanayaka and Sardana, 2010a, Ahmad, 2014b). The export-oriented clusters at Sialkot are a major source of foreign exchange earnings for the country (Nadvi, 1999a) and 90% of the firms in Sialkot export their products (Akhtar, 2010). Sialkot has various industrial clusters, prominent among which are those of leather, surgical instruments, and sports goods (Nadvi, 1999a, Rana and Ghani, 2004, Bhutta et al., 2007, Ranjha, 2014).

Most of the local firms (except some large units) turn to local suppliers for raw material, machinery purchase and repair. Subcontracting is widespread in Sialkot, with the larger firms using micro firms for specific process activities in order to keep their overheads and inventory costs down. The presence of local subcontractors and suppliers ensures competitive prices, ready availability and swift delivery of wide range of services, helping the downstream manufacturers to quickly respond to varied customer demands and deadlines. The cluster also helps to minimise labour search and training costs (Nadvi, 1996, Nadvi and Halder, 2005). Nadvi (1999b) points out that the informal apprenticeship is the sole basis of training for the workforce in the surgical instruments sector. He further mentions that trade and sector related discussions are so commonplace in Sialkot “that intelligence on technical developments within the cluster (surgical instruments) spreads fast, despite attempts to restrict the flow of more sensitive data and know-how” (1999b, p. 91), as also reiterated in literature (Qureshi et al., 2004, UNIDO, 2014a). These clusters are discussed in more detail in the section 5.5.

5.4.2 Achievement of international accreditations

Ever since city firms entered international markets, quality assurance became an important theme among the leading firms (Nadvi, 1999a, Nadvi and Halder, 2005, Zaidi, 2006, UNIDO, 2010). Also, some of the firms are part of international manufacturers, where larger firms require SMEs to be accredited in various domains. Similarly, some countries require foreign firms to have certain accreditations before accessing their markets- a fact mentioned by sports goods firm F: *‘We have invested considerably in having accreditations for accessing Scandinavian markets.’* Generally, in all the interviewed executives’ offices, there were international accreditations which their firm held. These had to be renewed periodically, thus requiring regular shop floor level vigilance and financial commitment. The firm I interviewee specifically mentioned that he spent time, money and effort to win a 510K accreditation which helped his firm to tap into a particular USA surgical instruments segment.

5.4.3 Technical and policy reports

5.4.3.1 Reports by UNIDO on Sialkot

A report by UNIDO (Zaidi, 2006) on Sialkot clusters identified the lack of business development services (BDS) available. This included productivity management, marketing and sales, HR development, and software management. It also indicates a high turnover of middle management in SMEs. The sports cluster, leather goods cluster and surgical instruments cluster development were made a priority by the Government of Punjab in collaboration with UNIDO. The aim and objectives of the initiative were: understanding the clusters, their contribution, strengths and weaknesses, main capabilities and major issues facing them. The lack of training

institutes and quality assurance institutes were identified as weaknesses of the clusters (Zaidi, 2006). Another report of UNIDO on export-oriented clusters of Pakistan (UNIDO, 2007) again emphasised issues affecting the quality of goods produced in Pakistan and recommended setting up a proper international standard and certified laboratories for providing services to export-oriented SMEs of Pakistan. The lack of local international standard testing laboratories was also mentioned by the interviewee of firm I. Similarly, other international reports on export-oriented clusters in Punjab mention lack of quality assurance, low productivity, lack of awareness of international accreditations as factors hindering export growth (UNIDO, 2007, UNIDO, 2010). Overall from 2000 to 2010, an integrated programme was launched by UNIDO to support capacity building for sustainable industrial development in Pakistan and was aimed to cover components such as: institutional capacity-building for SMEs development, metrology, standardisation, testing, quality assurance and continuous improvement, and technology transfer (UNIDO, 2014a). Thus, it could be seen that main emphasis is on operational efficiency but not technological capability building of SMEs and their clusters, which is a source of sustained technical competitive edge.

5.4.3.2 Reports by Government of Pakistan (GOP)

The GoP announced its national science, technology and innovation policy in 2012-2013 (Pakistan, 2012). Admitting a lack of R&D in local industry, the policy document concedes that this is in contrast to the industrialized countries where the industrial sector is a major contributor to the overall R&D effort of the country. The policy recommends international technology transfer for local TCs upgradation. The policy document envisages ambitious goals and objectives. However, how these goals and objectives would be achieved and a time frame for achieving the goals is not mentioned in the policy document. Also, the document does not discuss how the TC needs of the industrial sector, especially SMEs, would be assessed and addressed. The results of this research could be used to assess and address the SMEs and their cluster needs by identifying their existing innovation level and factors affecting their TIC level.

5.4.3.3 Reports by European Union

Recently, the European Union in cooperation with UNIDO started the Trade Related Technical Assistance (TRTA) (<http://trtapakistan.org/>) programme for increasing the productivity and quality assurance of the export-oriented clusters of Pakistan. The TRTA programme has issued reports on various export-oriented industrial clusters of Pakistan. The TRTA report on leather industry in Pakistan (TRTA, 2014b) explains the constraints of the leather sector which are mainly economic such as the high cost of doing business. It also mentions in passing the need for better machines for producing higher quality hides to reduce wastage in the industry. Thus,

again the emphasis is on productivity and quality but not TCs upgrading to target better value-added markets abroad.

Similarly, another report of TRTA deals with the surgical sector of Pakistan (TRTA, 2014a). The report mentions that to move up the value chain, surgical instrument sector needs to have better machinery and develop greater design and R&D capacity, which could be facilitated through collaboration with clients in foreign markets. Therefore, the report recommends better inter-firm collaboration in the Sialkot surgical cluster for resource leverage, government facilitation for international collaboration on technology transfer and setting up of proper training centres suited to local surgical cluster needs. Importantly, the report mentions that a group of visionary companies of the Sialkot cluster should be created which are willing to invest resources for TCs upgrading. My TIC assessment model developed in this research helped to identify 'leader firms'-visionary firms, which could be selected for the initiative proposed.

In sum, major emphasis of SME executives, international agencies and government organisations are on cost competitiveness, productivity, quality control and market accessibility (Nadvi, 1999b, Kureshi et al., 2009, Pakistan, 2012), which are not a source of sustained technical competitive edge (Pietrobelli and Rabellotti, 2011). And where it is mentioned that moving up the value chain is required for having access to better markets and increased revenues, no method is defined for assessing firms or clusters technological capabilities and needs, and factors affecting them (Caniels and Romijn, 2003, Rana and Ghani, 2004, Pakistan, 2012). This is the research gap which my research targeted, and developed TIC assessment model and identified leader (progressive) firms among the interviewed firms, their competitive characteristics and factors affecting their competitiveness. Thus, the research findings could be used for policy formation for TCs upgrading of interviewed clusters and may be extended to other export-oriented clusters of Pakistan.

5.4.4 Economic issues affecting the clusters

Recently, businesses in Pakistan have been affected by severe power outages and the deteriorating law and order situation in the country. Power shortages are also resulting in the closing down of firms and lay off of workers (Mansoor, 2011b, Reporter, 2015). Firms are complaining that they cannot meet orders due to frequent power outages and therefore lose foreign customers (Ahmad, 2010, TRTA, 2014b). Sialkot firms are also protesting against the rising utilities cost and frequent power breakdowns (Mansoor, 2011b). Therefore, one of the last questions of the semi-structured interview was about whether the firm felt affected by any socio-economic conditions (socio-economic challenges). Firms generally expressed concern

over the present socio-economic issues affecting their image and performance in the foreign markets. When I asked from the executive of firm J about the challenges affecting his company, he replied: '*Pakistan's deteriorating social setup.*'

5.5 General characteristics of the researched clusters of Sialkot

In this section the leather goods cluster, sports goods cluster and surgical instruments cluster are analysed in detail and any watershed moments in their histories are mentioned. The aim is to bring the reader up to speed with their existing capacities and capabilities, which serves two purposes. First, it helps to reflect in section 3.5 what has and has not been done (practice oriented) and is and is not known (research oriented) about the three clusters technological capabilities and their contribution to firms and cluster competitiveness. Secondly, the information here would help to validate or otherwise the findings from the data analysis in chapters 6 and 7. The general characteristics of the interviewed clusters are described in Table 5-1 and explained in sub-sections below show that all the clusters are exporting low-value added items mainly to Europe and North America; and all clusters compete on quality and cost competitiveness.

	General characteristics of the researched clusters			References
Leather goods cluster	General products	Markets targeted	Business strategy	(www.smeda.org.pk/ http://punjab.gov.pk/sialkot_key_industry http://www.plgmea.pk/)
	Motor bike garments, gloves, shoes, fashion accessories	EU, and North America but efforts are afoot to target new markets like Russia, Africa, Latin America	Quality and cost competitive	
Sports goods cluster	General products	Markets targeted	Business strategy	(http://punjab.gov.pk/sialkot_key_industry http://www.psgmea.com/) (https://www.unido.org/fileadmin/user_media/UNIDO_Worldwide/Offices/UNIDO_Offices/Pakistan/Cluster_Report.pdf)
	Soccer balls, volley balls, beach balls, cricket bats, hockey sticks, gloves, and sportswear like track suits, T shirts, wind breakers, Judo/ karate kits etc	EU and USA	Quality and cost competitive	
Surgical instruments cluster	General products	Markets targeted	Business strategy	(www.simap.org.pk/ , www.smeda.org.pk/ , www.SCCI.com.pk/ http://punjab.gov.pk/sialkot_key_industry)
	Mostly disposable stainless steel instruments but also produces higher quality theatre instruments	Japan, EU , North America	Quality and cost competitive	

Table 5-1: General characteristics of the interviewed clusters at Sialkot. Source (Drawn from various GOP websites)

5.5.1 Leather goods cluster of Sialkot

The Pakistan Leather Garments Manufacturing & Exporters Association (PLGMEA, <http://www.plgmea.pk/>) protects, promotes and develops leather garments & allied industry all over Pakistan. It was established in 2001 to protect and promote the interests of its members regarding various trade taxation and manpower related matters. It carries out an aggressive international marketing campaign to try and boost the exports of leather garments mainly through participation in international exhibitions. The association has two zones: Southern and Northern. Sialkot falls under the northern zone.

The development of the leather cluster development was made a priority by Government of Punjab in collaboration with UNIDO. The aim and objectives of the initiative were: understanding the cluster, their contribution, strengths and weaknesses, main capabilities and major issues facing them (Zaidi, 2006). The report identified that firms were concentrating mostly on Western countries, while markets like Russia, Africa, Latin America remained unexplored. Also, the firms were exporting low value added products, and there are no leather training institutes. The initiative recommendations were first to increase cooperation and confidence building among the leather manufacturers to discourage damaging price competition in the cluster. Second, the cluster should explore new avenues and markets and adopt latest leather equipment and machines. Third, the firms should be aware about social compliance and environmental or waste issues. However, the recommendations did not address the issue of identifying existing process or product capabilities in the cluster nor developing and exploiting these capabilities for better value-added products. Also, the issues of monitoring technology and market trends and how training institutions could help the cluster is not discussed at all in the UNIDO's report.

5.5.2 Sports goods cluster of Sialkot

Sialkot has been known at the international level for its sports goods for more than a century. The product range of the sports goods cluster includes soccer balls, volley balls, beach balls, cricket bats, hockey sticks, gloves. Sialkot was selected to supply footballs for the 1998 Soccer/ Football World Cup. Most of the sports goods manufacturers are also make sportswear in addition to sporting goods. Initially, international buyers bought sports goods from Sialkot and sportswear from South Korea, Taiwan, and Turkey. As the apparel industry diminished in these countries, buyers who were already very satisfied with the quality of sports goods from Sialkot, asked local exporters to produce sportswear as well. This helped international buyers to reduce their sourcing overheads (Dasanayaka and Sardana, 2010a). As per Dasanayaka and Sardana, skilled stitchers were already available in the local cluster; therefore the sportswear industry was soon established and prospered. Also, moving into sportswear helped the firms leverage their risks into more than one product line. The sports wears being exported are track suits, T

shirts, wind breakers, Judo/ Karate kits, casual wear, etc. The cluster employs more than 10,000 workers, and earned more than US \$90 million during the FY 2004-2005. International names such as Adidas, Nike, Puma, Lotto are the main customers of Sialkot sportswear cluster.

5.5.3 Surgical instruments cluster of Sialkot

The ³Surgical Instruments Manufacturers Association of Pakistan (SIMAP, <http://www.simap.org.pk/>) was established in 1958 with the aim of promoting and supporting the interests of surgical instruments manufacturing community. The Surgical Association has 3000 members firms, where more than 500,000 workers are engaged in manufacturing of surgical instruments to meet the export commitments in the international market. The surgical instruments industry of Sialkot, Pakistan has a history of more than 100 years. It came to prominence when some British doctors got their surgical instruments repaired by the skilled workers of Sialkot, which set the foundation of the industry. The surgical instruments sector of Pakistan is located wholly at Sialkot.

Pakistani surgical tools are cost competitive, and have short lead times. Sialkot's surgical instruments cluster strength is high volume disposable instruments, but also makes higher quality theatre instruments. Many surgical firms have entered into joint ventures with international manufacturers. The USA accounts for the bulk of disposable exports while theatre instruments are mainly destined for the EU (Nadvi and Halder, 2005). Nadvi and Halder mention the important part played by Tuttlingen (Germany) in raising the surgical instruments cluster capabilities at Sialkot. Workers from Sialkot went to Tuttlingen, while technicians from Tuttlingen came to Sialkot to train workers.

The Sialkot Material Testing Laboratory (SIMTEL) was established in 2001 under the supervision, guidance and initiative of Federal Drug Administration (FDA) USA to provide consultancy to the manufacturers and exporters to improve manufacturing techniques and processes. The current world market of medical products is estimated at USD 30 Billion and is growing, and it is hoped that the Sialkot surgical sector will capture a greater share of the world market in the future (Mansoor, 2011d).

5.5.3.1 Role of Tuttlingen in increasing the surgical instruments cluster capabilities

Of all the clusters in Pakistan, the surgical instruments cluster has been the most extensively researched at the international level, owing to a DPhil by Khalid Nadvi (1996) from the University of Sussex. Since then, Nadvi has written extensively on the Sialkot surgical cluster (Nadvi, 1999a, Nadvi, 1999c, Nadvi, 1999b, Nadvi and Halder, 2005) and on the role

³ Source: SIMAP website: www.simap.org.pk

Tuttlingen has played in increasing the competitiveness of the Sialkot surgical instruments cluster.

A small town in Germany, Tuttlingen is home to about 75% of Germany's surgical instrument industry, and it employs more than 6200 artisans (Nadvi and Halder, 2005). The Tuttlingen industry manufactures two distinct types of products: traditional surgical instruments and new products such as endoscopes, surgical apparatus and surgical implants. In the 1980s, one of the largest producers of surgical instruments in Tuttlingen setup a joint venture with one of a firm in Sialkot, which was soon followed by other Tuttlingen firms in order to gain from the local low wages and expertise. The manufacturing expertise of the Sialkot surgical instruments cluster was raised by transfer of knowledge, expertise and machinery from Tuttlingen (TRTA, 2014a). Initially, Sialkot firms were responsible for the intermediate, and relatively labour intensive tasks of grinding, filing, and polishing. Semi-finished products were sent to Tuttlingen for further processing. As the metal forging techniques improved in Sialkot, it took over the role of original equipment manufacturer (OEM) and is now producing finished products for the customers in Tuttlingen customers. The relationship between Tuttlingen buyers and Sialkot producers range from arms-length to quasi-hierarchical (Humphrey and Schmitz, 2002).

Thus, all the three clusters: sports goods cluster, leather goods cluster and surgical instruments cluster produce low-value added products mostly for Europe and the US. The sports goods cluster owes much of its technology upgrading and product diversification to international manufacturers such as Adidas, Puma which started purchasing sportswear from the local cluster in the late 1980s. The surgical instruments cluster owes its technology upgrading to Tuttlingen manufacturers who transferred some of their expertise to the cost competitive Sialkot surgical instruments cluster.

5.6 Summary

This chapter first introduces the country of research Pakistan, its general industrial base, the importance of SMEs to its economy. It then describes various actors involved in promoting SMEs competitiveness. Next, the leather goods cluster, the sports goods cluster and the surgical instruments cluster of Sialkot are introduced. Finally, the technological capabilities literature on SMEs in Pakistan and on Sialkot in Pakistan is analysed. The analysis shows that most of the government initiatives relate to increasing productivity, quality awareness and meeting international standards for exports among the SMEs, but does not address how new knowledge in the clusters could be generated, which could then be exploited by the SMEs for better value-added markets.

The next two chapters present the research findings based mainly on the primary data obtained from the twelve interviewed firms. Chapter 6 deals with CDI, firm and cluster level analysis, while chapter 7 deals with cross-cluster level analysis.

6. Firm and cluster level data analysis

6.1 Introduction

In each cluster, executives of four firms were interviewed. The case study reports of the twelve interviewed firms in three Sialkot clusters: the leather goods cluster, the sports goods cluster and the surgical instruments cluster are analysed in this chapter. The case studies were designed to achieve the research questions: types of CDIs introduced by interviewed SMEs, their competitive characteristics, the role of each cluster in supporting the interviewed firm's CDIs and TCs. At the end of each cluster, the findings from each interviewed firm are compared with each other, and supported by extant literature on Sialkot clusters to determine their overall competitive characteristics and TIC levels.

Table 6-1 shows the general demographics of the interviewed firms. Firm A and firm H's executives requested to see the list of firms to be interviewed and they endorsed the firms as well-know, reputable and growth-oriented in Sialkot. Generally, all the interviewees (Chief Executives) were males and owner of the firms. Most of the interviews took place in executives' offices, which allowed the researcher to observe various international accreditations displayed in the offices, which allowed firms to access international markets and customers. The duration of interviews was around thirty to forty minutes with another thirty-forty minutes visiting shop floor, where allowed. All the interviews were recorded except one. The ages of the executives were not asked but they all generally appeared to be in their late fifties. All the interviewed firms were in manufacturing and more than twenty years old.

Interviewee Characteristics									
Firm	Gender	*Age of interviewee	Position of interviewee	Interviewee's education	Place of interview	Duration of interview (minutes)	Was the interview recorded?	Was shop floor visited?	Date of interview
Leather Goods Cluster Firms									
A	Male	Early 40s	General Manager	MBA	Firm's Boardroom	40	Yes	No	19-01-2011
B	Male	Late 60s	Chief Executive with his Son in attendance	Not known	Executive's office	50	Yes	No	20-01-2011
C	Male	Late 40s	Chief Executive at his office	MBA	Executive's office	70	Yes	Yes	19-01-2011
D	Male	Late 60s	Chief Executive	Master's	Executive's office	90	Yes	Yes	07-01-2011
Sports Goods Cluster Firms									
E	Male	Early 50s	Chief Executive	Doctor of Medicine	Executive's office	46	Yes	No	09-02-2011
F	Male	Early 50s	Chief Executive	Not known	Executive's office	42	Yes	No	08-02-2011
G	Male	Early 70s	Chief Executive	Not known	Executive's office	45	Yes	Yes	07-02-2011
H	Male	Early 50s	Chief Executive	Not known	Meeting room by shop floor	38	Yes	No	08-02-2011
Surgical Instruments cluster Firms									
I	Male	Late 40s	Chief Executive	Graduate	Executive's office	90	Yes	Yes	10-02-2011
J	Male	Late 50s	Chief Executive	College dropout	Executive's office	42	Yes	Yes	10-02-2011
K	Male	Late 20s	Marketing Executive (Son of Chief Executive)	MBA	Firm's reception area	40	Yes	No	
L	Male	Late 50s	Chief Executive	Graduate	Executive's office	Interview was not recorded	No	Yes	09-02-2011

*Executives were not asked their age, so this is an estimate by the researcher

Table 6-1: Interviewed firms' demographics

6.2 Data analysis format

Data was analysed at four levels: CDI, firm, cluster and cross-cluster level, as shown in Figure 6-1. CDI and firm level data analysis feeds into cluster level analysis, which feeds into cross-cluster level analysis. This chapter discusses the data analysis at CDI, firm level and at cluster level. First, CDI level analysis helped to analyse how an innovation is assimilated and adds to the existing capabilities and competitive edge of a firm. In each case study report, the analysis of CDIs initiated helped to validate the general characteristics of the interviewed firm such as market targeted, competitive strategy, and competitive edge as mentioned by the interviewee. On the basis of CDI, TIC level, firm's resources and product portfolio (Table 4-7), interviewed firms are classified as either leader, follower or reactor firm, as already discussed in chapter 4.

Second, at the cluster level, the interviewed firms were then compared with each other to identify any common or differentiating characteristics such as business strategy, competitive priorities, CDIs. Third, cluster level analysis helped to identify the types of CDIs introduced and TCs level of interviewed firms whether at the acquisition, assimilation or innovation stage. Also, the comparison allowed to highlight any enabling or constraining factors (in or outside the firm) affecting firm competitiveness, which is used for policy recommendations in chapter 8.

6.2.1 Individual case studies format

Each case study first describes the general characteristics of a firm such as market and customers targeted and competitive edge. Next, firm's CDIs (Table 4-5) accumulated over the period of its existence are analysed to understand how each of them contributed to their competitive edge. Later, CDIs are mapped onto a chronological time line, which helps to identify internal and external factors which affected firm's capabilities accumulation process. Also, the time line helps in data triangulation that is whether the CDIs add up to the competitive advantage as stated by SME executive earlier in the interview. Further, the timeline represents the technological capabilities upgrading process at firm level. Finally, the case study is concluded by analysing interviewee's recommendations for increasing the firm/ cluster competitiveness.

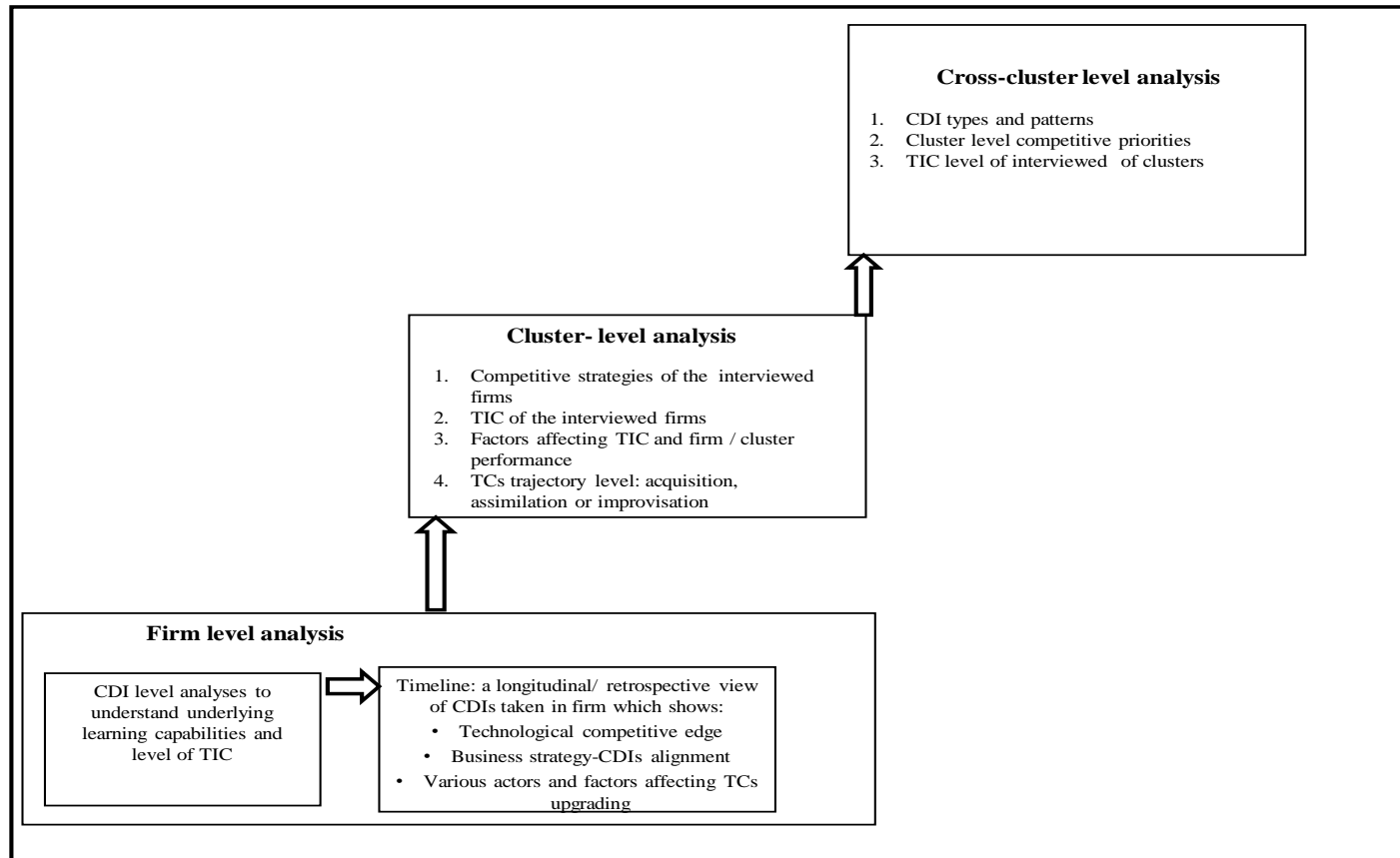


Figure 6-1: Data analysis pattern

Figure 6-2 represents the layout of the chapter. Section 6.3 describes the case studies of the four interviewed leather goods firms assigned as A, B, C, and D. Section 6.4 examines all the leather goods firms collectively for common themes and patterns, and compare it with existing literature on SMEs existing in clusters. Similarly, section 6.5 deals with the sports goods cluster firms: E, F, G, and H, while section 6.6 analyses the interviewed firms for common themes and patterns, and compare the findings with general SME literature. Finally, section 6.7 deals with the surgical instruments cluster case studies: I, J, K, and L, and section 6.8 analyses the interviewed firms for common themes and patterns. Section 6.9 is the chapter's summary.

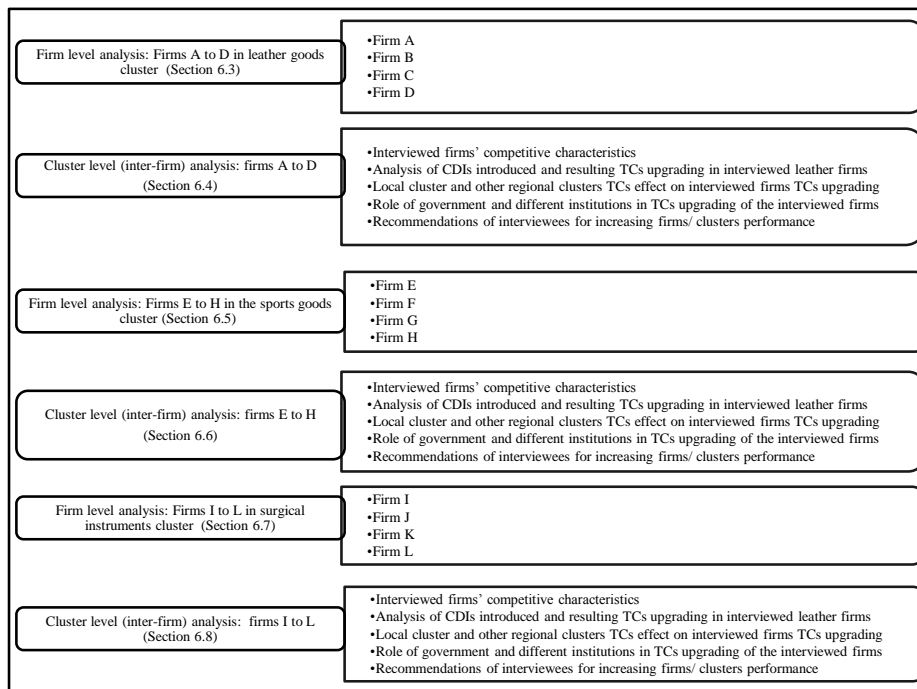


Figure 6-2: Chapter layout

6.3 Firm level analysis: Firms A to D in the leather goods cluster

6.3.1 General leather cluster characteristics

General products manufactured by the cluster: As discussed in chapter 5, the leather goods cluster traditionally manufacture motorbike garments and accessories (gloves, protective gear) for which the cluster has developed expertise and sufficient trained manpower. The leather cluster is following global market trends, but has constrained itself to a limited product range, and has not invested in technology for more value added products such as high-end fashion garments and accessories (Mansoor, 2010a, TRTA, 2014b).

General capabilities of the cluster: Leather cluster development was made a priority by the Government of Punjab, Pakistan and an initiative was launched in collaboration with UNIDO with the aim of understanding the cluster, its contribution, strengths and weaknesses, capabilities and major issues (Zaidi, 2006). The report identified that firms are concentrating mostly on Western countries, while markets like Russia, Africa, Latin America remain unexplored. Further, the report found that the firms are exporting low value added products, and there are no leather training institutes.

Also, the extant literature on Pakistani manufacturing SMEs does not address the issue of identifying existing process or product capabilities in the cluster nor developing and exploiting these capabilities for better value-added products (Pakistan, 2012). Also, the issues of monitoring technology and market trends are left unattended in the literature. Therefore, the case studies in this section identify the TIC level of the interviewed firms and various internal and external factors which affect the TIC, which could then be used for formulating policies for the technological upgrading of interviewed firms/ clusters.

All the firms interviewed have been in business for more than twenty years, are part of GVCs, and their general characteristics are described in Table 6-2. Generally, the interviewed firms have an 'arm's length' relationship with their customers, which is one sign of generally producing mature products for mature markets (Humphrey and Schmitz, 2002). Further, interviewed firms attend international expositions where new or existing customers asked them to produce garments, the designs of which are given to the leather firms.

Firm	Established	Product portfolio	Noticeable characteristics	Hierarchical relationship with customers Humphrey and Schmitz (2002)
A	1988	<ul style="list-style-type: none"> • Motor bike garments • Leather upholstery • Fashion accessories 	<ul style="list-style-type: none"> • Wining best export trophy since 1991 from Sialkot • Hired foreign experts for motor bike garments manufacturing • The chief executive has been the President of SCC&I 	Arm-length
B	1971	<ul style="list-style-type: none"> • Motor bike garments 	<ul style="list-style-type: none"> • The chief executive has been the SCC&I president • Supplier of motor bike garments to HONDA 	Arm-length
C	1996	<ul style="list-style-type: none"> • Motorbike garments • Leather jackets • Leather gloves and Saddles 	<ul style="list-style-type: none"> • President of local chapter of PLGEMA 	Arm-length
D	1963	<ul style="list-style-type: none"> • Motorbike garments 	<ul style="list-style-type: none"> • Group of companies related to sports goods, sports accessories and leather garments • The chief executive of Group of Companies has been the President of SCC&I 	Arm-length

Table 6-2: Interviewed leather cluster firms' general characteristics. Source (From interviews, shop floor visits, firm brochures, firms websites and SCCI website)

Mostly Chief executives of the firms were interviewed, who were also asked to grant a shop floor visit. The interviews, which took place in the offices of the chief executives, along with the shop floor visits helped to fill the observational frame work. The observational framework (Table 4-7) was filled out for the four interviewed firms A, B, C and D to help categorise the interviewed firms as leader, follower or reactor.

	Observations	Firm A (Firm premises visited)	Firm B (Firm premises visited)	Firm C (shop floor visited)	Firm D (shop floor visited)
Layout of the shop floor	*Is the shop floor properly lit?	Not known	Not mentioned	No	Yes
	Are work instructions/ SOPs prominently displayed?	Not known	Not mentioned	No	No
	Are safety signs properly displayed and emergency exits defined?	Yes	Yes	No	Yes
	Are fire extinguishers provided and working?	Extinguishers displayed	Yes	No	Yes
	Is the work place airy and well ventilated?	Yes	Yes	Yes	Yes
	Is the shop floor are properly cleaned such as free from oil, grease?	Yes	Not mentioned	Yes	Yes
Facilities provided to the workforce	Is Air conditioning provided to the workforce?	Apparently not	Not mentioned	No	No
	Are medical/ housing facilities provided to the workforce?	Firm billboards displayed the facilities provided	Mostly contractual workers	Accommodation provided	Small workforce
	Are the families of work force facilitated in any way such as providing education scholarships, recreational trips?	Yes, billboards displayed the facilities provided	Not mentioned	There is no mention in brochures or on billboards	There is no mention in brochures Or on billboards
Resources	Make of the machines such as Japanese, Korean	Not mentioned	Not mentioned	Korean	Japanese
	Conditions of the machines such as newly purchased or second hand	Not mentioned	Not mentioned	Second Hand	Brand new
	Maintenance of the machines such as if they are properly cleaned?	Not mentioned	Not mentioned	No	Properly cleaned
Firm characteristics	Does the firm hold international accreditations? (from websites, brochures, executive's room)	Yes	Yes	Yes	Yes
	Is the firm manufacturing for customers?	Yes	Yes	Yes	Yes
	Does the firm have its own brand name?	In the process of building	No	No	No
	Is the firm marketing directly into the markets?	Firm has recently started this initiative in USA	Firm has recently started this initiative in Canada	No	No
	If any multinational is regular customer of the interviewed firm	None	HONDA	None	None

Table 6-3: Observational checklist for the leather cluster interviewed firms

6.3.2 Firm A

6.3.2.1 Interview details

The interview was conducted in the firm's conference room on their premises, which was a spacious, elegantly decorated and had all the necessary IT amenities. During the interview, initially, the interviewee received a few calls regarding the approval of people who were proceeding abroad for different international exhibitions.

6.3.2.2 Shop floor visit

The researcher reached the firm at lunch time so had to wait for the lunch hour to finish for the interview. The firm premises are located in a densely populated area, and most of the workers came out of the premises to smoke and sit in the sun. This gave the researcher a chance to chat with a group of six workers.

There was a consensus among the workers that this firm was the largest leather goods manufacturing firm in the area. However, they disagreed about the growth of the firm in terms of number of people employed, with some said that the peak employment level had already been passed. A possible reason could be an explanation given by firm B and C executives that initially the leather industry of Sialkot was affected by China, but now China's labour costs have increased due to which smaller orders are again being diverted to Pakistan.

The researcher was escorted to the conference room and on the way researcher observed the billboards hung by the walls which displayed different welfare steps taken by the firm for its employees such as medical expenditure, excursions and trips, and money spent on the education of children of workforce. The premises were neat and clean, as mentioned in Table 6-3. Thus, from observation and conversation with the workforce, it appeared that firm A possessed robust financial resources and large production capacities.

6.3.2.3 Firm's characteristics

The interviewee was with one of the three General Managers (GMs) of the firm. The firm considers itself to be the largest manufacturing concern in the local leather cluster. At the time of interview, firm was trying to develop a capability to market under its own brand name in the US market. When asked about any competition, the interviewee replied: *'Locally we are not threatened because the volumes we are handling cannot be handled by any other local competitor.'*

When asked about the firm's competitive advantage, the interviewee replied: *'The firm considers its quality, competitive cost, highly trained work force and bulk volume handling as*

its competitive edge.' The firm also claimed to have strong marketing, purchasing and networking skills, and a diversified customer base. The interviewee informed the researcher that: *'The firm retains a core workforce and hires a contractual workforce available in the cluster to minimise overheads.'* It rarely sub-contracts its manufacturing activities outside the firm. Its managers regularly attend international expositions to meet established customers, seek new markets, view the latest machinery and observe the latest trends in the leather goods fashion industry. To the question of how the firm's performance is measured, the interviewee replied: *'By revenue earned.'* The interviewee mentioned shop floor productivity as another measure of firm performance. When the researcher asked for the firm's measure of productivity, the interviewee replied: *'For an order of 100 jackets, we cut material for only 101 jackets.'* Among its accomplishments, the interviewee remarked: *'We have the largest tannery in Pakistan, have been winning the best export trophy since 1990; and the firm is the largest exporter of finished leather apparel to Europe and the USA from Sialkot.'* Thus, the interviewee had a clear idea about the firm's competitive edge, measures of productivity and the parameters of performance.

6.3.2.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the level of TICs of the firm and resulting TCs upgrading achieved by the firm (Table 6-4).

For the first CDI, foreign experts were hired to train the workforce. As claimed by the interviewee: *'We were the first to hire foreign consultants, and the expertise gained by our firm slowly disseminated in the leather goods cluster.'*⁴ Therefore, this CDI is categorised as radical. The firm at the start of CDI had a semi-skilled workforce, which was further trained with the help of foreign experts. This CDI demonstrates the 'learning by training' capability by foreign consultants i.e. it had a willing, semi-skilled work force which absorbed and exploited the new knowledge. The CDI helped to commission a proper production line to increase productivity, product quality and reliability and reduce rejection. A proper quality control system was also set up. However, all these activities relate to acquisition level and represent process upgrading for improved quality and productivity (Lall, 1992).

The second CDI of the firm involved incorporating a tannery which helped to integrate upstream operations. The interviewee claimed: *'The firm has the largest tannery in Pakistan'*⁵.

⁴ Mr Fouzan (from SMEDA) also mentioned that the firm A was the source of latest manufacturing processes and techniques in the leather goods cluster.

⁵ Before entering the city, the researcher observed a sprawling tannery with the name of interviewed firm on it.

The expertise of the tannery operations has been acquired from a neighbouring cluster, displaying the ‘learning by interaction’ capability. Because of the scale, CDI has been categorised as major but shows a basic process engineering capability (Lall, 1992).

The third CDI builds upon the first and second CDIs, as remarked by the interviewee: *‘Over time we had developed sufficient knowledge to improve the existing processes to the level required for the fashion accessories market.’* This CDI relates to moving into the low valued fashion accessories market such as ladies purses and leather upholstery for sofas, cars, a sign of broadening product portfolio and business growth. Since all the products of this CDI are new/ novel to the cluster as claimed by the ⁶interviewee, the CDI has been categorised as radical. The interviewee claimed that they are the only firm manufacturing these items in the cluster. Moving into new products and markets by improving existing capabilities is a sign of firm’s basic ‘learning by doing/ using’ capability (Amara et al., 2008) and represents assimilation level (Lall, 1992).

Furthermore, currently the firm is also trying to **market overseas directly**. The interviewee did not dwell upon the problems faced in developing a marketing network, but the initiative could improve margins as the firm will sell directly in the retail market. This latest initiative is an example of downstream integration (Baines et al., 2005).

The firm is also trying to live up to **Corporate Social Responsibilities (CSRs)**. To keep the employees loyalty, the firm has initiated various welfare initiatives. Billboards around the firm entrance displayed the amount firm has spent on employees medical expenses, insurance, gratuity, recreational trips (Table 6-3). However, it is not clear whether this truly is the local culture or motivated by international customers, where such initiatives earn goodwill for the firm.

⁶ No other firm interviewee claimed to manufacture these products. Mr Fouzan also claimed that the firm A is the first to manufacture fashion accessories in leather goods cluster.

CDI (Cohen and Levinthal, 1990)	Learning capability and associated knowledge capability (Amara et al., 2008)		Level of TIC required/ displayed in the CDI (Lall, 1992)	Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4-6)	Resources of the firm as observed (Table 6-3)	Firm categorisation
Hiring of foreign experts	• Learning by training	Know-how	• Basic investment/ process engineering capability • Acquisition level	• Improvement in production process quality and productivity-process upgrading	Radical since the firm is first to hire foreign consultants in the local cluster	<ul style="list-style-type: none"> • The interviewed firm has two more manufacturing concerns in addition to the one visited by the researcher. • During the interview, interviewee issued a few directives on the phone for the employees who were to proceed abroad immediately for business visits. • Interviewee is GM in the firm along with two more GMs. 	Since the firm has demonstrated radical and major CDIs, and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm.
Up-stream integration of leather tannery	• Learning by interaction	Know-how	• Basic investment / process engineering capability • Acquisition level	• Functional integration	Major CDI, for which expertise was imported from a regional cluster		
Low-valued added fashion accessories	• learning by use/ doing	Know-what	• Intermediate process capability with respect to the cluster capability • Assimilation level	• Process upgrading	Radical since the interviewee claims that no other firm is producing these items in the cluster		
Down-stream marketing	Learning by interaction	Know-how	• Basic investment / networking capability • Acquisition level	• Functional integration	Radical CDI, since it involves developing market skills abroad (USA)		
*CDIs in a firm are assessed with respect to their respective cluster capabilities							

Table 6-4: CDIs analysis for TIC level of firm A

Thus, through its CDIs the firm has demonstrated the ‘learning by training/ interaction/ using’ capabilities. ‘Learning by using/ doing’- an intermediate production capability adds to process upgrading, which has resulted in developing a fashion accessories product line for the firm. Process upgrading is a sign of increasing depth of production technological capability, for better value-added products (Lall, 1992, Morrison et al., 2008, Kadarusman and Nadvi, 2013). The firm’s resources and neat and clean premises presented an image of a company with good financial health, and since most of the CDIs introduced are either radical or major, the firm is classified as a leader firm, as discussed in Table 6-4.

6.3.2.5 A macro view-time line, of CDIs adding to firm’s technological competitiveness

The timeline consisting of CDIs, which helped a firm achieve its competitive edge, quality and bulk volume handling capability is shown in Figure 6-3. The Y-axis represents capabilities development initiative (CDI) and its elements, while the X-axis describes the CDIs timeline and their categorisation.

The firm stated bulk volume handling as its competitive edge and cumulatively the firm’s CDIs show that it has developed a volume handling capacity which local competitors cannot match. Also, the firm is producing products which local competitors cannot produce. Thus, there is an alignment between its business strategy and CDIs accumulated which resulted in bulk volume

handling competitive edge. This alignment between the firm's strategy and competitive priorities and capabilities is considered important in the literature for sustained performance (O'Regan and Ghobadian, 2004, Singh and Mahmood, 2014), where strategy is about attaining competitive edge in the market (O'Regan and Ghobadian, 2005).

All the CDIs relate to operational improvement (Lall, 1992) and radical CDIs have been incorporated from abroad. Thus, this firm has a basic production/ operational capability, which implies that it is at the acquisition stage (Lall, 1992). External sources are considered an important source of resource leverage in the literature on SMEs for developing countries (Brehm and Lundin, 2012). However, the timeline does not show any inter-firm cooperation, nor is there any mention of any regional agency input to CDIs carried out.

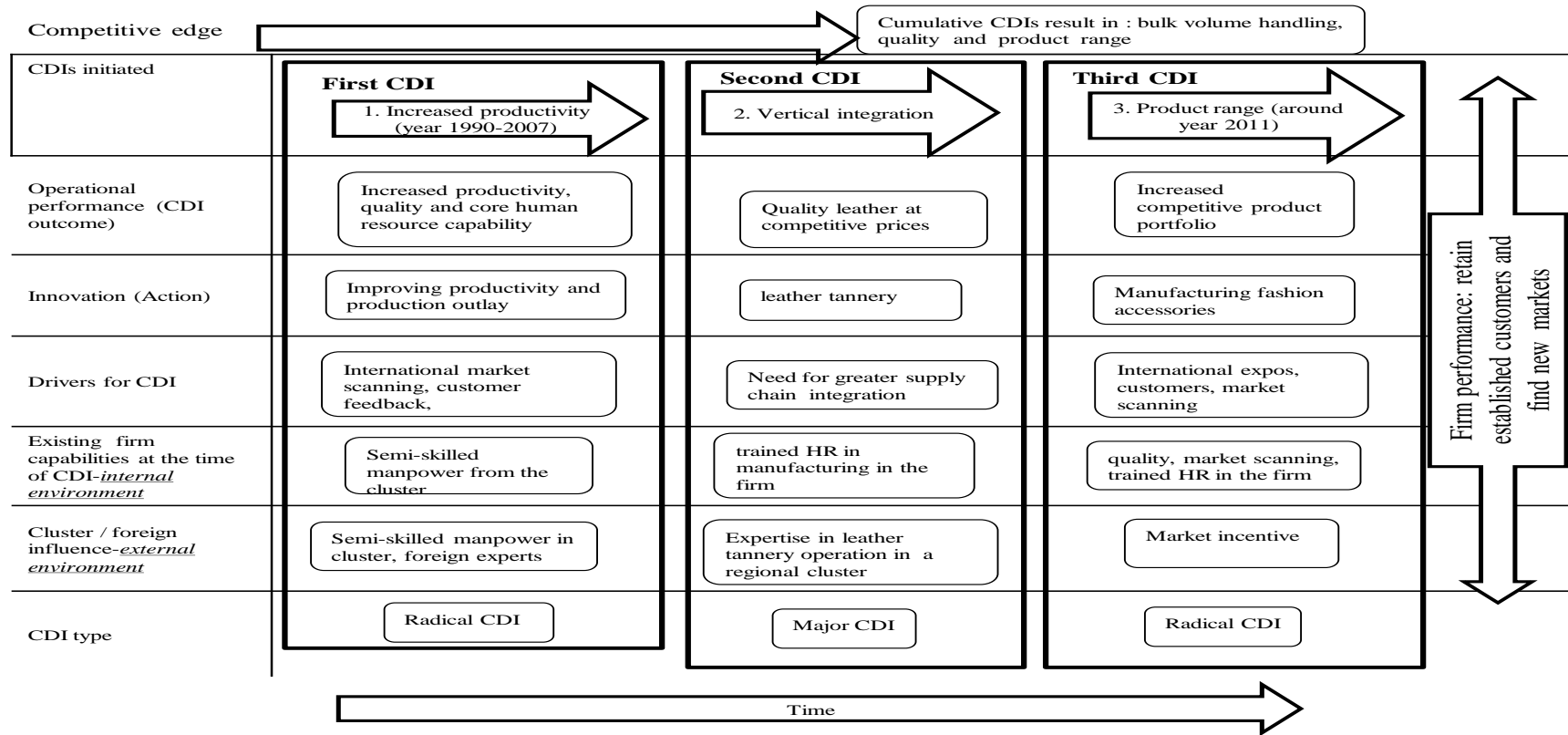


Figure 6-3: Timeline for firm A

6.3.2.6 Interviewee's comments/ recommendations for firm/ cluster competitiveness

The firm is trying to develop the capability to manage its brand name in foreign countries. However, the firm's movement to a high-velocity, higher value added market is constrained by its management's capabilities, as commented on by the interviewee: *'In the fashion garments industry there are frequent changeovers for which a strong management is required to take immediate decisions, which is lacking at the moment.'* Thus, the weakness pointed out by the interviewee for stagnation in the firm's product portfolio is too much centralisation of decision making and the lack of spirit of entrepreneurship, which is to take risks and explore new markets.

6.3.3 Firm B

6.3.3.1 Interview details

The interview was conducted with the Chief Executive (CE) of the firm, with the marketing executive in attendance. The interview took place at the CE's office, as mentioned in Table 6-1. The CE's office was located in a three story building which was also the site of administration and marketing offices. The interviewee has been the president of Sialkot Chamber of Commerce and Industries (SCCI), which is an indicator that firm is considered a serious competitor in the local cluster.

6.3.3.2 Shop floor visit

The firm's premises were neat, and buildings appeared to be well maintained. There were a few expensive cars (not ordinarily available in Pakistan) parked in the premises, and upon inquiry of the author from firm staff, it was revealed that they belonged to the CE's family. The CE has two sons who just returned after doing MBA's in the USA, and were now marketing executives of the firm. Thus, it appeared to be a family owned business.

6.3.3.3 Firm characteristics

The firm exports to Japan, Europe and Canada and is trying to strengthen its presence in Canada, but did not dwell upon the problems faced in this regard. As per the CE's comment: *'We do not have a brand name, and manufacture for someone else.'*

Increasing customer base is one of the aims of the business strategy, as remarked by the CE: *'I made a mistake of committing to one big customer and refusing to other customers in 1980, and learnt the lesson that when a big customer goes down, we also go down.'* As per the CE: *'Customers give us training, provide us with samples and we manufacture accordingly.'* The interviewee attributes the success of the firm to the skills of the local workforce of the cluster. The CE remarked that they had a core work force augmented by contractual work force.

When asked about the firm's competitive advantage, the CE replied: *'Quality and reliability i.e. a reputation among the customers that we would always supply quality material.'* When asked how the firm maintains its competitive edge, the CE replied: *'Through an experienced workforce, new machines from time to time, customers' input, and new products.'* The firm considers its present size to be just right for its intended market, as any further expansion would make the operations non-profitable. This cautious approach is indicated by the interviewee comments: *'Orders are in small quantities so the firm size fits in perfectly against the demand. You cannot grow bigger otherwise the firm becomes unprofitable.'*

During the interview, the CE remarked: *'International standards have to be followed'*, which is an indication that firm is exporting. The firm attends international exhibitions to find new customers, and look out for new designs and trends in the market. For selecting its product range, the CE replied: *'We keep profitability in view and emphasise on those products which sell along with bringing in new products.'* When asked how firm performance is measured, the CE remarked: *'With customer satisfaction there is demand for firm's products which results in increase in revenues.'*

When asked about any academia collaboration, the interviewee indicated that they saw input from academia as resource leverage. When the researcher asked about any suggestions for bringing about academic collaboration, the interviewee was not sure how to manage it. Upon the question of cooperation among SMEs, interviewee conceded that SME executives are working individually but then added: *'This is the philosophy of the SME, entrepreneurship and the efforts of the executive.'*

Thus, apparently, the executive has a clear business strategy and is running a successful enterprise by skilful integration of opportunities offered by the local cluster into the firm.

6.3.3.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the nature and level of TICs of firm B and the resulting TCs upgrading achieved. Table 6-5 represents CDIs analysis of firm B

First CDI: The Chief Executive said that they have a tannery, on which marketing executive added: *'It's a big tannery.'* However, the CE immediately waved his hand, remarking: *'It's a modest tannery.'* The CE added that tannery was added to save costs.

Second CDI (year 2000, mentioned in one of SCCI books): The CE did not mention this CDI but it was picked up from a book published by SCCI on its Golden Jubilee and given to the researcher by the CE. This CDI involved a range of garments which firm A and D also mention in their product range. Therefore, this CDI gives credence to CE's policy of selecting and manufacturing those products which sell in the market.

Third CDI (year 2011): The CE mentioned recently introducing motorbike boots. The marketing director remarked: *'We are successfully manufacturing them'*, CE quickly added: *'The firm still has manufacturing and quality problems, perhaps we need better machines.'* However, as per literature available to the researcher published by SCCI, another firm was the first to introduce motorbike boots in the local leather goods cluster.

CDIs (Cohen and Levinthal, 1990)	Learning capability and knowledge capabilities (Amara et al., 2008)		Level of TIC required/ displayed in the CDI (Lall, 1992)	Types of process upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-3)	Firm categorisation
	• Learning by interaction	Know-how					
Installation of a modest tannery	• Learning by interaction	Know-how	• Basic investment/ process engineering • Acquisition	• Functional	Minor as capability already exists in the cluster and the scale of CDI is modest	Optimised as CE remarked that firm does not want to expand beyond a certain limit	Since the firm has demonstrated CDIs, which already existed in the cluster, but has CDIs-business strategy alignment, therefore firm is categorised as a follower
Increased (selective) product range	• Learning by interaction	Know-how	• Basic investment/ process engineering • Acquisition	• Operational	Minor as capability already exists in the cluster and the scale of CDI is modest		
Increased (selective) product range	• Learning by interaction	Know-how	• Basic investment/ process engineering • Acquisition	• Operational	Minor as capability already exists in the cluster and the scale of CDI is modest		
Efforts to create market in Canada	• Learning by interaction	Know-how	• Basic networking • Acquisition	• Functional	Major CDI, since it involves developing market skills abroad (USA)		
Trying to Install software for inventory operations	• Learning by interaction	Know-how	• Basic networking • Acquisition	• Operational	Minor, as other interviewed firms have talked about		

*CDIs of the firm assessed with respect to their respective cluster capabilities

Table 6-5: CDIs analysis for TIC level of firm B

Through its CDIs, the firm has at best displayed basic capability of ‘learning by interacting’, as shown in Table 6-5, and did not exhibit any sign of ‘learning by using/ doing capabilities’ through its CDIs, essential for process/ product upgrading for better value-added products (Lall, 1992, Morrison et al., 2008, Kadarusman and Nadvi, 2013). The firm has been categorised as a follower, as CDIs are copied on a limited scale from the cluster. Further, only those items are selected which sell. Also, in all the CDIs the CE did not mention any difficulty about identification/ assimilation of technology, except the latest CDI-manufacture of motorbike boots. This CDI has recently been introduced by a competitor in the cluster, and maybe the expertise has not properly been disseminated. However, the CE pointed out that they need to buy better machines to come up with better quality products, indicating that tentative production problem has been identified. Overall, the firm exhibits competitive characteristics of flexibility, cost competitiveness, customer diversification, which are among general characteristics exhibited by SMEs, as discussed in sub-section 3.2.2

6.3.3.5 A macro view-time line, of CDIs adding to firm’s technological competitiveness

The timeline consisting of CDIs, which helped achieve firm its present competitiveness is shown in Figure 6-4. The firm stated selecting and absorbing expertise from the cluster as per its strategy and thus introduced CDIs on limited scale with in the firm to keep its size at an optimum level. Thus, there seems to be an alignment between the stated business strategy of the

firm, which is to develop limited production capacity in selected products, to the CDIs acquired, an aspect supported in the literature on firm performance (Raymond and Croteau, 2009).

Thus, the timeline shows that this follower firm did not add to but draws from the cluster capabilities and infrastructure. Further, the time line does not show any evidence of collaboration with government development agencies for CDIs selection, assimilation and exploitation. Since all the CDIs have been acquired from the cluster and resulted in operational improvement (Lall, 1992), the firm's TIC level is categorised as acquisition.

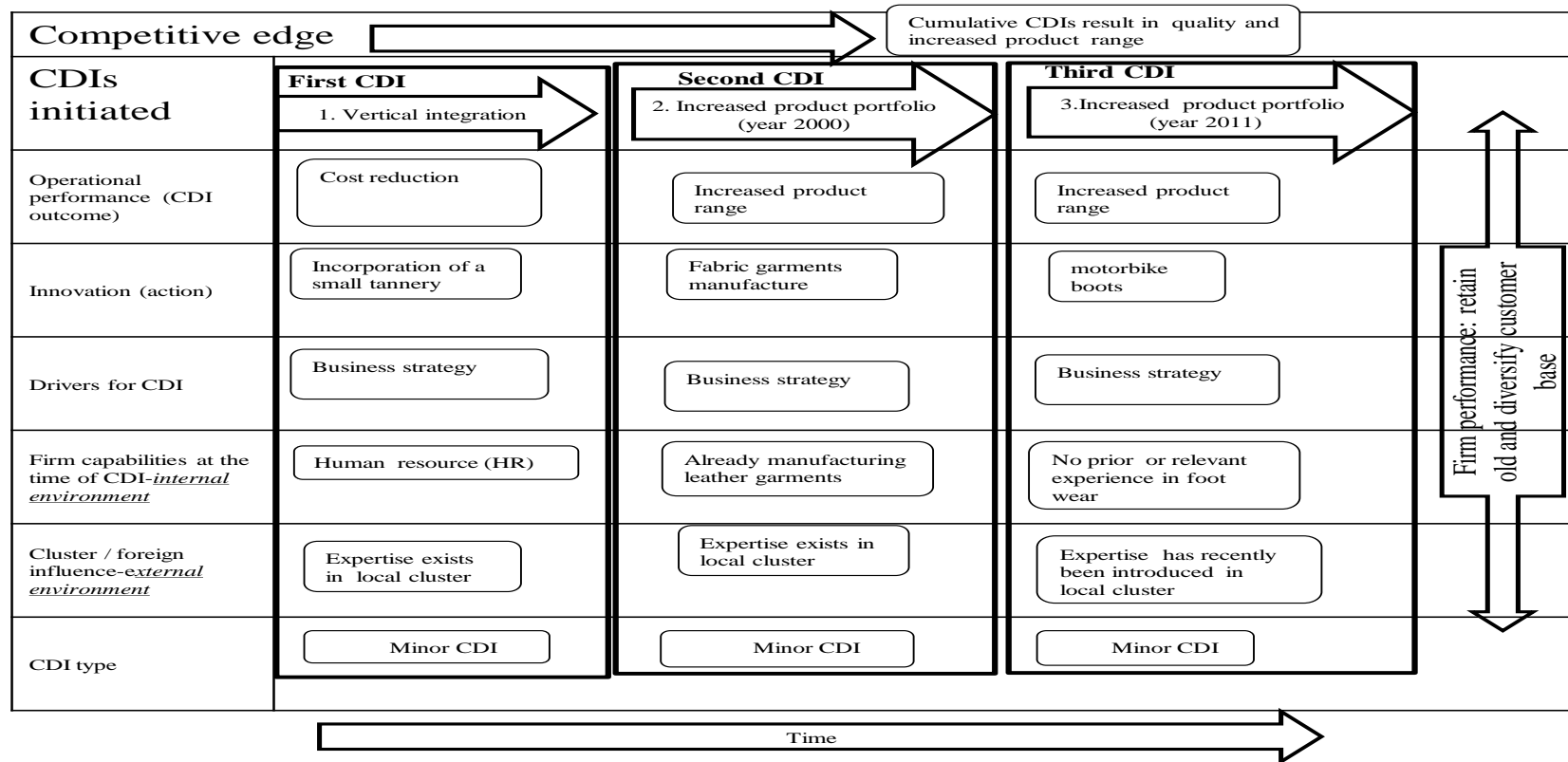


Figure 6-4: Timeline for firm B

6.3.3.6 Interviewee comments/ recommendations for firm/ cluster competitiveness

The CE gives two recommendations when asked about any future challenges: *'The utilities and socio-economic conditions of the country are a worry, and they have to improve themselves to enable us to expand'*, something which has been highlighted in literature review (TRTA, 2014b). Pakistan is presently facing acute power shortages and utilities prices have been regularly increased by the successive governments, thus increasing the cost of doing business in the country (Mansoor, 2011b, Ahmad, 2012b). The aforementioned recommendations (concerns) are similar to those expressed by the executives of firms C and D.

6.3.4 Firm C

6.3.4.1 Interview details

The researcher met the SME executive at PLGEMA (Pakistan Leather Garments Manufacturing Association) office. We sat there for some time, while the executive conducted some affairs in the office. Later on, there was meeting of major executives of the leather cluster with Secretary Industries of Pakistan, and the researcher accompanied the executive. At the meeting, firm C executive introduced the researcher to a few executives to whom interviews were requested. The researcher did not attend the meeting but went on to interview the GM of firm A. Later on, the researcher came back to meet the firm C executive on his new firm premises. After the interview, a detailed factory visit was given by the executive.

6.3.4.2 Shop floor visit

The shop floor visit showed that the firm had recently moved to new premises, outside the city centre, in a newly established industrial estate. The masonry and lighting work was incomplete in the building and only a selected few rooms were liveable. It was a well-designed two storey building, with living quarters for the workforce. It had dedicated sections for different products such as gloves, saddle bags, motor bike garments. However, quite a few rooms were empty and machines idle. The interviewee said that the machines purchased were second hand i.e. used machines. These observations, recorded in Table 6-3 supported the executive comments that although the firm had planned big, it was presently losing business.

6.3.4.3 Firm characteristics

This firm manufactures for an international client, and considers flexibility with orders and prompt delivery as its competitive edge. When asked how firm performance is measured, the answer was: *'Through increased sales.'* However, the interviewee laughed and said: *'Sales have been going down for some time now.'* The Executive stated that the firm is presently losing business from the customer owing to increased complaints about the quality of the products. The interviewee told the researcher that having invested in several other businesses; he was short of cash and could not afford to travel abroad to international expositions. The interviewee admits that he did not attend international expositions to increase the customer base, but relied on one major customer. The interviewee also said that he has recently done an executive MBA. Further, the firm has second-hand equipment from South Korea. When asked about industry and academia collaboration, the interviewee remarked: *'Academia and industry are not aligned and not in collaboration.'* The executive was also asked if a record of complaints/ suggestions from the customers was kept, the answer was in the negative.

6.3.4.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the level of TICs of the firms and resulting TICs upgrading achieved by the firm (Table 6-6).

First CDI: An expert local worker was hired to improve the quality of the firm's saddle bags. However, this initiative was only implemented upon receiving quality complaints from the customer. This behaviour shows that firm does not have a robust quality control system and relies on customer feedback for improving its operations.

Second CDI: A foreign consultant on expensive terms was hired to manage the firm's operations, as the executive (interviewee) was busy with other businesses. However, when the researcher asked the interviewee about the contribution of the consultant, he could not detail the consultant's contribution to the firm capabilities or competitiveness. Thus, apparently the second CDI was taken by executive without thinking out its aim and objectives.

Third CDI: The firm started receiving quality complaints from the customers about its motorbike garments. Therefore he hired, on lucrative terms, a ⁷worker from the local leather cluster to remove quality issues in the motorbike garments. Again, this CDI is a reaction to customers' feedback.

In the above CDIs, problems arise not due to technology (machines) per se, but the lack of artisans (workforce) with the required level of skills in the firm. As per the executive's narrative, to troubleshoot the problems, workforce with required skills is hired from the cluster. Further, the executive of firm D remarks that information about technology/ machines required for different jobs is more or less available in the cluster.

⁷ The interviewee said that this worker having more than 10 years of leather garment manufacturing experience was hired from firm A.

*CDI	Learning and knowledge capability displayed (Amara et al., 2008)		TC required/ displayed in the CDI (Lall ,1992)	Types of upgrading as result of CDI (Humphrey and Schmitz, 2002)	Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-3)	Firm categorisation
Removing defects in saddle bag manufacturing	• Learning by interacting	Know-how	• Acquisition level	• Process upgrading	Minor	<ul style="list-style-type: none"> • Firm executive mentioned that he is losing orders because of quality problems • Executive is not able to proceed abroad to exhibition s for lack of financial resources • New firm premises is poorly equipped • Therefore, firm is categorise d to have poor financial resources 	Since all the firm CDIs have been reactive , no CDIs-business strategy alignment , plus firm is showing poor financial health, therefore the firm is classified as a reactor .
Hiring a foreign consultant	Learning by training	Know-how	• Acquisition level	• Firm executive failed to mention any contribution	Major		
Removing defects in motorbike garments	• Learning by interaction	Know-how	• Intermediate process capability with respect to the cluster capability • Acquisition level	• Process upgrading	Minor		
Construction of new factory premises	• Learning by interaction	Know-how	• Acquisition level	• Operational	Major		
*CDIs are assessed with respect to their existing cluster capabilities							

Table 6-6: CDIs analysis for TIC level of firm C

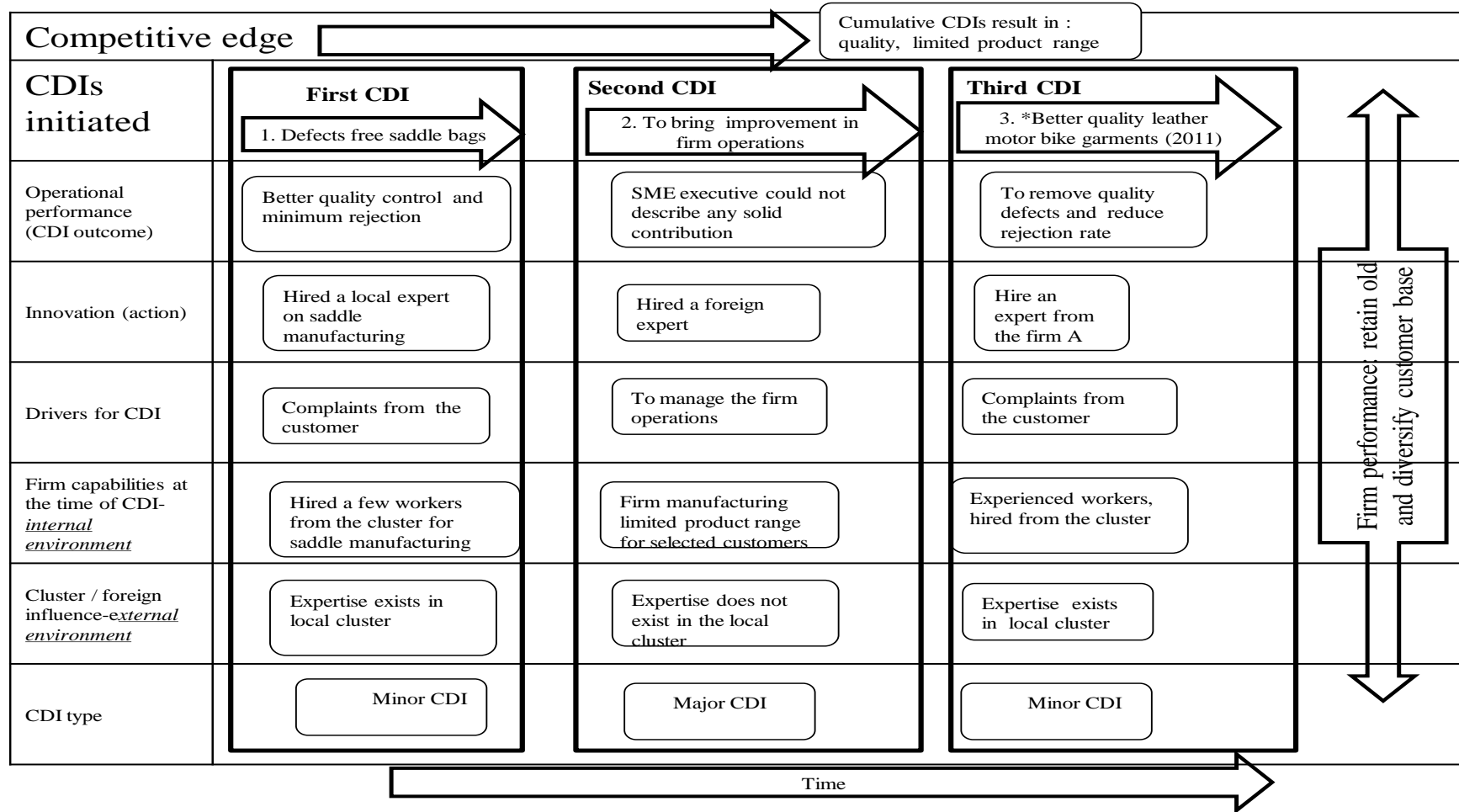
The history of CDIs in the firm shows that all its initiatives were reactive measures i.e. only when there were problems, the interviewee did try to address them. Further, generally the CDIs relate to the basic production/ operations category (Lall, 1992).Therefore, based upon the CDIs taken, which have been drawn from the cluster, and the firm’s apparent narrow resources and poor financial performance , the firm has been categorised as a reactor firm, as show Table 6-6.

6.3.4.5 A macro view-time line of CDIs adding to firm’s technological competitiveness

Figure 6-5 shows the time line for the firm. While both of firms A and B define competitive cost and quality as their competitive advantage and have increased their product range, firm C seems to be presently beset with quality problems due to which it’s losing its customer’s confidence. From the different firm initiatives it seems that it wants to grow, become competitive, but does not have a strategy to achieve its ambitions. The executive has a business degree but it seems that the firm does not have a long term business competitive strategy to which CDIs should be aligned. All the CDIs have been reactive; the firm has concentrated on single customer; firm did not invest back in the business and did not attend international exhibitions to observe international trends.

Also, apparently, the firm does not give any training to its employees but hires experienced workers from other competitor firms. In one of its CDIs, it has hired an experienced worker

from firm A on better wages. This action of the firm gives credence to two things. First, the inter-firm workforce is responsible for dissemination of new knowledge in the cluster. Second, firm A disseminated new expertise in the leather goods cluster by employing foreign consultants, as also claimed by the interviewee of firm A.



* At the time of interview, this initiative was being implemented

Figure 6-5: Timeline for firm C

6.3.4.6 Interviewee's comments/ recommendations for firm/ cluster competitiveness

At the time of interview, the executive also held the position of President of the local chapter of PLGEMA. Therefore, he also spoke of the general problems faced by the leather industry of Sialkot. He complained of a lack of supporting infrastructure for the competitiveness of leather goods sector. He explained that weak micro firms could not provide quality input to medium size exporting firms. Further, there was issue of expensive import of raw materials for leather garments, which could be manufactured within the country given the right incentives by the government. The import of accessories for leather garments such as zips, buttons is also mentioned by firm D executive. The views expressed by the interviewee, the President of PLGEMA (the Sialkot chapter), supports the general obstructions faced by SME clusters of Sialkot, as discussed in various recent UNIDO and TRTA reports (Zaidi, 2006, TRTA, 2014b).

The executive also spoke of effects of reliance of Sialkot cluster firms on customers as: *'Being too dependent upon customers' input. It is harmful as the firms become used to spoon feeding and do not do any of their own R&D, market research with the result that if customer finds any item cheaper in China, India, Bangladesh, the customer switches over there.'* Further, the interviewee also pointed out that firms are not directly selling into the markets therefore their products do not fetch the desired prices. Finally, the firm executive added that the local leather cluster is not doing much of value-addition, while China and India import leather from abroad and with a better educated workforce, do superior value addition. The interviewee finally recommended indigenising designing and pattern making facilities, which are presently being done by the customers for better value addition and competitiveness. This very recommendation of the executive is aligned to the notion of increasing the technological content of existing TCs or acquiring new TCs for process and/or product upgrading as recommended by researchers (Kadarusman and Nadvi, 2013).

6.3.5 Firm D

6.3.5.1 Interview details

This was the researcher's first interview. The interviewee was also previously involved with football manufacturing and marketing, and gave a detailed background on the history of different clusters in Sialkot. This introduction helped the researcher to update and corroborate his previous research on the Sialkot clusters. The interviewee is presently more involved in advocating the interests of Sialkot clusters at different forums such as writing in local newspapers, SCCI newsletter and giving TV interviews.

6.3.5.2 Shop floor visit

The shop floor visit showed neat and clean premises. There were separate rooms clearly marked for various operations such as inventory management, dying, stitching, quality control, and packaging operations. The researcher inspected the machines for their make and found them to be of Japanese origin. There were quality checks at critical stages. When researcher asked how the inspection stages were developed, interviewee replied that these checks and stages were developed and improved through experience and customers feedback.

6.3.5.3 Firm characteristics

Firm D originally started as football manufacturer in 1904 but officially became a group of companies in 1961. The group of companies consist of three firms:

- i. A leather goods manufacturing firm which mostly manufactures motorbike garments and gloves.
- ii. A sports good manufacturing firm which mostly manufactures different types of balls such as basket balls, footballs.
- iii. A sportswear manufacturing firm which mostly manufactures martial arts uniform, school uniforms, boxing gear.

It's a family run business, and different family members run different companies. One of the family members has been the president of SCCI. The interviewee heads the leather goods manufacturing firm which exports mostly to Europe.

For firms' competitive edge, the interviewee replied that firm D has selected satisfied customers with whom the firm has developed a strong reputation for quality, order flexibility and on-time delivery. The interviewee informed that each of the three firms has 50-60 employees and remarked: '*The firm has a limited product portfolio and production capacity.*' It sub-contracts some of its manufacturing activities outside the firm to reduce overheads. The interviewee

clearly specified that: *'The firm does not accept orders beyond its production capacity, so as not to affect product quality.'* He traced this business principle to his father, who always refused orders beyond the operational capability of the firm. For measuring firm performance, interviewee replied: *'Through revenues earned.'* Thus, apparently, instead of increasing/ investing in product portfolio, functional upgrading or process or product upgrading, the firm is diversifying into different profitable businesses on a limited scale. The firm's business strategy is also supported from the interviewee's comment: *'Recently sportswear manufacturing has become a big business in Sialkot'* and the firm's corresponding movement in the sportswear manufacturing business.

The interviewee claimed that they consistently use profits to invest back in the firm's infrastructure. The interviewee stated that they use the latest machinery from Japan, which is the best on the market. About the information about technology/ machinery selection, the interviewee said that there is always enough information available in the local market (cluster) regarding the best machines available. When asked what makes a firm more competitive than its local competition, the interviewee replied: *'Leadership difference and vision.'* Further when asked from the interviewee: what are the competitive factors among the local competitors? The interviewee replied: *'A healthy competition exists among the local competitors to achieve better quality, have better machines and employ experienced labour.'*

CDIs: The interviewee did not mention any specific CDI, and repeatedly identified feedback from customers as its main source of incrementally improving processes and products. The interviewee remarked: *'Customers are the one who drive the change. They bring new ideas, new products to be developed, give feedback on the products produced and how to improve the quality.'*

Since the firm relies heavily on the cluster capabilities to run its operations, it is targeting only small time buyers; selectively tries to capitalise on any new opportunity in the Sialkot clusters; and has not contributed to its or the cluster's technological upgrading, therefore the firm is categorised as opportunistic/ reactor. However, financially the firm seems to be in good health, as the interviewee as asked about future firm prospects, he replied: *'I am looking towards growth and profits.'*

6.3.5.4 Interviewee's comments/ recommendations for firm/ cluster competitiveness

Regarding raw materials for leather garments manufacturing, the interviewee remarked: *'Accessories for the leather garments such as buttons and zips are imported.'* This remark validates the CE of firm C's remarks that accessories need to be imported. The interviewee was worried about the socio-economic conditions of the country which might affect their business.

Presently, Pakistan is presently facing acute power shortages which has affected production output of the industry (Ahmad, 2013c, Ahmad, 2013e).

Further, machine stitched footballs have become a big business in the international market as admitted by the interviewee: *'The machine stitched balls market has surpassed hand stitched balls market.'* But the interviewee was more focused on the achievements of hand stitched football in the international arena, which might represent the inertia present in firms/ industries for accepting and acquiring new technologies. Also the interviewee remarked that: *'China and other countries which are leaders in machine stitched footballs are slowly losing their competitiveness during to their rising costs.'* This remark is another indicator that the firm/ cluster emphasis is on cost competitiveness and not competing on technology acquisition/ assimilation for improved products.

6.4 Cluster level (inter-firm) analysis: firms A to D in the leather goods cluster

The aim of this section, as mentioned in the introduction section, is to cross-compare the case study reports of four interviewed leather firms in the light of SME cluster literature review conducted in chapter 2 and chapter 3 to identify the strengths and weaknesses of the researched firms. These findings are again compared with other cluster findings in chapter 7 to give suggestions for TCs upgrading and competitiveness of the interviewed firms and their clusters—the research aim.

Table 6-7 presents the business strategies and technology strategy (TS) and the interviewed firms, as drawn from interview time lines, observational checklist, and technical and policy reports on Sialkot clusters. The business strategy represents the markets targeted and competitive edge of the firms, while capabilities, types of CDIs and sources of these CDIs represent TS. The leather firms' data analysis show that they generally have production capabilities, but have neither upgraded their existing production TCs nor incorporated new TCs along their existing value-chain for tapping better value-added markets.

	Firm characteristics	Firm A	Firm B	Firm C	Firm D
Business strategy	Export markets	Low-end market segment in USA, Europe	Low-end market segment in Canada, Japan, Europe	Low-end market segment in Europe	Low-end market segment in Europe
	Competitive edge	Bulk volume handling capacity, large product breadth, brand name in USA	Small to medium volume orders, considerable product range, brand name in Canada	Small volume orders, limited product range, diversified business	Small volume orders, limited product range
	Technology strategy	Leader, operating at a level where local competitors cannot match in capacity	Follower, developing capacity for selective medium to small order volume products	Reactor, limited volume capacity for limited product range	Reactor, limited volume capacity for limited product range. However, firm has diversified into other different businesses
Technology strategy	Capabilities and resources	learning by training and R&D capabilities, large tannery, strong market scanning skills, trained HR, IT skills, worker friendly policies	Learning by interaction, modest tannery, IT skills, marketing skills,	Learning by interaction, Second-hand machinery for firm operations	Learning by interaction, latest machinery for stitching and other firm operations
	Types of CDIs introduced	Vertical integration, foreign expertise hire, process improvement,	Limited vertical integration, assimilating new products introduced in the local cluster	Efforts for process improvement to remove increasing customer complaints	Incremental process improvement for better product quality
	Source of input for CDIs	Foreign trainers, international expositions, local clusters	Customers, local cluster	Customers, local cluster	Customers, local cluster

Table 6-7: Characteristics of the interviewed leather goods firms. Source (From interviews, shop floor visits, firm brochures, firms websites and SCCI website and Table 6-2)

6.4.1.1 Interviewed firms' competitive characteristics

Interviewed SMEs A, B, C and D described cost competitiveness, flexibility with order quantity, quality and close customer interaction as part of their competitive edge, as shown in Table 6-7 which are similar to those mentioned in the literature review on SMEs (Nadvi and Halder, 2005, Singh and Mahmood, 2014), and technical and policy documents on the Sialkot cluster (Pakistan, 2012).

Looking at the strategies of firms A, B and D (Table 6-7), it can be discerned that they target a specific market and customer segment and develop capabilities accordingly. These firms identified and targeted different customer segments in the same low-valued market and have developed/ scaled technological capabilities accordingly.

Another important aspect of the findings is that both leader and follower firms are trying for functional integration i.e. they are setting up leather tanneries and develop their own brand name, a trend also mentioned in the literature for greater value appropriation (Baines et al., 2005).

The alignment between strategy and capabilities acquired has been supported as an important element in the sustained performance of manufacturing SMEs (O'Regan and Ghobadian, 2006). Leader and follower interviewed firms show an alignment between their business and TS because CDIs introduced added to firms' value appropriation and competitiveness (Table 6-7). However, firm C fails to show such alignment i.e. successive CDIs have failed to develop any firm specific technological competitive edge.

6.4.1.2 Analysis of CDIs introduced and resulting TCs upgrading in the interviewed leather firms

Looking upon the CDIs in the interviewed leather goods firms, most of the radical CDIs have been about operational process improvements resulting in productivity and improved product quality, in cooperation with customers. Leader and follower firms have also done some functional integration. These CDIs are an indirect reflection of the Pakistan's industry's emphasis on collective efficiency with scant attention paid to upgrade the technological capabilities for better value-added products (Nadvi and Halder, 2005, Correspondent, 2010, Pakistan, 2012).

As per Lall's categorisation (1992), the CDIs introduced by the firms are of basic production nature for daily operations of a firm, thus are at acquisition TIC level. For better value-added processes and products a firm has to develop intermediate/ advanced TCs in investment, production and linkage capabilities. Therefore, those efforts and CDIs should be promoted

which increase the complexity of TCs for better value-added processes and products for sustained competitiveness, as also envisaged in the Government of Pakistan's recent technological policy (Pakistan, 2012).

6.4.1.3 Local cluster and other regional clusters' TCs effect on the interviewed firms TCs upgrading

Drawing upon the cluster capabilities and infrastructure, evident from individual firms' time lines, firms A, B and D have developed and improved operational capabilities such as volume flexibility, low production cost, delivery speed and dependability. Firm C hired an experienced employee of firm A, showing that the cluster acts as a tool of expertise dissemination, also mentioned in the literature (Nadvi and Halder, 2005). For vertical integration, the firms have tapped into other regional clusters for transfer of expertise i.e. installation of leather tanneries. Thus, the interviewed SMEs are exploiting their opportunities available in their respective cluster, as also mentioned in cluster literature on SMEs (Bulak and Turkyilmaz, 2014).

6.4.1.4 Role of government and different institutions in TCs upgrading of the interviewed firms

The support provided by development agencies and government institutions play an important part in firm and cluster competitiveness through new knowledge generation, as recognised in the literature (Ismail et al., 2011). The cooperation of development agencies with the interviewed firms is more on improving productivity, quality assurance, market access and international accreditations, as mentioned in policy reports on clusters (Pakistan, 2012) and apparent from interviewees' recommendations. However, the interview data did not show any active collaboration between interviewed firms and development agencies (SMEDA, TUSDEC) in TCs upgrading for better value-added products.

6.4.1.5 Recommendations of interviewees for increasing interviewed firms'/ cluster performance

Most of the firms mentioned sub-contracting non-critical work to micro firms in the cluster. As per firm C executive, the capabilities of micro firms need to be improved for achieving consistent quality in their operations to support the operations of larger firms in the cluster. The executives of firms B, C and D talked about the prevailing socio-economic conditions in Pakistan which affect business growth. Similar concerns have been recorded by other researchers while researching export-oriented firms in Pakistan. In their paper Bhutta et al. (2007) found that export-oriented firms main concern were the provision of local infrastructure, and maintenance of law and order so that a positive image of the country is projected abroad,

which would help to attract more customers. Thus, it can be seen that instead of promoting TCs which underpin firm's competitiveness, the emphasis of interviewees is on improving production efficiency, attracting new customers and finding new markets, which is as per the academic literature not a recipe for long term, sustained growth and competitiveness (Pietrobelli and Rabellotti, 2011).

6.5 Firm level analysis: Firms E to H in the sports goods cluster

6.5.1 General sports cluster characteristics

General products manufactured: As discussed in section 5.5.2, the sports goods cluster traditionally manufactures different types of footballs, hockey sticks and racquets, and the cluster is more than 100 years old. International customers used to buy sports goods from Sialkot and sportswear from South Korea, Taiwan and Turkey. Recently, the international customers asked local exporters to produce sportswear as well, which helped international buyers in reducing their sourcing overheads (Dasanayaka and Sardana, 2010a).

General capabilities of the sports cluster: Football manufacturing firms try to incorporate specifications in their products as such those of international regulatory bodies like FIFA. The majority of the footballs made in Sialkot are hand stitched and are usually for the low to medium end ⁸market. In the 1998 football World Cup, footballs from Sialkot were used. Again in the recent World Cup football extravaganza held in Brazil, footballs were exported from Sialkot (Ranjha, 2014, UNIDO, 2014b). However, the general trend in the world market has shifted to machine stitched footballs, but Sialkot has yet to follow the trend. Only recently, a facility has been developed in Sialkot through public-private partnership with the aim to disseminate expertise to the local cluster for machine stitched footballs. It's a 50-50 percent partnership between Government of Pakistan (GOP) and Sialkot Chamber of Commerce and Industry (SCCI), and will be managed by SCCI. Most of the balls manufactured in Sialkot are used at club or league ⁹level in Europe.

The general characteristics of interviewed firms as derived from brochures, firm websites and the SCCI website are show in Table 6-8. The interviewed firms have been in business for more than 20 years, and all are manufacturing and exporting firms. The firms are generally manufacturing balls of various types such as footballs, volleyballs, handballs along with sportswear. Further, most of the firms are at arm's length relationship with their customers which indicate a mature market (Humphrey and Schmitz, 2002).

⁸ Mentioned by SMEDA representative, Sialkot, and reiterated by the interviewee of the firm G

⁹ Mentioned by interviewees of firms E and G

Firm	Established in	Product Range	Noticeable characteristics	Hierarchical relationship with customers Humphrey and Schmitz (2002)
E	1951	<ul style="list-style-type: none"> • Footballs, volleyballs, handballs • Sportswear • Hockey sticks • Cricket accessories 	<ul style="list-style-type: none"> • Executive has twice been the President of SCCI 	<ul style="list-style-type: none"> • Arms length • Semi-hierarchical
F		<ul style="list-style-type: none"> • Footballs, volleyballs, handballs • Sportswear 	<ul style="list-style-type: none"> • Executive has been the President of SCCI • Manufacturing unit in Uzbekistan • Manufacturing machine stitched footballs • Environment friendly accreditations 	Arms length
G	1975	<ul style="list-style-type: none"> • Footballs, volleyballs, handballs • Sportswear 	<ul style="list-style-type: none"> • Executive has been the President of SCCI • Executive is actively involved in SDIC affairs 	Arms length
H	1996	Garments and Sportswear	<ul style="list-style-type: none"> • Manufacturing unit in Lesotho • Diversified into different businesses 	Arms length

Table 6-8: Interviewed sports goods firms' general characteristics. Source (From interviews, shop floor visits, firm brochures, firms websites and SCCI website)

Mostly Chief executives of the firms were interviewed, who were also requested to facilitate a shop floor visit. The interviews, which took place in the offices of the chief executives, along with shop floor visit helped to fill the observational frame work (Table 6-9). The observational framework for firms E, F, G and H is used to categorise the interviewed firms as leader, follower or reactor.

The case studies of four interviewed firms are discussed in this section. In each case study, first, the general characteristics of each firm are described; next individual CDIs accumulated over period of firm's existence are analysed to understand TICs of the firm and then CDIs are mapped on a time line to understand their inter-linkage. Finally, each interviewee's recommendations for increasing firm/ cluster competitiveness is discussed.

	<u>Observations</u>	<u>Firm E</u> (Firm premises visited)	<u>Firm F</u> (Firm premises visited)	<u>Firm G</u> (shop floor visited)	<u>Firm H</u> (Firm premises visited)
Layout of the shop floor	*Is the shop floor properly lit?	Not Known	Not Known	Yes	Yes
	Are the work instructions/ SOPs prominently displayed?	Not Known	Yes	Yes	Yes
	Are safety signs properly displayed and emergency exits defined?	Yes	Yes	Yes	Yes
	Are fire extinguishers provided and working?	Yes	Yes	Yes	Yes
	Is the work place airy and well ventilated?	Not Known	Not known	Yes	Yes
	Is the shop floor is cleaned such as free from oil, grease	Not Known	Not Known	Yes	Yes
Facilities provided to the workforce	Is Air conditioning provided to the workforce?	Not Known	Not Known	No	Yes
	Are medical/ housing facilities provided to the workforce?	Yes	Yes	Not mentioned	Not mentioned
	Are the families of work force facilitated in any way such as providing education scholarships, recreational trips?	Yes	Not mentioned	Not mentioned	Not mentioned
Machines	Make of the machines such as Japanese, Korean	Not mentioned	Not mentioned	Japanese	Not mentioned
	Conditions of the machines such as newly purchased or second hand	Not mentioned	Not mentioned	New	New
	Maintenance of the machines such as if they are properly cleaned?	Not mentioned	Not mentioned	Maintained	Maintained
Firm characteristics	Does the firm has international accreditations? (from websites, brochures, executive's room)	Yes	Yes	Yes	Yes
	Is the firm manufacturing for customers?	Yes	Yes	Yes	Yes
	Has the firm its own brand name?	Yes	Yes	No	No
	Is the firm marketing directly into the markets?	Yes	No	No	No
	If any multinational is regular customer of the interviewed firm	Yes	Yes	Yes	Not mentioned

Table 6-9: Observational checklist for sports goods cluster interviewed firms

6.5.2 Firm E

6.5.2.1 Interview details

The interview was conducted with the firm's executive in his office, which was located in a spacious building. The executive had a secretary who ushered the author into executive's room. On the office walls various international accreditations won by the firm were displayed. The firm is run by the executive along with his brother, who was abroad at the time of interview to attend an international exhibition. The interviewee has twice been the president of local chamber of commerce and industry, and his office was decorated with the photographs of various high level government dignitaries (former presidents and prime ministers of Pakistan) whom he had met.

6.5.2.2 Shop floor visit

A visit to the firm's offices showed a well-developed IT network, various sections dealing with finance, marketing, purchasing. All the corridors were neat, clean and well lit. The aforementioned observations helped to fill the observational checklist Table 4-7. The firm's brochures were received at the end of the interview. This case study report was prepared using interview details along with information from firm brochures and firm's website.

6.5.2.3 Firm characteristics

The interviewee is the executive of the firm, and describes the business strategy of the firm as: *'To exploit the potential of Sialkot to its maximum.'* The firm is an original equipment manufacturer (OEM) for an international sports goods company and manufactures for different international customers as well. The firm exports 100% of its manufactured products to North America, UK and Europe. On the firm's strength, the executive replied: *'We are dealing with selected customers, not large number of customers. They bring their market studies and give us world trends. They concentrate on marketing and we work on product development.'*

When the executive was asked for the tools used for scanning and selecting technology, he replied: *'First, all latest information is available on the internet. Second, Sialkot people travel abroad a lot; in all exhibitions we are present. Even now my elder brother is in Germany for an exhibition.'* The firm executive also mentioned that recently sportswear is a big field and *'There is a huge potential in sportswear.'* The executive's comments are similar to firm D's executive comment, which has moved into the sportswear business owing to the profits involved.

6.5.2.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the level of TICs accumulated and resultant process and product upgrading achieved by the firm (Table 6-10). The CDIs discussed below have been mentioned in the firm's brochures given to the researcher, and the products are also mentioned on the firm's website.

First CDI: The firm initially was manufacturing wooden field hockey sticks for the lower market segment at international level. Thus, it had initial expertise on the basis of which it contacted an international hockey manufacturer to become their original equipment manufacturer (OEM). With the help of transfer of expertise from the customer, the firm started manufacturing hockey sticks for the customer in 1964. This CDI is a demonstration of having a 'learning by interacting' and 'learning by training' capabilities which the firm successfully used to upgrade its processes (Amara et al., 2008, Yam et al., 2011, Rush et al., 2013). The firm is presently manufacturing ice hockey sticks as well. This journey from field hockey to ice hockey reflects the technological upgrading which has resulted in it increasing hockey sticks product range. However, ice hockey sticks were still being improved at the time of ¹⁰interview.

Second CDI: Next, the owner visited Germany in 1966, saw pre-stretched leather technology used in the football industry and introduced it back into his firm, which was the first such initiative in the local sports goods ¹¹, cluster as claimed by the interviewee. This CDI-'learning by interaction', resulted in a product which stayed as a symbol of quality for decades as per the interviewee.

Third CDI: Next, the firm in cooperation with its customer in a Scandinavian country started producing artificial leather footballs, another first in the local sports goods cluster as per the ¹²interviewee. This CDI is an instance of 'learning by training'.

Fourth CDI: In 1983, the firm started manufacturing moulded and stitched protective gear for various sports for international customers. This was at the time when international companies such as Adidas, Puma were shifting their sportswear purchase from South Korea, Turkey and other countries to Pakistan (Dasanayaka and Sardana, 2010a). The existing protective gear expertise helped it to start manufacturing hockey and associated gear for an international

¹⁰ During the interview, there was a discussion of the interviewee with his team for improving the ice hockey sticks.

¹¹ As claimed by the interviewee.

¹² The interviewee gave the researcher a booklet commemorating the firm's Jubilee celebrations. The booklet enumerates all the firm's accomplishments (CDIs).

hockey manufacturer in 1985. This CDI is an instance of absorbing available expertise-learning by interaction, in the cluster to start a new product line.

Fifth CDI: Lately, the firm has setup a garment manufacturing unit (1991) and a rubber unit to meet its in-house demands. As per the interviewee, the expertise for garment and rubber units has been drawn from nearby geographical clusters of Lahore, which along with Faisalabad is the hub of the textile industry in Pakistan (TRTA, 2014b). The firm's assimilation of a rubber unit from another regional cluster is an instance of inter-cluster cooperation.

Corporate Social Responsibilities: Firm brochures extensively mentioned the welfare schemes initiated for the firm's workers. There are photographs of long time workers with firm's senior management in the brochures, which researcher also saw displayed in the firm premises. Honouring of long serving workers is an indication that firm has a core work force. This observation helped to fill the Table 4-7 for the firm.

CDI (Cohen and Levinthal, 1990)	Learning and knowledge capabilities (Amara et al., 2008)		Level of TICs required/ displayed in the CDI (Lall, 1992)	Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-9)	Firm categorisation
Transfer of hockey manufacturing technology to firm from client	• Learning by training	Know-how	• Acquisition level	• Process improvement for new product line	Radical since the firm is first to hire foreign consultants in the local cluster	<ul style="list-style-type: none"> • Firm has broad product range • Firm has vertical integration • Firm has numerous foreign clients • Firm visibly spends on CSRs 	Since the firm has demonstrated radical and major CDIs, CDIs-business strategy alignment , and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm.
Pre-stretched leather football manufacturing	• Learning by interaction	Know-how	• n level	• Process improvement for new product line	Radical since the firm is first to manufacture them in the local cluster		
Artificial leather football manufacturing	• Learning by training	Know-how	• Acquisition level	• Process improvement for new product line	Radical since the firm is first to manufacture in the cluster		
Sports wear manufacturing	• learning by interacting	Know-how	• Acquisition level	• Diversification to sportswear	Major		
Vertical integration	Learning by interaction	Know-how	• Acquisition level	• Functional integration	Radical CDI, since it involves developing market skills abroad (USA)		
*CDIs in the firm are assessed with respect to their respective cluster capabilities							

Table 6-10: CDIs analysis for TIC level of firm E

Keeping in view the firm's large product range, vertical integration, long-term relationships with external customers and well established offices, and CDIs introduced which are either radical or major (Table 6-10), the firm is classified as a leader firm. The interviewee claims: *'We were first to introduce certain CDIs'*, therefore it is assumed that with time these capabilities disseminated in the cluster.

6.5.2.5 A macro view-time line, of CDIs adding to firm's technological competitiveness

The timeline consisting of CDIs which helped the firm achieve its present competitive edge is shown in the Figure 6-6. The Y-axis represents capabilities development initiative's (CDI) elements. The X-axis describes CDIs i.e. how each new CDI added to the existing capabilities and competitive edge of the firm. The time line shows the firm's implementation of strategy into action through CDIs. The interviewee stated the firm's strategy was to exploit Sialkot's potential to the maximum. The firm has done so by manufacturing all the sports items and accessories whose expertise existed in the cluster.

The firm increased the skill and knowledge of its process capabilities through its customers' feedback (learning by interacting/ training capability). Upgrading the existing process technological capabilities helped the firm to move from low-value added market to medium value-added market, resulting in new markets and customers, as also supported in the literature (Oyelaran-Oyeyinka and Lal, 2006, Morrison et al., 2008, Kadarusman and Nadvi, 2013). The CDI of producing ice hockey sticks is an instance of improving upon the existing firm capabilities to diversify product range and enter new markets. In all of the CDI instances, the firm had an initial innovative capability, which was further exploited with customers/ market input.

Thus, the firm displays an alignment between the firm's strategy and its competitive priorities and capabilities, which has been supported in the literature for better firm performance (O'Regan and Ghobadian, 2004, Shavarini et al., 2013). The time line shows that CDIs have been about process and product improvement, new product introduction and vertical integration, which have resulted in a diverse product portfolio and new markets and customers. However, the CDIs do not show any government support or inter-firm collaboration.

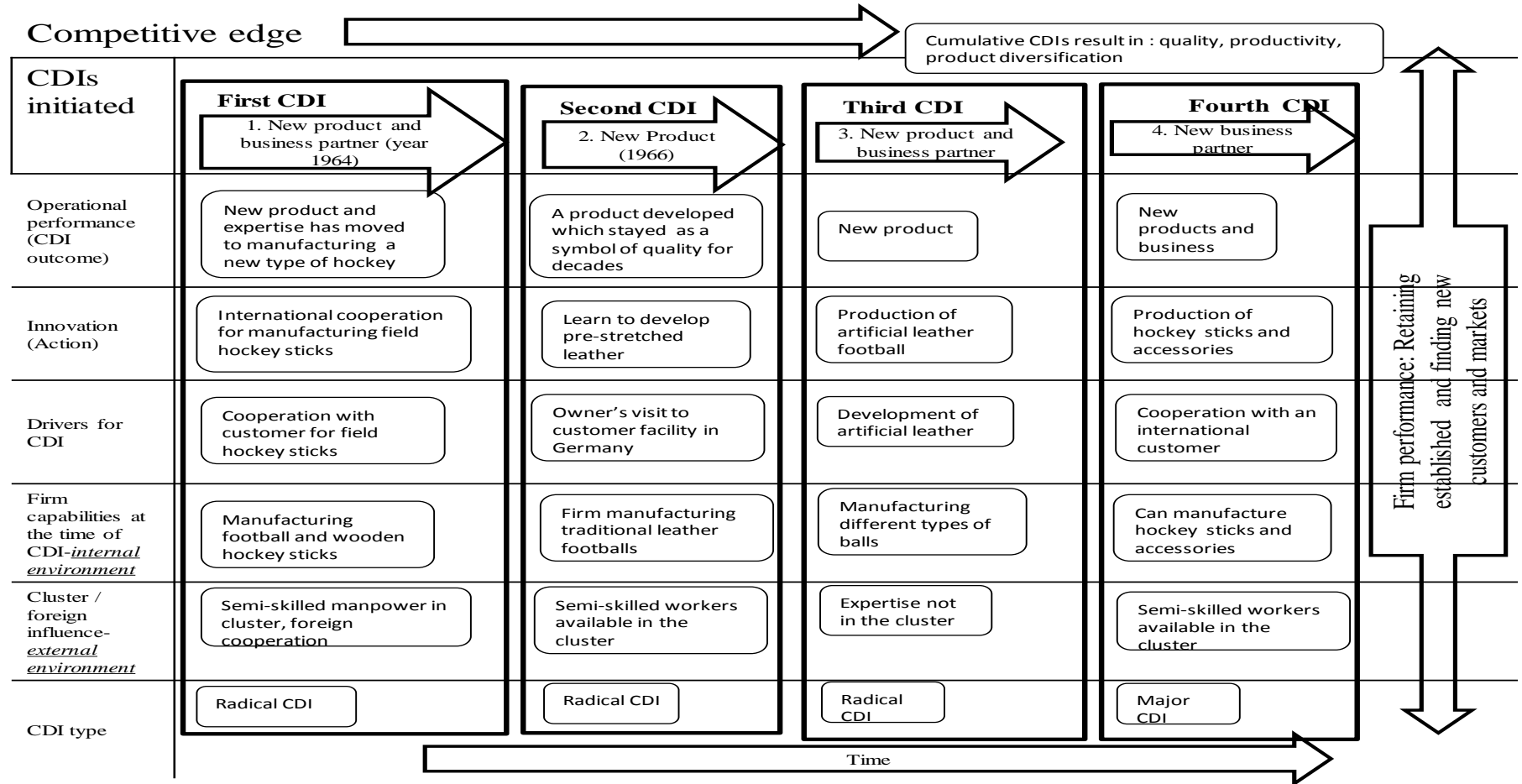


Figure 6-6: Time line for firm E

6.5.2.6 Interviewee comments/ recommendations for firm / cluster competitiveness

Similar to the comments of the executive of firm C, firm E's interviewee remarked: '***We source performance fabrics from different countries. Pakistan is trying to develop them but there is not much government support, thus making products more costly.***' He appreciates the importance of SMEs links with academia and spoke of the Chamber's links with a few universities. However, he did not mention his own firm's links with academia. Similarly, regarding role of academia in the industry's competitiveness, he commented: '***We have approached universities as they have expensive machines but they are working in isolation with no connection whatsoever with the industry.***' The Firm interviewee mentioned drawing upon the cluster for semi-skilled workforce, supply of raw materials. With regard to the capability of work force, the interviewee replied: '***Our workforce is illiterate but very quick to learn. We call foreign experts to train our workforce.***'

6.5.3 Firm F

6.5.3.1 Interview details

The interview was held with the chief executive of the firm. The researcher explained the purpose of his visit to which interviewee replied: *'I will give you my feedback, which will be especially on my firm and will also be about general Sialkot industry.'* Therefore, the interview was more of a monologue with the researcher asking for further explanations where required.

6.5.3.2 Shop floor visit

The researcher observed that the firm had a good infrastructure: sprawling premises with neatly trimmed lawns, a welfare shop for the workers, properly displayed health and safety instructions, fire extinguishers installed in well-lit corridors and freshly painted buildings, which helped to fill the Table 4-7 for the firm. Fire extinguishers were inspected by the researcher and it was found they were duly checked and renewed. In this research the infrastructural observations are taken by the researcher as an indirect representation of the firm's current good financial health (Yin, 2003).

After the interview, firm brochures were provided to the researcher which helped to corroborate the research data. The firm's website was also checked for the details mentioned in the interview.

6.5.3.3 Firm characteristics

Firm F is specifically targeting Scandinavian countries, where customers are conscious about the environment and manufacturing practices. It manufactures different types of balls and sportswear, and considers itself to be a leader within the cluster. For survival, the interviewee believes that diversification is the key: *'Every industry should have the capacity to diversify. If diversification is not there, factories will be closed. In 1998, keeping diversification in view, we went into manufacturing sports garments such as shoes, jackets, shirts.'*

On the firm's competitiveness, interviewee said: *'High performing Sialkot firms since 2000 have been putting emphasis on Corporate Social Responsibilities (CSRs).'* He went on to say: *'Quality consciousness and sustainability of quality and productivity is another factor along with CSRs in a firm's competitiveness in Sialkot. And his firm has both.'* As per interviewee, an emphasis on CSRs has helped the firm to retain the skilled workforce.

When asked about firm performance, the interviewee replied: *'Sale is the ultimate indicator that you (the firm) have grown. Growth should be in money as well as firm image as a*

responsible firm.' Also, the firm attends international expositions to stay abreast of ¹³opportunities.

6.5.3.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the types of TICs accumulated and resultant process and product upgrading achieved by the firm (Table 6-11).

First CDI: The firm claims that it was the first to win ¹⁴ 'Fair trade certification' in Sialkot in 1998 along with several other international accreditations. Thus, the firm demonstrates a capacity to acquire the international accreditations required to penetrate the targeted market.

Second CDI: It is among the few firms which manufacture machine stitched footballs in the local sports goods cluster through expertise transferred from abroad, demonstrating a 'learning by training' capability.

Third CDI: It also claims to be the only firm to manufacture sports shoes in the ¹⁵ sports goods cluster through international cooperation, although the source of the expertise was not divulged. This CDI is an instance of 'learning by training'.

Fourth CDI: It has an office/ production facility in Uzbekistan setup in 2008, which shows resource availability with the firm. The firm brochure specifically mentions the production facility in Uzbekistan and contains its pictures.

Fifth CDI: The firm has also recently installed an effluent treatment plant for its garment dyeing operations, the expertise of which has been acquired from outside the cluster. This claim is also made in firm's brochure.

As per the interviewee, the firm has spent considerable time and resources in gaining various international accreditations and developing the firm's structure and resources to present an image of environment and worker friendly firm. As per the interviewee: *'Since benefits started coming to the workers, their commitment to the firm increased and our quality increased.'* The interviewee reported increased product quality, productivity and worker loyalty, when the firm environment was made more workers friendly. Thus, the firm experimented with changing

¹³ At the time of interview, one of the firm's executive was on a foreign tour to attend an international exhibition and meet customers.

¹⁴ The Fair Trade Certification claim was chalked on the entrance gate of the firm and also mentioned in firm brochures.

¹⁵ No other interviewed firm claimed to manufacture sports shoes, although firm G plans to invest in sports shoes manufacturing.

its work culture, which resulted in positive results. When asked if a competitor can gain these accreditations, the interviewee replied: *'Let's see who spends the money.'*

CDI (Cohen and Levinthal, 1990)	Learning and knowledge capabilities (Amara et al., 2008)		Level of TICs required/ displayed in the CDI (Lall, 1992)	Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-9)	Firm categorisation
Fair trade certification accreditation	• Learning by training	Know-how	• Acquisition level	• Process upgrading	Radical since the firm claims to be the first to achieve it	<ul style="list-style-type: none"> • As per interviewee, firm has spent enormous resources to acquire certifications and accreditations and implement shop floor plan to develop an 'Employee friendly' image • Firm has set up an international manufacturing plant 	Since the firm has demonstrated radical and major CDIs, and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm.
Machine stitched footballs manufacturing	• Learning by training	Know-how	• Acquisition level	• Process upgrading	Major, since only few firms are manufacturing it through foreign training		
Sports shoes	• Learning by training	Know-how	• Acquisition level	• Process upgrading	Radical since no other firm is manufacturing it		
Manufacturing facility in Uzbekistan	• Learning by doing	Know-how	• Acquisition level	• Operations management	Radical		
Effluent treatment plant	Learning by interaction/ training	Know-how	• Acquisition level	• Functional integration	Radical CDI, since they are among the few in the cluster which have this capability		
*CDIs are assessed with respect to their existing cluster capabilities							

Table 6-11: CDIs analysis for TIC level of firm F

The firm has taken steps to differentiate it from local competitors by developing an environment and worker friendly image. The acquisition of various accreditations should be continuously renewed, thus requiring continuous resource and investment commitment. The interviewee said: *'The implementation of CSRs lead to increased expenditures.'* The CDIs have resulted in basic process capabilities upgrading of the firm as shown in Table 6-11. Since all the CDIs introduced are either radical or major to the sports goods cluster and the firm has strong resources, it is classified as a leader firm (Table 6-11).

6.5.3.5 A macro view-time line, of CDIs adding to firm's technological competitiveness

The time line (Figure 6-7) shows various CDIs taken by the firm to implement its competitive strategy of targeting environment friendly customers in Scandinavian countries. The researcher was not properly able to ascertain the chronological order of second and third CDIs. The firm's time line demonstrates an alignment between business strategy (focus on the Scandinavian market), competitive priorities (manufacture environmentally responsible products), and the CDIs initiated support its competitive priorities, which are among the conditions for success in

manufacturing SMEs (O'Regan and Ghobadian, 2004, Shavarini et al., 2013). Further, generally foreign customers and consultants were responsible for the radical CDIs in the firm.

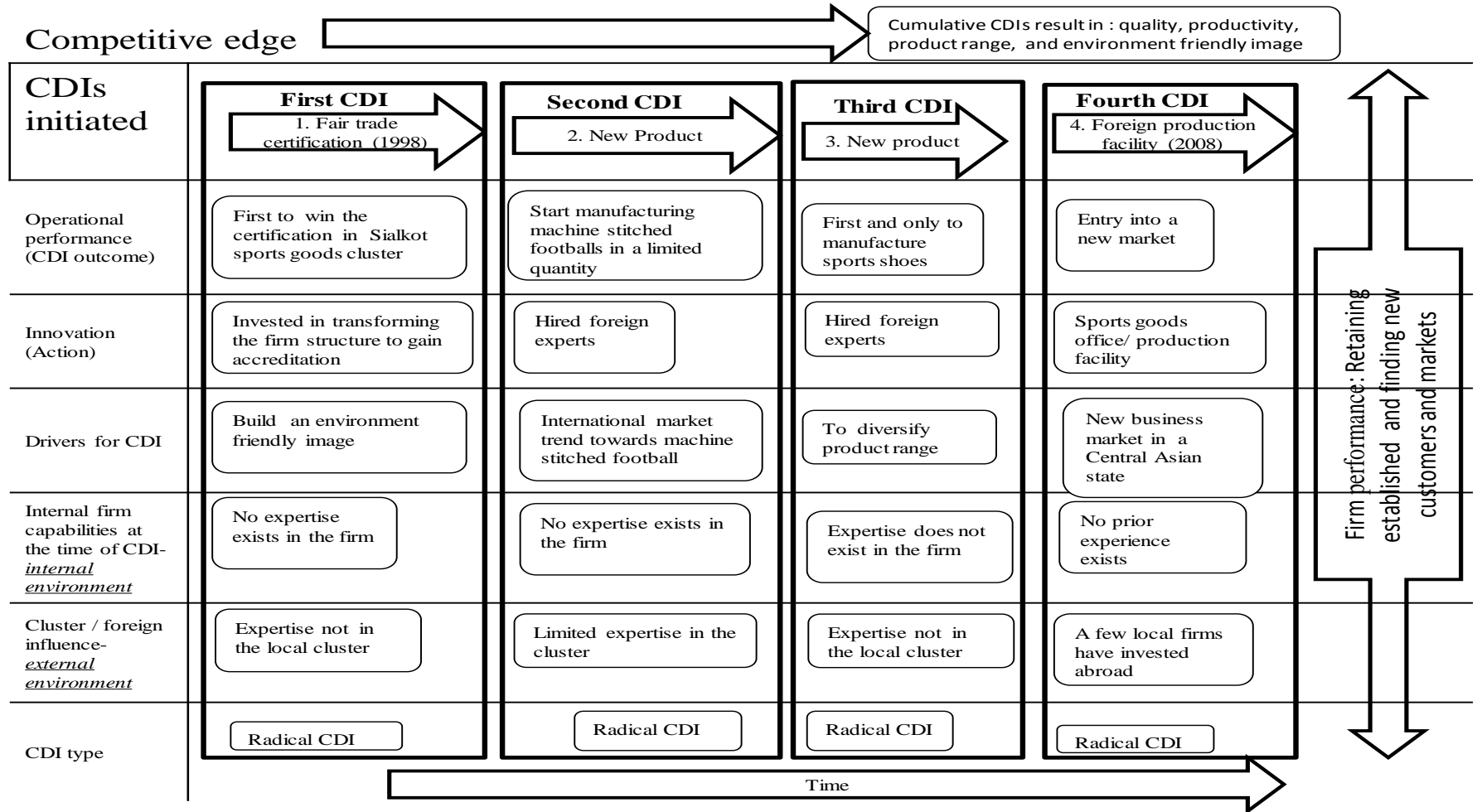


Figure 6-7: Time line for firm F

6.5.3.6 Interviewee comments/ recommendations for firm/ cluster competitiveness

The interviewee ascribes the awareness of quality, CRS in Sialkot firms to SAGA sports which is considered the role model for the whole of Pakistan generally and for Sialkot in particular. Regarding the problems facing Sialkot industry, the interviewee replied: *'Most of the industries run on specific orders which have to be delivered within certain time period because of which it is difficult for firms to hold on to their employees and also implement CSRs.'*

On academic cooperation, the interviewee said: *'I have this stand that there should be cooperation and linkage between industry and research institutes. These research institutes should be aware of the latest products coming in the international market.'* However, the firm neither mentioned any CDI which displayed any contact with local R&D institutes nor displayed any inter-firm collaboration.

In terms of future challenges, the executive replied: *'Socio-economic conditions. The raw material price fluctuations along with fuel prices affect international competitiveness.'* Thus, like other interviewed executives, this executive terms local socio-economic conditions as a challenge to business growth. Pakistan is recently facing severe power shortages and steep rising power rates, which has increased cost of doing business, especially for SMEs (Ahmad, 2012b, Mirza, 2013).

6.5.4 Firm G

6.5.4.1 Interview details

The interview was conducted with the Chief executive of the firm in his office. The interviewee appeared to be in his early 70s. He had a desktop on his office table and was finishing a skype conversation with one of his customers when the author entered the room. The interviewee had a gentle personality, offered tea and Danish cookies which he had brought from his last trip abroad. The executive's office was spacious and had a bed as well. The executive explained that because of time difference in different foreign markets, he had to work odd hours.

6.5.4.2 Shop floor visit

The firm's premises were located in a densely populated area. The building had three floors. Access to the production floor was restricted, evident from the instructions written on the entrance gate. On requesting a visit to the shop floor, the researcher was granted limited access on the condition that no photographs would be taken. The executive mentioned the facilities visited as their R&D facilities. There were facilities for checking the leather quality and the string used in stitching. Also, the lots of finished footballs were tested for certain specifications such as its natural bounce, circularity.

6.5.4.3 Firm characteristics

For the firm's strategy, the interviewee said: *'In short, we analysed the weaknesses of the cluster and tried to improve upon them.'* When asked about firm's competitive advantage, interviewee replied: *'Quality and customer confidence as its competitive edge'*, and to maintain their competitive edge, the interviewee replied: *'Collaboration with customers and going to international exhibitions.'* The firm owner also spoke of being actively involved in a public-private venture for the benefit of sports ¹⁶cluster. The venture will make available to the sports cluster the latest technology and also help in manufacturing machine stitched balls, an expertise which is still new to the cluster. When asked about how the firm performance is measure, interviewee replied: *'Try to retain customers, while searching for new customers.'*

6.5.4.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the types of TICs accumulated and resultant process and product upgrading achieved by the firm (Table 6-12).

¹⁶ This initiative is also on the SMEDA's website, and has been mentioned at the start of section.

First CDI: The firm was initially manufacturing football for general recreational use. There was no proper quality control because of which the lots were rejected. The interviewee said that *'I emphasised that the reason for complaint should be investigated and promptly settled.'* Further, the firm started as supplier of footballs to a German customer. To learn more about quality control and customer requirements, the interviewee went to Germany to visit the customer's facilities. He learnt about quality control requirements and incorporated them as quality control specifications for his own firm.

The interviewee commented: *'We started with a few priorities. We checked the ball for leakage, proper stamping, and packaging.'* Because of these simple quality checks the firm became the biggest supplier to the German customer from Sialkot. Thus, this is 'learning by interaction' CDI and categorised as a radical CDI since it helped the firm to become largest supplier to the German customer from the Sialkot cluster.

Second CDI: For the second CDI, the interviewee commented: *'They started sending us pieces for stitching. Now confidence is building up. Next, they thought that leather is available in Pakistan, so why no prepare leather in Pakistan. They decided to send their technical person to help us to prepare good leather to make balls here in Pakistan.'* With the transfer of expertise, firm started manufacturing for low to medium international market. This is learning by training CDI and the CDI is categorised as radical due to the involvement of foreign trainers. The firm was very conscious of stopping the dissemination of the expertise in the local sports goods cluster, and employed and trained deaf and dumb people.

Third CDI: *'We had an agreement with Adidas in 1975. Stitching for a company in Germany was a factor for to have confidence on us. In due course of time, Adidas started buying low end balls from us.'* Next, as per the interviewee Adidas deputed a quality inspector/trainer within the firm. The executive is also able to attend seminars hosted by Adidas for its suppliers, to educate them about productivity, efficiency and lean manufacturing concepts. This CDI is an instance of having an initial innovation capability which was exploited to secure a contract with Adidas. The firm was the first to make the contract with Adidas in the local sports goods cluster. Therefore, this CDI is another instance of 'learning by training' and the CDI is categorised as radical.

Fourth CDI: The firm also started manufacturing sportswear, as multinational firms started sourcing sportswear from the sports goods cluster. The firm also wanted to expand overseas, and made a decision to purchasing a facility in Europe for manufacturing different types of balls. A multinational firm was divesting from that facility. However, it proved to be a bad investment decision, as the interviewee remarked: *'We suffered heavy financial losses and had to abandon the project.'*

The interviewee mentioned that the firm is presently considering diversifying into sports shoes, a sign that the firm’s financial health is now improving.

CDI (Cohen and Levinthal, 1990)	Learning and knowledge capabilities (Amara et al., 2008)		Level of TICs required/ displayed in the CDI (Lall ,1992)	Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4.8)	Resources of the firm as observed (Table 6-9)	Firm categorisation
Improved football manufacturing	• Learning by interaction	Know-how	• Acquisition level	• Process upgrading	• Radical	<ul style="list-style-type: none"> • Firm admits losses in one of its CDI's but now mentioned investing in a few new ventures, which shows financial resources availability with the firm 	Since the firm has demonstrated radical CDIs, CDI-business strategy alignment , and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm.
Collaboration with German customer	• Learning by interaction/ training	Know-how	• Acquisition level	• Process upgrading	• Radical		
Collaboration with Adidas	• learning by training	Know-how	• Acquisition level	• Process upgrading	• Radical		
Sports wear	Learning by interaction	Know-how	• Acquisition level	• Diversification	• Minor		

*CDIs in a firm are assessed with respect to their respective cluster capabilities

Table 6-12: CDIs analysis for TIC level of firm G

Most of the firm CDIs have been about progressively increasing the content of manufacturing processes of the firm, which resulted in better quality, higher productivity and better value-added products over time. However, one common thing among the CDIs was that there was an existing innovation capability in the firm on which a new capability was assimilated.

The firm has also joined the sportswear manufacturers club, similar to the other interviewed firms in sports cluster giving strength to the argument that the sportswear business is thriving in the Sialkot sports cluster. In sum, the firm slowly built its capabilities and all the sources of its innovations were customers, a sign of ‘learning by training’ and ‘learning by interaction’ capabilities (Oyelaran-Oyeyinka and Lal, 2006, Yam et al., 2011).

6.5.4.5 A macro view-time line, of CDIs adding to firm’s technological competitiveness

The timeline of CDIs which helped the firm achieve its competitive edge is shown in the Figure 6-8. The Y-axis represents capabilities development initiative’s (CDI) elements. The X-axis describes CDIs timeline and how new CDIs built upon the existing capabilities of the firm.

International customers were responsible for all the CDIs of the firm, which helped the firm to produce products of international quality. Thus, similar to other leader firms, the firm has a clear business strategy i.e. to analyse and circumscribe competitor's / cluster's weaknesses and thus gain new customers while retaining old ones. And time line shows firm's alignment business strategy alignment with CDIs initiated. However, no government's patronage is seen in these CDIs, although in literature government support helps to upgrade firms' TIC levels (Brehm and Lundin, 2012).

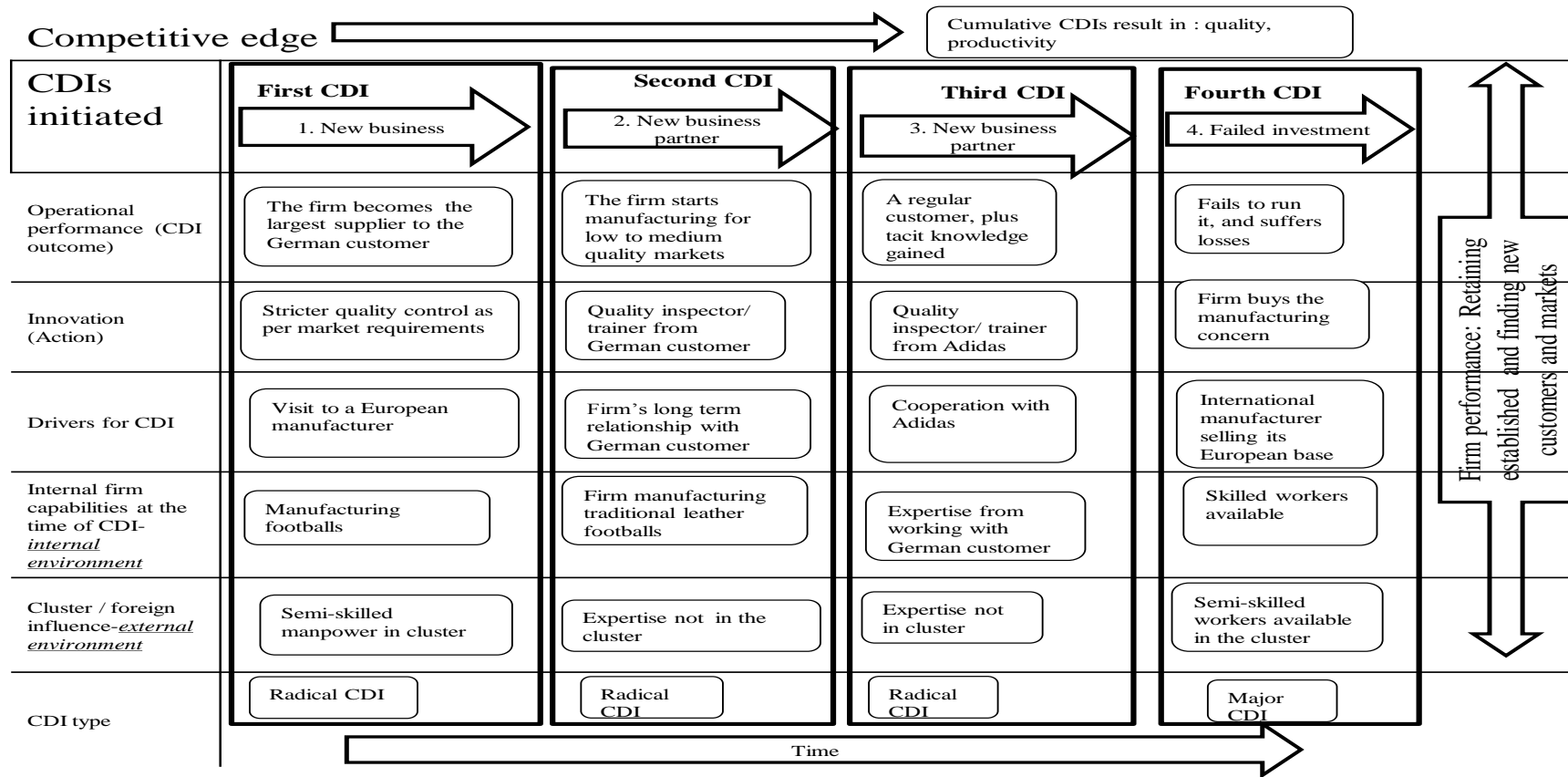


Figure 6-8: Time line for firm G

6.5.4.6 Interviewee comments/ recommendations for firm/ cluster competitiveness

When the interviewee was asked about future challenges, he replied: '*Diversification and quality improvement.*' These comments are similar to firm E's executive comments when he said that diversification is the key to competitiveness.

6.5.5 Firm H

6.5.5.1 Interview details

The interviewee was the Chief Executive of the firm, which has regular customers in Europe and the US. The interviewee appeared to be in his late fifties' and exuded confidence. The researcher explained the purpose of his visit to the interviewee and showed him the list of firms he was interviewing. Interviewee nodded in approval about the firm's reputation in Sialkot as successful. Instead of answering the questionnaire, interviewee explained that he would give a general picture of Sialkot clusters, problems faced by them and a bit about his business as well. The researcher listened to the interviewee's monologue, asking for explanations where required.

6.5.5.2 Shop floor visit

The firm premises included a multi-story building, and there was a queue of trucks outside the building collecting consignments for onward haulage. The researcher sat with the interviewee at the ground floor in a room which looked into a shop floor. All the machines were occupied, the room was well lit and appeared to be air-conditioned, a luxury in a developing country. Further, all the machines appeared to be new and there was symmetry to the layout of machines at the shop floor, giving credence to the interviewee's assertion that he hires professionals to run the business. Thus, the firm appeared to have robust resources.

6.5.5.3 Firm characteristics

For the business strategy, the interviewee replied: *'I hire professionals to do the job.'* Executive remarked: *'When I hired professionals at exorbitant wages, (with respect to the prevailing wages in the local cluster) to run a garment business, my colleagues were sceptical of my success.'* The interviewee says that the firm's sportswear business has grown around 100% in its operational capacity since it started in 1996. The interviewee owes his business growth to the professional approach he took to conducting the affairs of the business.

The interviewee was very analytical in his approach to the problems facing Sialkot. The researcher explained that Sialkot firms are facing numerous hurdles and: *'These firms (interviewed by the researcher) are successful because they overcame those problems to some extent to produce products which are to be cost and quality competitive at international level.'* The interviewee defined marketing as:

'Our strongest weapon is marketing. What is marketing? The sector you are in can produce a product which is cost and quality competitive to your competitor's product in China. This is the reason I am among the progressive (successful) firms.'

Further, the interviewee also had a point of view on the definition of **diversification**. According to the interviewee, the definition of diversification is:

‘Everybody is diversifying in the same field; add another product to the list of products. This is not diversification. My firm started in 1996. You start a project with certain investment and goals. At the end of successful rolling of project, you have achieved your goals and profits. Now those profits should be invested in some other venture! I have five units entirely different from each other.’

Thus interviewee has clear concepts about his business strategy, aim and objectives which he has effectively translated into CDIs (discussed in the next section).

6.5.5.4 Analysis of CDIs initiated and resultant TICs upgrading

This section analyses individual CDIs to understand the types of TICs accumulated and resultant process and product upgrading achieved by the firm (Table 6-13). According to the interviewee: *‘I have five units entirely different from each other: sportswear, livestock, meat and flower export and wind turbine.’* The firm has also established an overseas garment manufacturing unit in ¹⁷Lesotho for exports to the USA. Lesotho is a duty free zone for the USA.

*CDI	Learning and knowledge capabilities (Amara et al., 2008)		TIC required/ displayed in the CDI (Lall, 1992)	Types of upgrading as result of CDI (Humphrey and Schmitz, 2002)	Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-9)	Firm categorisation	
Garment manufacturing unit	• Learning by training	Know-how	• Acquisition level	• Improvement in production process quality and productivity	Radical since the firm is first to hire consultants in the local cluster	• Robust as factory premises were clean, shop floors appeared to be well-lit and air-conditioned	Since the firm has demonstrated radical CDIs, CDIs-business strategy alignment, and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm.	
Foreign manufacturing unit	• Learning by interaction/ training	Know-how	• Acquisition level	• Operations management	Radical			
Live stock	Diversification							
Flower and meat export	Diversification							
Wind Turbine	Diversification							
*CDIs are	assessed with respect to their existing cluster capabilities							

Table 6-13: CDIs analysis for TIC level of firm H

¹⁷ Firm’s website also claims to have a manufacturing unit at Lesotho, with photographs of the setup.

Based upon the firm's resources, business growth and diversification, and resource observations, it is classified as a leader firm (Table 6-13). However, the firm has not added to the cluster capabilities per se but only assimilated sportswear manufacturing prowess from regional clusters.

6.5.5.5 Interviewee comments/ recommendations for firm/ cluster competitiveness

Highlighting the problems facing Sialkot, the interviewee enumerated: *'Lack of information on how to make a product? How to produce quality? How to increase efficiency? How to reduce cost? Because of which we cannot compete internationally.'* The interviewee was also critical of the lack of government support in solving the above problems. The interviewee lamented: *'I need operators (workforce) but I cannot find suitably skilled workers in whole of district of Sialkot.'* The Interviewee added: *'The government training institute teachers are so ill-trained that even I have volunteered to train them.'*

The interviewee's observations and comments about the local workforce and government institutions are similar to the executive of firm J, who also deplored the lack of skills needed by the market among the local workforce and has offered to train government institute teachers. Similarly most of the interviewed leather cluster firms give training to their workers through foreign experts. Thus, this is an indicator that lack of proper technical training is a problem which cuts across the clusters of Sialkot, and there is not much government support in alleviating this problem.

The interviewee claimed that given the right incentives such as properly trained workforce, proper R&D facilities, the businessmen of Sialkot can increase their exports well past those from Faisalabad, which is the hub of textile industry in Pakistan and the largest contributor of foreign exchange to the national exchequer (Akhter, 2011).

6.6 Cluster level (inter-firm) analysis: firms E to H in the sports goods cluster

This section compares general characteristics, competitive advantage of the interviewed firms with respect to the existing literature on SMEs and their clusters, as discussed in chapters 2 and 3. The findings of this section are compared with other cluster findings in chapter 7 to give suggestions for TIC upgrading and competitiveness of the interviewed clusters-the research aim. The interviewed firms generally mentioned North America and Europe as their export region, as also obvious from the literature in chapter 5.

Table 6-14 presents the business strategies and technology strategy (TS) of the interviewed firms as generated from the time lines of the interviewed firms discussed in previous sections. Business strategy includes the markets targeted and competitive edge of the firms, while capabilities, types of CDIs and sources of these CDIs represent the TS (Slater et al., 2011). The interviewed firms' research data analysis reveals that firms are generally production oriented with emphasis on operational improvement.

6.6.1.1 Interviewed firms' competitive characteristics

Similar to leather cluster firms, the sports cluster interviewed firms are also targeting the low-value added market in Europe and North America, but have developed their competitive priorities and TCs according to the markets and customers targeted. Firm E develops a large product portfolio with international collaboration, while the firm F develops environment friendly capabilities for customers in Scandinavian countries. Firms F and H have overseas manufacturing concerns in other developing countries.

The interviewed firms generally listed their competitive characteristics as: cost competitiveness, quality and close customer interaction, which are similar to the competitive characteristics of SMEs mentioned in the academic and policy literature on Sialkot (Singh et al., 2008, UNIDO, 2010, TRTA, 2014b). Further, retaining/ increasing their existing customer base and finding new markets are the measures of firm performance for the interviewed firms.

Based upon the CDIs introduced, firm resources and researcher's observations, all the interviewed firms have been classified as leader firms. The interviewed firms are not developing but acquiring technological capabilities from different sources, mostly international customers as discussed in next sub-section.

	Firm characteristics	Firm E	Firm F	Firm G	Firm H
Business strategy	Export markets	Low to medium end market segment in USA, Europe	Low to medium end market segment in Scandinavian countries	Low to medium end market segment in Europe	Low to medium end market segment in USA, Europe
	Competitive edge	Broad product range,	Worker and environment friendly image, broad product range	Increasing product range	Productivity, sustained growth
	Technology strategy	Leader, hire foreign experts to exploit the capabilities already existing in the cluster	Leader, Environment friendly image	Leader, international collaboration with multinationals	Leader, hiring local professionals, diversification in different businesses
Technology Strategy	Capabilities and resources	Learning by interaction and learning by training capabilities, skilled workforce, tacit knowledge, strong IT and marketing network, several international joint ventures	Learning by interaction and learning by training capabilities, international accreditations, skilled workforce, overseas manufacturing facility,	Learning by interaction, skilled workforce	Productivity, skilled manpower, overseas manufacturing facility
	Type of CDIs introduced	New product introduction, process improvement, vertical integration	Vertical integration, new product introduction	Process and product improvement	Firm claims to be the first to introduce garment manufacturing in the local cluster
	Sources of input to CDIs	Foreign trainers, customers, international expos, joint ventures	Local clusters, customers, foreign experts, international expos	Local cluster collaboration with customers (Adidas etc)	Local regional clusters

Table 6-14: Characteristics of the interviewed sports goods firms. Source (From interviews, shop floor visits, firm brochures, firms websites, SCCI website and Table 6-8)

6.6.1.2 Analysis of CDIs introduced and resulting TICs upgrading in the interviewed sports firms

The literature conditions that for successful acquisition of a new technological capability, the firm should have an adequate innovation capability i.e. sufficient expertise should exist in the firm to successfully absorb the new knowledge (Rush et al., 2007, Rush et al., 2013). Sialkot and adjoining clusters have expertise in football and garments manufacturing, which was successfully exploited by interviewed leader firm executives by collaborating with international customers for improved processes for better quality products, a sign of process upgrading/improvement.

The learning capabilities have been defined as necessary for continuous rejuvenation of capabilities of a cluster and its constituent firms (Amara et al., 2008, Rush et al., 2013). All the leader firms which successfully collaborated with the foreign customers demonstrated ‘learning by interacting’ and ‘learning by training’ capabilities (Asheim et al., 2003, Tödting and Trippel, 2005, Yam et al., 2011). However, these capabilities are basic process/ production capabilities and firms need technical knowledge generation sources either through internal R&D or through technology and know-how transferred from customers for having capabilities for producing better value-added products, as mentioned in the literature (Spithoven et al., 2011).

6.6.1.3 Local cluster and other regional clusters’ TCs effect on the interviewed firms TCs upgrading

All the interviewed firms mention benefitting from their local cluster resources such as availability of skilled labour, tapping micro firms for non-critical work, assimilating new expertise introduced in the cluster, as also discussed in chapter 3. The executive of firm H claims that its firm was the source of new expertise in the local sports cluster. Similarly, firm F mentions taking steps to inhibit the dissemination of an expertise from one of its CDIs to the cluster from the firm. This process of dissemination of expertise from leading firms into the cluster has been mentioned in the local Sialkot cluster literature (Nadvi and Halder, 2005, Pakistan, 2012). Some of the interviewed firms have also tapped into other regional clusters for functional integration i.e. installation of a rubber unit and effluent treatment plant. Thus, there appears to be a symbiotic relationship between a cluster and its constituent firms TCs for sustained firms/ cluster competitiveness, as also supported in the literature (Putro et al., 2013).

6.6.1.4 Role of government and different institutions in TCs upgrading in the interviewed firms

The interviewed sports firms’ CDI data indicated that foreign customers were the main source of TCs process upgrading in the cluster, while capabilities from other regional clusters were assimilated for functional integration, as also admitted by a GoP recent report (Pakistan, 2012). The interviewed firms were critical of the local government vocational training institutes, which were not aligned to local market needs. Also, the interviewed firms expressed difficulty in sourcing/ selecting the latest technology which is still on the horizon. The interviewed firms have acquired the know-how from customers but do not possess the know-what and know-why knowledge of the acquired technological capabilities, which drives innovation and technological upgrading for better value-added products and processes (Morrison et al., 2008, Kadarusman and Nadvi, 2013).

6.6.1.5 Recommendations of interviewees for increasing firm/ cluster performance

Similar to the leather cluster executives, the sports firms' executives were critical of the role of local vocational institutions which are not aligned to local needs. Some executives even proposed training the vocational institutes' instructors. Also, all the interviewed executives, similar to the leather cluster, were wary of the prevailing socio-economic conditions in Pakistan, which was affecting their business, a fact which has been admitted by the government (Pakistan, 2012) and repeatedly mentioned in newspapers (Mansoor, 2011b). Thus, there seems to be a consensus on certain issues which could be further looked into while devising policy tools for TCs upgrading in the interviewed clusters.

In summary, some of the interviewed leader sports goods firms' characteristics are similar to those of the interviewed leather goods leaders: both clusters have drawn from other regional clusters, target low-value added market segment; use international customers feedback for process upgrading and product portfolio expansion. Further, leader firms are trying for functional integration and show an alignment between their strategy and operational attributes.

6.7 Firm level analysis: Firms I to L in the surgical instruments cluster

6.7.1 General Surgical instruments cluster characteristics

General products manufactured by the surgical instruments cluster: The Surgical instruments cluster in Sialkot mostly manufactures non-reusable stainless steel (SS) items and is more than 100 years old. The instruments manufactured are labour intensive and require special expertise, which is only available with workers from Sialkot in the whole of Pakistan. The manufacturing techniques, productivity and quality of the surgical instruments cluster has been greatly enhanced by collaborating with the surgical cluster at Tuttlingen, Germany (Nadvi and Halder, 2005, TRTA, 2014a). The raw material required for producing high quality SS items currently has to be imported, but can be manufactured locally given government incentives such low interest loans for the industry on upgrading, reduced custom duty on the ¹⁸machinery required, also discussed in the local media (Ahmad, 2013b).

General capabilities of the surgical instruments cluster: Pakistani surgical tools are cost competitive and have short lead times. Sialkot's surgical instruments cluster strength is relatively cheap and high volume disposable instruments, but is also producer of higher quality theatre instruments. Many surgical firms have entered into joint ventures with international manufacturers. The USA accounts for the bulk of disposable exports while theatre instruments are mainly destined for the EU (Nadvi and Halder, 2005, Mansoor, 2011d).

The interviewed firms have been in the surgical instruments business for more than twenty years (Table 6-15) and are part of GVCs. Mostly, the interviewed firms produce non-reusable surgical instruments as the literature review in chapter 5 also revealed. Further, generally all the firms are in 'arms-length' relationships which indicate that the interviewed firms are operating in a market where products and their technology generally mature (Humphrey and Schmitz, 2002). The executives from the cluster attend international expositions to explore new markets and customers, meet with established customers and identify any new technologies which could be useful for their firms.

¹⁸ Comments of the executive of firm K

Firm	Established in	Product Range	Noticeable characteristics	Hierarchical relationship with customers Humphrey and Schmitz (2002)
I	1985	<ul style="list-style-type: none"> • Non-reusable electro-surgical instruments 	<ul style="list-style-type: none"> • First firm to be approved by FDA, USA in electro-mechanical surgical instruments 	Arms length
J	1972	<ul style="list-style-type: none"> • Non-reusable, SS product range 	<ul style="list-style-type: none"> • Executive has been president of SCCI 	Quasi-hierarchical
K	1980	<ul style="list-style-type: none"> • Non-reusable, SS product range 	<ul style="list-style-type: none"> • Brand name in Japan and Germany • Strong presence in USA 	Arms length
L	1987	Gynae and Obst. instruments	<ul style="list-style-type: none"> • One of the oldest Surgical firms in Sialkot 	Arms length

Table 6-15: Interviewed surgical instruments cluster firms' general characteristics. Source (From interviews, shop floor visits, firm brochures, firms websites and SCCI website)

Mostly Chief executives of the firms were interviewed, who were also requested to facilitate a shop floor visit. The interviews, which took place in the offices of the chief executives, along with the shop floor visits helped to fill in the observational frame work (Table 6-16). The firm's resources such as machines, training provided to the work force, attention to health and safety issues were taken as an indirect measure of an interviewed firm's financial health and performance (Yin, 2003).

Case studies of four interviewed firms are discussed in this section. Each case study first describes the general characteristics of the firm such as markets and customers targeted. Second, CDIs accumulated over the period of firm's operation are analysed. Third, CDIs are mapped using on a time line to show inter-linkage among the CDIs, if any, and identify various actors and factors which affected CDIs.

	Observations	Firm I (Shop floor visited)	Firm J (Firm premises visited)	Firm K (Firm premises visited)	Firm L (Firm premises visited)
Layout of the shop floor	*Is the shop floor properly lit?	Yes	Yes	No	Not known
	Are the work instructions/ SOPs prominently displayed?	Yes	Yes	No	No
	Are the safety signs properly displayed and emergency exits defined?	Yes	Yes	No	No
	Are the fire extinguishers provided and working?	Yes	Yes	No	Partially
	Is the work place airy and well ventilated?	Yes	Yes	No	Partially
	Is the shop floor are properly cleaned such as free from oil, grease	Yes	Yes	No	Partially
Facilities provided to the workforce	Is the air conditioning provided to the workforce?	Yes	No	No	No
	Are medical/ housing facilities provided to the workforce?	Yes	Yes	No	Not mentioned
	Are the families of work force facilitated in any way such as providing education scholarships, recreational trips?	Not provided	Not provided	Not provided	Not mentioned
Machines	Make of the machines such as Japanese, Korean	Not provided	Not provided	Not provided	Not mentioned
	Conditions of the machines such as newly purchased or second hand	New	New	Second hand	Not mentioned
	Maintenance of the machines such as if they are properly cleaned?	Maintained	Maintained	Poorly maintained	Not known
Firm characteristics	Does the firm has international accreditations? (from websites, brochures, executive's room)	Yes	Yes	Yes	Yes
	Is the firm manufacturing for customers?	Yes	Yes	Yes	Yes
	Has the firm its own brand name?	No	No	No	Yes
	Is the firm marketing directly into the markets?	No	No	No	Yes
	If any multinational is regular customer of the interviewed firm	Yes	Yes	No	Yes

Table 6-16: Observational checklist for surgical instruments cluster interviewed firms

6.7.2 Firm I

6.7.2.1 Interview details

The interview was held in the Chief Executive's office. It was tastefully and very aesthetically designed. When the researcher asked about the office and general office building design, the executive replied: '*Customers come to meet me here, therefore it is important to make a good impression.*' Various firm products and accreditations were displayed in the spacious executive's office. As per interviewee, firm I has customers in the US, UK, Europe and the Middle East.

6.7.2.2 Shop floor visit

The executive personally showed the author different sections of the firm after the interview and showed all the CDIs mentioned during the interview. The firm exhibited robust resources. All the equipment was new and clean. Proper safety instructions were displayed everywhere, the shop floor was neat and there were no obstacle or equipment on the floor. The executive also showed the assembly line area, which was air-conditioned.

6.7.2.3 Firm characteristics

The interviewee initially spent a decade or so in the US before coming over and setting up a surgical instruments business in the early 1980s. He said that whenever he wanted to take an initiative which was new to the cluster, his competitors believed that he would go bankrupt. The interviewee also gave firm marketing brochures to the researcher. The brochures are very aesthetically designed, lists all the instruments manufactured and the various accreditations held by the firm.

When asked about the firm's business strategy, the interviewee replied: '*Controlled growth, selected customers, adding new products and no compromise on quality.*' And when asked about factors which influence business strategy, the interviewee said: '*Inputs from international exhibitions, customers serve as main sources for increasing the capabilities of the firm.*'

He regularly attends foreign expositions to find new customers, markets, and to scan for new technologies which could be used in the firm operations. The interviewee also regularly searches the internet for the latest information to improve and introduce new products. When asked about the manufacturing differentiation, the interviewee said: '*Quality, new product development and satisfied service to customers.*' The executive measures firm performance through revenues earned and new products launched.

6.7.2.4 Analysis of CDIs initiated and resultant TIC upgrading

This section analyses individual CDIs to understand the resultant process and product upgrading achieved by the firm (Table 6-17). The firm brochures and firm website mention the CDIs discussed below.

First CDI: The firm started its operations in 1985, manufacturing standard surgical tools. But the firm wanted to distinguish itself from the competition. The first CDI consisted of developing a specialised product for a customer (firm) in 1985/86, which still buys from the firm. Thus, this CDI represents 'learning by interaction' capability and is classified as major. The successful CDI gave financial security and confidence to the firm. As per the executive: *'The firm has been bought three times but each new owner retained us as the supplier.'*

Second CDI: In the second CDI, the firm decided to reverse engineer a non-reusable bi-polar forceps, which required the development of new in-house capabilities. The firm finally developed a prototype after rigorous in-house trial and error, thus developing a 'learning by doing' capability in the firm. When the firm asked a potential customer about the product, the executive laughed and said that the customer reply was: *'It is worthless.'* According to the interviewee, the prototype was improved, finalised and approved via feedback from a potential customer, representing a 'learning by interacting' capability. Since the firm claimed to be the first to manufacture the product, therefore this CDI has been classified as radical.

Third CDI: However, to export bi-polar forceps to the customer in the USA, the firm needed 510 K certification from the FDA, which till then no one had in the Sialkot surgical instruments cluster. The third CDI relates to the efforts which went into getting the required accreditation. The interviewee said: *'It took two and half years and USD\$ 40,000 to get certification, but that taught me a lot.'* The accreditation helped the firm access the US markets for its bi-polar forceps. Later that year at MEDICA, a surgical exposition in Germany, the firm received orders from international clients for bi-polar forceps. The interviewee told that these clients kept coming to firm stall for the last two years but never placed an order. When he asked one of the customers why he placed the order now, the customer replied that the 510 K accreditation displayed by the firm showed that it is a firm which is serious in doing business. Thus, the accreditation opened markets not only in the US but also in Europe. Therefore, this CDI has been classified as radical

The fourth CDI was initiated by an Italian customer at MEDICA 1998/99. The customer showed them a non-reusable instrument and asked if they could manufacture it. The firm had no prior experience in plastics but it bought machines and slowly gained experience in their operations. Finally, the firm reverse engineered the plastic product through continuous trial and

error process. Now, the firm cannot keep up with the customer demand for the product. This CDI also represents ‘learning by doing’ and ‘learning by using’ capabilities of the firm. This CDI is categorised as radical since no other firm in the cluster was doing the process, as claimed by the interviewee.

Fifth CDI: The firm needs to sterilise its products before sending them abroad. Initially, it was using a government run institution which was time consuming, and involved a lot of paper work. Plus, there were also issues with the accreditation of the government sterilisation facility, since the customers asked: *‘Is the facility providing sterilisation certified?’* Therefore, the firm decided to import and run its own facility, and was the first one to do this in the Sialkot surgical instruments cluster. A lot of firm’s local competitors were pessimistic about the initiative’s success. But the firm after much hard work succeeded. This is its fifth CDI and an example of ‘learning by using’. It is also now providing service to local surgical instruments cluster as well. Since the firm claims to be the first one to install this facility, therefore this CDI has been classified as radical.

As the firm’s business is growing, it decided to incorporate a module of ERP for better inventory and sales order management. At the time of interview, firm had hired a consultant to implement an ERP module customised to their inventory management needs.

CDI (Cohen and Levinthal, 1990)	Learning capability and associated knowledge capability (Amara et al., 2008)		Level of TIC required/ displayed in the CDI (Lall ,1992)	Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-16)	Firm categorisation
Customised product	• Learning by interaction / doing	Know-how	Acquisition	• Process upgrading	Major	<ul style="list-style-type: none"> • Firm has a large product portfolio • Firm has made numerous capital purchases over its time of operation • Firm has large clientele • Firm has successfully assimilated previously outsourced operations 	Since the firm has demonstrated radical CDIs, CDIs-business strategy alignment, and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm.
Reverse engineer a product	• Learning by doing/ interaction	Know-why	Acquisition	• Process upgrading	Radical		
International accreditation	• Learning by using/ interacting	Know-how	Acquisition	• Process upgrading	Radical		
Reverse engineer a product	• Learning by doing	Know-why	Acquisition	• Process upgrading	Radical		
Installing/ running a steriliser	• Learning by using	Know-how	Acquisition	• Functional integration	Radical		
*CDIs in the firm are assessed with respect to their respective cluster capabilities							

Table 6-17: CDIs analysis for TIC level of firm I

Thus, firm has been able to develop ‘learning by using’ and ‘learning by doing’ capabilities, which has helped the firm upgrade its TCs, as also stated in the literature (Oyelaran-Oyeyinka and Lal, 2006, Kadarusman and Nadvi, 2013).

6.7.2.5 A macro view-time line of CDIs adding to firm’s technological competitiveness

The time line consisting of CDIs, discussed above, which helped the firm achieve its present competitiveness is shown in Figure 6-9. The time line shows the firm’s implementation of its strategy into action through CDIs.

In this firm, CDIs have been about process improvement, new product assimilation, acquiring international accreditation and incorporating new facility. The time line shows that foreign collaboration has been essential in enhancing the technological capabilities of the firm along with firm’s internal ‘reverse engineering ’capability. The second and fourth CDIs show that the firm reverse engineered a few products on the market with the help of customers and marketed them successfully. The shop floor visit did not show any design facilities, therefore it can be said that through trial and error at the shop floor level, the firm has developed reverse engineering capabilities.

A macro view of the time line shows that firm continuously increased its TICs through in-house efforts and foreign collaboration which resulted in better quality products. Thus, the firm shows an alignment between its business strategy- continuously introducing new products, and CDIs which is one of the factors for sustained competitive edge (Singh and Mahmood, 2014).

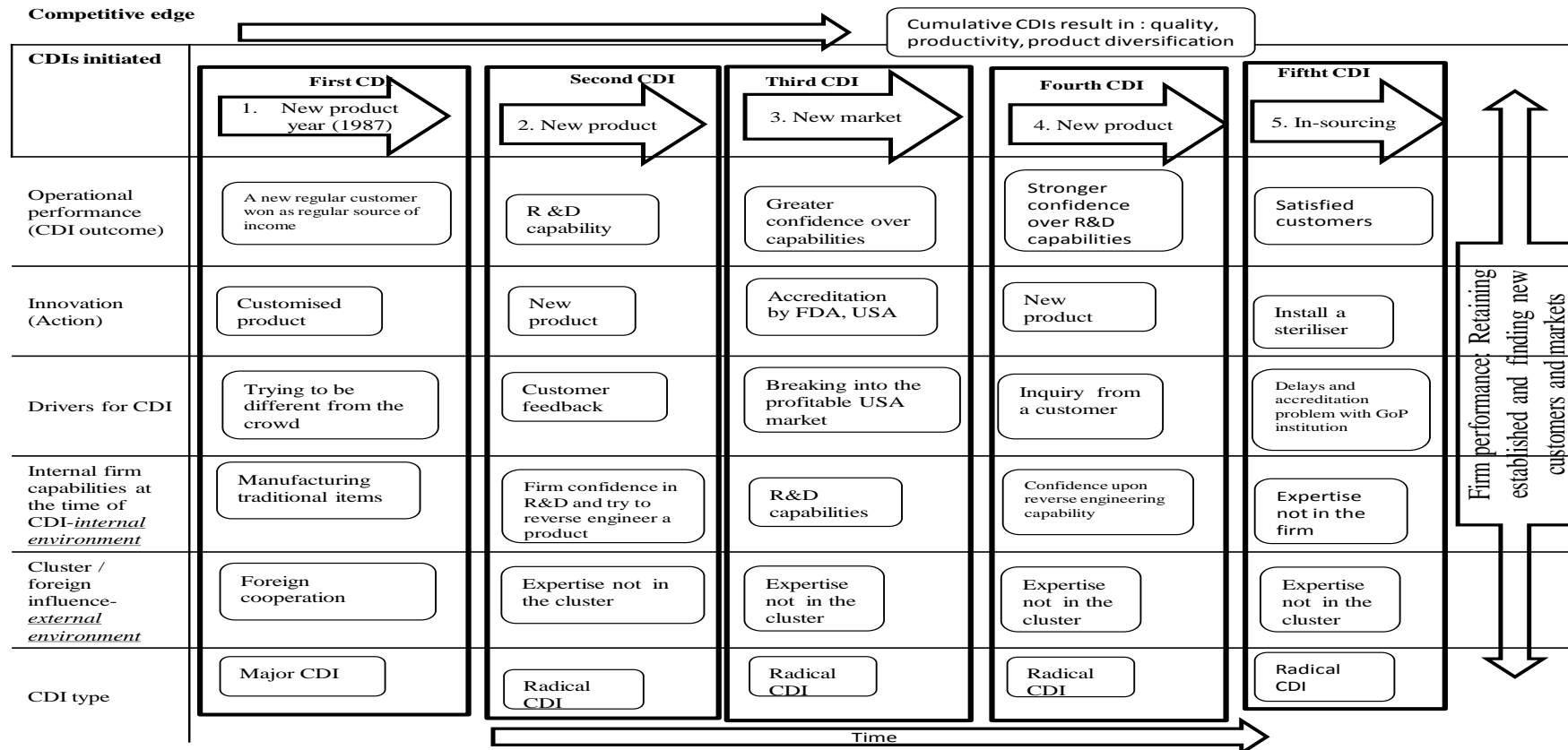


Figure 6-9: Time line for firm I

6.7.2.6 Interviewee comments/ recommendations for firm / cluster competitiveness

During the interview, the interviewee described the efforts he had to make to identify and source the machinery required for product manufacturing. He even had to understand the mechanism of different instruments given to him by different customers to reverse engineer. The interviewee also searched the internet for seminars relating to research on tools and material used in the firm's field of interest. He was soon leaving for China to attend one such seminar. Further, the interviewee said that: *'Businessmen in Sialkot are hesitant to invest in HR, materials, technology, infrastructure'*, a fact also admitted by the executive of firm J.

Thus, the identification of suitable present and emerging technologies and their implications at the firm and cluster level could be easily be facilitated by governmental development agencies and vocational institutions to foster innovation in SMEs and their respective clusters.

6.7.3 Firm J

6.7.3.1 Interview details

Firm J is an original equipment manufacturer (OEM) for a multinational firm in Germany. The researcher was told by Mr Fouzan (SMEDA representative) that the researcher would be lucky to interview firm J's executive, as most of the year he is out of the country on business deals. The author found the interviewee convalescing from a recent heart by-pass operation and had curtailed his overseas visits. However, interviewee was still actively involved in the technical affairs of the firm because soon after the interview, he went straight to the shop floor to address a few problems.

The interview was done in the office of the Chief Executive. It was a spacious office with elegant furniture. The interviewee was wearing an expensive business suit and a Rolex watch. The researcher explained the purpose of his visit. The executive proposed that he would give his views about firm/ cluster competitiveness and factors affecting competitiveness. Researcher listened to the Executive, asking for clarifications where required.

6.7.3.2 Shop floor visit

The firm is located outside Sialkot city and has sprawling premises, which was well maintained. The researcher reached the firm at lunch time, and all the workers were sitting on the lawns, enjoying the winter sun. Roughly, workers appeared to be at least 300 in numbers. The researcher had to wait for lunch hour to be over. Therefore researcher had a chance to chat with the workforce sitting in and outside the firm premises. There were also expensive vehicles parked in the firm premises.

The researcher was lead to the executive office through shop floors. Hence, the researcher had a chance to generally observe the shop floors. There were two shop floors with about 200 different machines, which were all busy. Thus, it appeared that firm had good production orders from its client. Also, the shop floors appeared to be properly planned with respect to the types of machines, their capacities and capabilities. Accordingly it could be inferred that the firm have robust resources.

6.7.3.3 Firm characteristics

The interviewee says that he is a college dropout, a self-made man and has worked hard for to get to where he is right now. The interviewee claimed that first he introduces a product in his firm, the expertise of which is then disseminated in the local surgical instruments cluster. He claimed that most of the local firms were employing his former workforce.

When asked about the firm's strategy, the interviewee replied: *'I Look for competitor's weaknesses and analyse market demands.'* The executive further elaborated: *'Our focus is on manufacturing. I do not go to exhibitions and whatever money I have is invested back into the business.'* The firm considers its quality, broad product portfolio, skilled workforce and its strategic alliance with the multinational firm as the sources of its competitive edge.

When the interviewee was asked about the firm's manufacturing competence, he replied: *'It is combination of each and everything and also human nature, sociology i.e. how to motivate the people, retain the customer, communication skills.'* And when asked about how the firm maintains its manufacturing competence, he replied: *'Thirst for technology, introduction of good equipment, continuous improvement of production processes and identifying weaknesses of competitors.'*

In terms of increasing manufacturing competence, the interviewee mentioned: *'I instruct the shop floor supervisors to manage the workforce, train them and not get bogged down by small details.'* Thus, according to the interviewee, strategic alliance allows easy transfer of expertise from the multinational partner and firm J only has to invest in machinery. This helps to save on marketing and R&D efforts. The firm does not visit international exhibitions for new customers or markets because its entire capacity is consumed by the multinational firms.

When asked about measuring firm performance, the interviewee replied: No business can sustain itself without introducing new products continuously: *'To make your business sustainable, you need innovative ideas, new products, improve your production efficiency, develop your human resource and improve your quality management system.'* However, during the interview twice employees from the shop floor came to the interviewee to show him their finished work. The interviewee appreciated and approved their work. This behaviour indicates that some employees instead of reporting to their shop floor supervisors' report to the executive. This is an apparent contradiction of the philosophy which the interviewee wants in his firm i.e. that his shop floor supervisors' should be managing the floor operations. This behaviour gives credence to the comments of the interviewee of firm A, when he said that decision making in SME is highly centralised which does not allow the firm to move to more fast-paced, demanding markets.

6.7.3.4 TCs of the firm acquired through CDIs and resulting upgrading

The firm seems to be in a quasi-hierarchical relationship with a multinational in Germany, which is the source of upgrading of the technological capabilities of the firm. However, the firm cannot market its products directly into the market as that would bring it into direct competition with its customer. Also, it manufactures those products which are required by the customer.

Thus, the firm's capabilities are determined by the customer, as also mentioned in the literature (Humphrey and Schmitz, 2002). The researcher asked the interviewee about the contingency plans if the customer has problems. The interviewee replied: *'The customer is one of the largest manufacturers of surgical instruments in the world so any problems are unlikely. Even in the worst scenario case, good products always sell in the market, which I have.'* The firm did not show any collaboration with any other firm or with an R&D institute.

6.7.3.5 Interviewee comments/ recommendations for firm / cluster competition

The interviewee was very critical of the governmental vocational institutes which existed at Sialkot. The interviewee said: *'The existing vocational institutes' facilities and syllabus are outdated, and they cannot train apprentices to the current needs of the local market.'* The interviewee mentioned that when the President of Pakistan came to visit Sialkot, he asked him to establish a local university which could understand the local needs. The interviewee said that one such institute is now being established in Sialkot. Finally, when asked about the factors which might be affecting firm performance, the executive, similar to other interviewed executives, said: *'I am very concerned about the deteriorating local social setup which is affecting every part of our society.'* Thus, generally all the interviewed firms whether leader, follower or reactor are concerned about the prevailing socio-economic conditions of the country.

6.7.4 Firm K

6.7.4.1 Interview details

Access to the firm premises was restricted. Before entering the firm premises, there is a welcoming lounge. The interview took place in the lounge with the son of the firm's executive. The son had recently returned after doing his MBA in USA.

6.7.4.2 Firm characteristics

Firm K has numerous international customers and considers itself to be a market leader. When asked about competitive edge, the interviewee commented: '*We differentiate on quality*', and said that they produce quality products and charge for it. The interviewee categorically said that their firm does not train the workforce but has a strong financial position and therefore is able to hire the best workforce in the cluster. The workforce brings with them new skills which help in manufacturing new products, already introduced in the cluster. When asked how firm performance is measured, the interviewee replied: '*By sales, customer satisfaction, profit margins, customer retention, and customer feedback*', which is same as other interviewees' comments.

The interview data was validated through checking of the contents of the firm's website. The interviewee mentioned a strong presence in Germany and Japan, which is also shown on the firm's website. In Japan, the firm markets under its own brand name. It has distribution offices in USA and Germany where it supplies to multinational firms but is trying to develop its own brand name in these markets as well.

The interview said the surgical cluster has benefited from the automotive cluster in Lahore region, and production costs could be brought down if high quality SS is produced in Pakistan. During the interview, the interviewee did not mention CDIs but concentrated more on the problems generally faced by the surgical instruments cluster relating to its capabilities and competitiveness management.

In this case, the firm has been termed leader on the basis of its broad product range, established brand name in Japan and Germany, and a strong presence in USA, where it is trying to build a brand name as well. The researcher found that firm K's website was the most comprehensive of the interviewed firms. The website lists all the instruments produced, the processes used, the quality checks involved, the different accreditations held by the firm. On their website, the firm claim that it can manufacture any product given a drawing or an existing sample, which implies that it has a level of reverse engineering capability.

6.7.4.3 Analysis of CDIs initiated and resultant TCs upgrading

This section analyses individual CDIs to understand the types of TICs accumulated and resultant process and product upgrading achieved by the firm (Table 6-18).

CDIs: The firm's website details major events in the operational history of the firm. It was established in 1980. It produced its first catalogue in 1982 and started manufacturing general surgery, tungsten carbide & dental instruments in 1993.

First CDI: The firm went into a joint venture with a German firm in 1994 to produce surgical instruments. Thus this CDI represent 'learning by training capability' and the CDI is classified as radical since it involves foreign collaboration.

Second CDI: In 2002 firm established a Japanese joint venture. Again because of foreign collaboration, this CDI is classified as radical and represents 'learning by interaction' capability.

Third CDI: In 2008, firm started manufacturing diamond dusted jaws instruments, which is a major development since most of the surgical instruments in Sialkot cluster are made from stainless steel. However, the firm assimilated this capability from the local cluster, therefore this is a minor CDI and represents the 'learning by interacting' capability.

Fourth CDI: In 2009, firm started manufacturing electrosurgical instruments, minor CDI.

Fifth CDI: while in 2011 the firm consolidated its general surgery catalogue. Again, these instruments are already being made in the local cluster, therefore this is again a minor CDI.

CDI (Cohen and Levinthal, 1990)	Learning and knowledge capability (Amara et al., 2008)		Level of TIC required/ displayed in the CDI (Lall, 1992)	Type of upgrading as result of CDI (Humphrey and Schmitz, 2002)	*Categorisation of CDI (as per criteria defined in Table 4.6)	Resources of the firm as observed (Table 6-16)	Firm categorisation
Brand name in Japan	• Learning by training	Know-how	• Acquisition level	• Functional integration	Radical	<ul style="list-style-type: none"> Firm has the largest product portfolio of the interviewed firms Firm employs on better wages experienced employees from the cluster Firm has international recognition 	Since the firm has demonstrated radical CDIs, shown CDIs-business strategy alignment and has visibly strong infrastructure, therefore the firm is categorised as a Leader firm .
Brand name in Germany	• Learning by training	Know-how	• Acquisition level	• Functional integration	Radical		
Diamond dusted surgical instruments manufacturing	Learning by local interaction	Know-how	• Acquisition level	New product portfolio	Minor		
Electro-surgical instruments manufacturing	Learning by local interaction	Know-how	• Acquisition level	New product portfolio	Minor		
*CDIs are assessed with respect to their existing cluster capabilities							

Table 6-18: CDIs analysis for TIC level of firm

6.7.4.4 A macro view-time line of CDIs adding to firm's technological competitiveness

The time line consisting of CDIs discussed above which helped the firm achieve its present competitiveness is shown in Table 6-18. In this firm, CDIs have been about either acquiring technological capabilities from the local surgical cluster or downstream integration i.e. developing a marking brand in foreign markets. In the surgical sector, firms are making an effort to establish their own brand name and are also soliciting government help (Mansoor, 2011c, Ahmad, 2014b). However, no government or academic cooperation is visible in the CDIs initiated by the firm K.

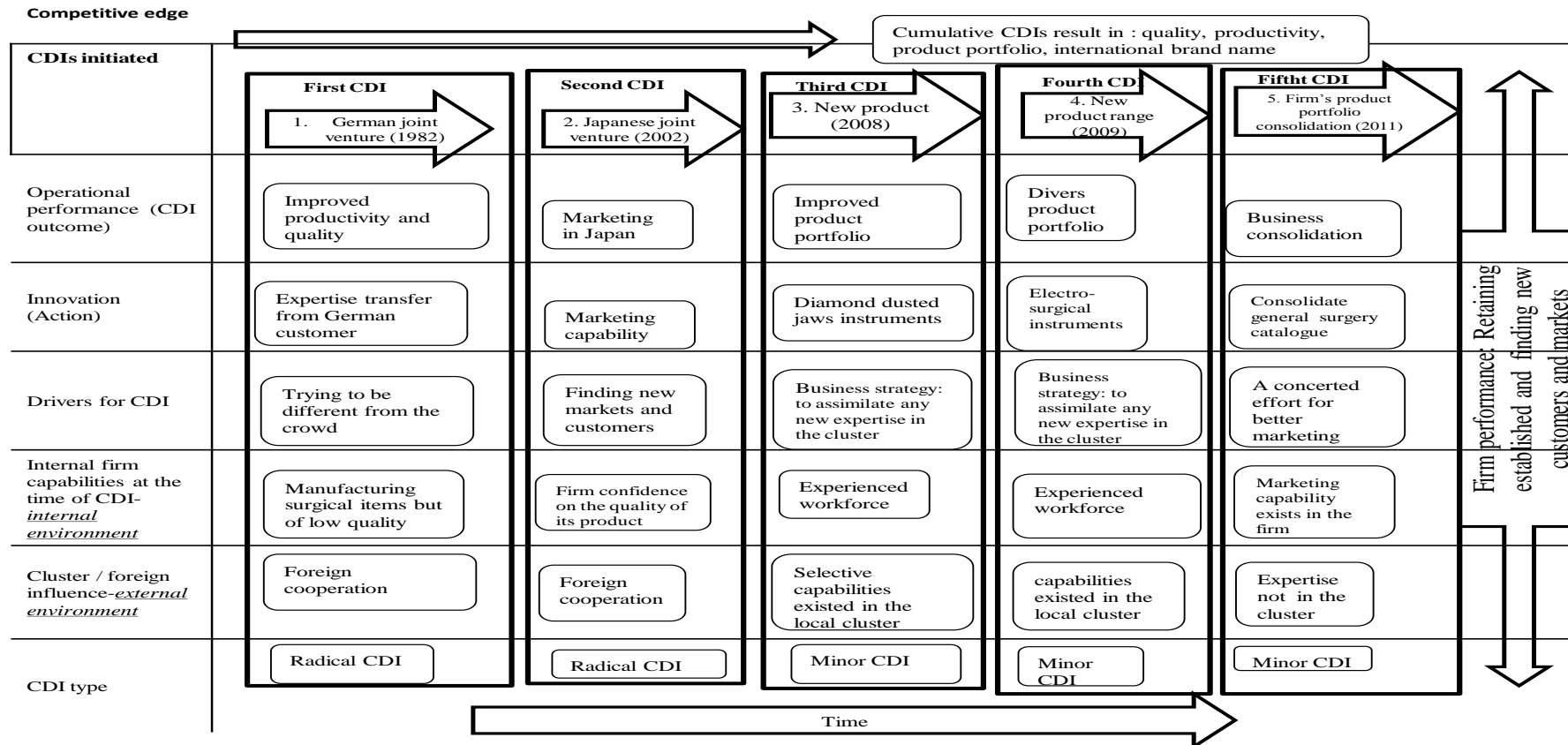


Figure 6-10: Time line for firm K

6.7.4.5 Interviewee comments/ recommendations for firm/ cluster competitiveness

The interviewee summed up his concerns and recommendations for cluster competitiveness as: *‘The major problem is lack of skilled labour. The available skilled labour is aged, while the other portion is young and inexperienced. There is no training institute. This is a skilled job. There is no system for skill transfer. The government setup available is out-dated, with old machines. We are competing internationally in real-time. When these apprentices come here, they start learning.’*

Further, the interviewee gave an example of a recent internal firm initiative for coding information on different processes being conducted on different surgical instruments. He said that it was difficult to communicate to the workforce what a process was and where one process ends and the next one starts. In addition, he has to explain the quality control process. Although the interviewee’s firm was beneficiary of the experienced workforce, he was not a supporter of training the workforce as then they become a liability. The firm loses financially if the trained worker is hired by someone else.

Also, the interviewee commented the SS manufacturing industry needs incentives from the government such as tax breaks to break even with the initial costs involved in setting up SS furnaces. Finally, the interviewee was concerned about: *‘Socio-economic conditions, including utilities.’* Thus, firm’s executive observation about workforce skills and government training institutes and socio-economic situation are similar to those expressed by other interviewed firms, whether of leather, sports or surgical instruments sector.

6.7.5 Firm L

6.7.5.1 Interview details

The interviewee is a graduate and established the firm in 1987. The firm executive did not give his consent to record the interview. The interview took place in the executive's office, with his sons in attendance.

6.7.5.2 Shop floor visit

A shop floor visit was not provided. However, the interviewee had a chance to move around in a part of the firm. It comprised of a double story building with rooms, which were not properly lit. The workers working there did not have proper Personal Protective Equipment (PPE), the main building had a glass front with many broken panes, which are taken as an indicator of poor resource health, as also indicated in the literature (Yin, 2003).

6.7.5.3 Firm characteristics

¹⁹Firm L manufactures selective gynaecology and obstetrics, and dental instruments. It has established customers in Europe and the US. Presently, it considers market conditions as depressed, and apparently the firm is in dire financial straits. During the course of the interview, the owner received two phone calls for the payment of dues. The interviewee asked for more time, as he was still waiting for payment from some other quarters. During the interview, an employee came to the interviewee to show him a piece of finished work. The interviewee approved and commended the work of the employee. This shows a centralised decision making, performance appraisal environment as already observed in firms J and A.

The firm considers quality and craftsmanship as its competitive edge. Describing his firm's manufacturing skills, the executive said: *'If we cannot manufacture it, nobody can produce it in Sialkot.'* The firm uses customer and cluster feedback as a tool for improving its products. For improving products, the executive replied that improvement is a continuous process. They keep receiving feedback from customers and try to improve the product range accordingly. The interviewee did not give any details about CDIs saying that improvements are continuous and incremental, and he does not remember any specific CDI.

¹⁹ *This interview was not recorded upon the request of the interviewee.*

6.7.5.4 Technological capabilities of the firm and the resultant TCs upgrading

The executive explained that his firm failed to invest in machines and product portfolio expansion. As per the interviewee, he failed to foresee the technologies which were going to affect surgical instruments manufacturing. The interviewee explained that presently computerised numerically controlled (CNC) machines are on the market for die and tool making. The firm cannot purchase those machines owing to the lack of finances and thus cannot manufacture those products which their competitors are manufacturing. He further added that due to cash shortage, he often has to purchase raw material on interest, which adds to the product cost. In the executive's words: *'He is a victim of his own ego'* i.e. he kept on improving the products beyond market requirements, thus consuming firm resources which could have been spent wisely somewhere else. Therefore, in view of apparent firm resources, interviewee's comments and telephone calls received by the interviewee, the firm has been categorised as a reactor firm.

6.7.5.5 Interviewee's comments/ recommendations for increasing firm / cluster competitiveness

The firm has not been able to translate its technological expertise into profits. As per Ritter and Gemunden (2004), having expertise is one thing but exploiting it is also a capability a firm should possess. Also, firm L failed to anticipate the new technologies which were going to affect the surgical instruments sector and did not invest timely in new machines. This is where the government organisations and academic institutions can help the SMEs by scanning for technologies which would affect the SMEs field of interests.

6.8 Cluster level (inter-firm) analysis: Firms I to L in the surgical instruments cluster

This section cross-compares the case study reports of four interviewed firms in the light of SME cluster literature, and identifies the strengths and weaknesses of the researched firms and the cluster. These findings are compared with other cluster findings in chapter 7 to make generic suggestions for the technology upgrading and competitiveness of the interviewed clusters-the research aim. Table 6-19 gives a comparative list of the characteristics of the interviewed firms, as identified in their individual case study reports and time lines.

	Firm and their characteristics	Firm I (Leader)	Firm J (Leader)	Firm K (Leader)	Firm L (Reactor)
Business Strategy	Export markets	USA, Europe, Canada, Middle East	Supplier to a multinational in Europe	Europe, USA, Japan	USA, Europe
	Competitive edge	Specialises in a electro-mechanical instrument, broad product range	Broad product range	Broad product range, markets under own brand name in Japan, developing brand name in the US and Europe, large portfolio of customers	Specialist in limited Gynae & Obstetrics and dental instruments
Technology Strategy	Technology Strategy	Leader, increase product portfolio through reverse engineering	Leader, invest in firm resources for more sophisticated machines	Leader, hire best people from the cluster, develop own marketing brand	Reactor
	Capabilities and resources	Reverse engineering, learning by doing and learning by interaction capabilities , skilled manpower IT skills, accreditations	Learning by interaction and learning by training capabilities , extensive firm resources	Latest machinery, highly skilled manpower, claims reverse engineering capability on its website	Strong technical and manufacturing skills, but old machinery
	Types of CDIs	New product introduction, different accreditations	New products as per the requirements of the customer, who transfers the required expertise	Copy new products as and when they are introduced in the cluster	Incremental improvements in the processes
	Sources of input to CDIs	Customers, international expos, internet	Single customer	Local cluster, feedback from customers	Local cluster, feedback from customers

Table 6-19: Characteristics of the interviewed surgical goods cluster firms. Source (From interviews, shop floor visits, firm brochures, firms websites, SCCI website and Table 6-15)

6.8.1.1 Interviewed firms' competitive characteristics

All the interviewed firms mostly manufacture non-reusable instruments for the low-value added market segment in the US, Europe, Japan and Middle East, as also stated in the literature on

Sialkot surgical instruments cluster (Nadvi and Halder, 2005, TRTA, 2014a) and discussed in chapter 5.

The interviewed firms are targeting different product markets in the surgical instruments sector as shown in the Table 6-19 . Of the interviewed firms, one firm is targeting electro-mechanical instruments; other is manufacturing gynae and obstetrics instruments, while rest are manufacturing a broad mechanical non-reusable product range. This shows the breadth of tools being manufactured in the Sialkot surgical instruments sector. The firms are trying to sell under their own brand name, a trend also observed in the leather cluster. Of the four firms interviewed, three have been classified as leaders except firm L, which is in financial problems due to its past policies as mentioned by its executive.

Most of the interviewed firms state competitive cost, close customer interaction, customer input and quality as their competitive advantage, also supported in the literature for SMEs (Singh et al., 2008, Singh and Mahmood, 2014) . Similar competitive advantages have been expressed by interviewed firms in the leather and sports cluster, indicating that technological capabilities are not playing a differentiating role.

Leader firms (Table 6-19) show alignment between their competitive strategy and the operational attributes, which has been supported in the literature for better firm performance (O'Regan et al., 2006a, O'Regan et al., 2006b, Kadarusman and Nadvi, 2013). Firm L, dealing in selected gynaecological and dental instruments, has not exhibited a clear long term competitive strategy; it has not invested in new resources such as machines, which is now restricting its product range growth and thus limiting the number of customers it can approach, as mentioned by the interviewee and supported in the literature (Slater et al., 2011).

6.8.1.2 Analysis of CDIs introduced and resultant TCs upgrading in the interviewed surgical firms

From Table 6-19 it can be seen that the firm I has successfully developed learning by doing, learning by using and learning by interacting capabilities (Amara et al., 2008), which it is using successfully in electro-mechanical surgical instruments to reverse-engineer products. Firm J is supplying to a multinational based in Germany, which is the source of upgrading of the firm's technological capabilities. The firm only invests in purchasing new machinery as per the requirements of the customer and saves costs on marketing and finding new customers. Firm K has developed a large product portfolio, does not train its employees, and is trying to develop its own brand name in European countries for better returns.

The successful assimilation of new expertise by firms I and J demonstrated that they have a TIC level, which was successfully exploited by firm executives for improved processes and products. However, in the above mentioned cases the sources of upgrading have been the foreign customers, with no input from local sources as also admitted by GOP in their recent technology policy (Pakistan, 2012). The input from government sources could help in identifying potential new technologies and markets for exploiting, having shorter product development times and better marketing techniques.

6.8.1.3 Local cluster and other regional clusters' TCs effect on the interviewed firms TCs upgrading

All the interviewed firms claim to have benefitted from their cluster infrastructure, while firms I and J claim to have also added to the cluster technological capability by introducing new CDIs to the local surgical instruments cluster. The firm K explicitly states that it hires from the local cluster to gain access to new expertise. Thus, the cluster seems to be a melting pot which first assimilates new expertise and then disseminates it in the cluster, as also supported in the literature (Porter, 1998, Nadvi and Halder, 2005, UNIDO, 2014a).

Firm K's executive mentioned that surgical cluster has benefitted from automotive cluster at Lahore, another nearby regional cluster. Computerised Numerically Controlled (CNC) machines were introduced in Lahore for die making, which quickly found its way to Sialkot and has helped the cluster to achieve quick turnaround times. Nadvi and Halder (2005) mention that small surgical instrument firms manufacturing mature products in Tuttlingen, Germany have given up manufacturing because of the increasing labour costs, moved to marketing and are sourcing from Sialkot, Pakistan and other cost competitive countries. A similar trend has been observed in the surgical instrument cluster in Sialkot, as recently reported in the press (Mansoor, 2011d, Mansoor, 2011c).

The quasi-hierarchical relationship of firm J with an international manufacturer at Tuttlingen, Germany confirms the findings of Humphrey and Schmitz (2002) that being part of global value chain (GVC) inhibits functional upgrading but still they are a source of new expertise in the cluster.

6.8.1.4 Role of government and different institutions in TCs upgrading of the interviewed firms

No mention was made in the interviews of inter-firm or research institute contact, and it appears that emphasis is on learning by doing on the shop floor or learning by interacting with the customer or market, as also reported in interviewed leather goods and sports goods firms

(TRTA, 2014b, UNIDO, 2014a). The research data also relates to the discussion in chapter 5, in which the general capabilities level of Sialkot surgical cluster was ascribed to a few surgical clusters in Europe.

6.8.1.5 Recommendations of interviewees for increasing firms/ cluster performance

The surgical instrument cluster depends upon local and imported SS for instruments manufacturing but firm K's executive insisted that if local steel manufacturers are helped by the government for better quality SS manufacturing, it would improve the cost competitiveness of surgical instruments cluster as well. Further, the mature firms at Sialkot surgical instruments cluster are requesting the Government of Pakistan help them build firm image and brand names at international level for better value appropriation (Mansoor, 2011d).

6.9 Summary

This research required identifying the level of CDIs initiated and factors affecting CDIs initiated in the interviewed firms existing in clusters. Thus, certain research tools were developed: semi-structured interview, CDI table, CDI categorisation table, firm categorisation table and time line, to operationalise the TIC model and extract the required information during the field research.

The semi-structured interview identified CDIs initiated by the interviewed firms in the context of their business strategy, existing capabilities and business environment. In this chapter, as per data analysis design defined in chapter 4, analysis at CDI, firm and cluster levels were performed which helped to identify the interviewed firms resources, CDIs initiated, factors affecting CDIs on the basis of which TIC level of interviewed firms were determined and firms were categorised as either leader, follower or reactor. The data analysis also identified that local firms were exploiting their respective clusters capabilities but the CDIs did not show any inter-firm cooperation, as also identified in the extant literature on Sialkot clusters (Nadvi and Halder, 2005, TRTA, 2014b).

The time line, a research tool, tracked the technological capabilities identification, acquisition and exploitation in the interviewed firms, over the period of their operation. The shop floor visit helped to physically support the claims made in the interviews and assess the physical resources of a firm. Firm brochures and pamphlets also helped to validate the interview details.

The data analysis showed that most of the leader firms claimed that their firms had been the source of new expertise in their respective clusters. Across all the interviewed firms, major emphasis of CDIs were on achieving economies of scale and scope and upgrading process capabilities for improved quality products, which is generally not a source of sustained technological competitive edge at international level (Pietrobelli and Rabellotti, 2011, TRTA, 2014b).

Further, the interviewed firms generally listed the challenges facing Sialkot firms as: prevailing socio-economic conditions in the country, non-alignment of local vocational institutes' syllabus to local market needs, and lack of government interests in promoting the local manufacture of raw material for the Sialkot industry, also indicated in extant literature on Sialkot clusters (TRTA, 2014b, TRTA, 2014a). In the next chapter, cross-cluster interviewed firms' analysis point out common themes, enablers and limiters in the interviewed firms' capabilities upgrading process for sustained competitiveness.

7. Cross-Cluster level data analysis of the interviewed firms

7.1 Introduction

Following the data analysis technique defined in chapter 4, this chapter extends the level of data analysed in the previous chapter to cross-cluster level.

Section 7.2 identifies the common characteristics of the interviewed firms. Further, the section identifies the types of CDIs introduced across the twelve interviewed firms. Next, the section discusses the categorisation of interviewed firms as leader, follower or reactor and their characteristics. Finally, the section describes various actors and factors which affected interviewed firms TIC levels and TCs upgrading. Thus, Section 7.2 helps to answer the RQs in chapter 9.

Section 7.3 compares the research results with the literature on Gujrat fan cluster (Qureshi et al., 2004) and farm equipment cluster near Daska (Caniels and Romijn, 2003) to help validate the research findings. A comparison of SME capabilities literature on Pakistan is also made with SME capabilities in England in section 7.4. The chapter summary is presented in section 7.5.

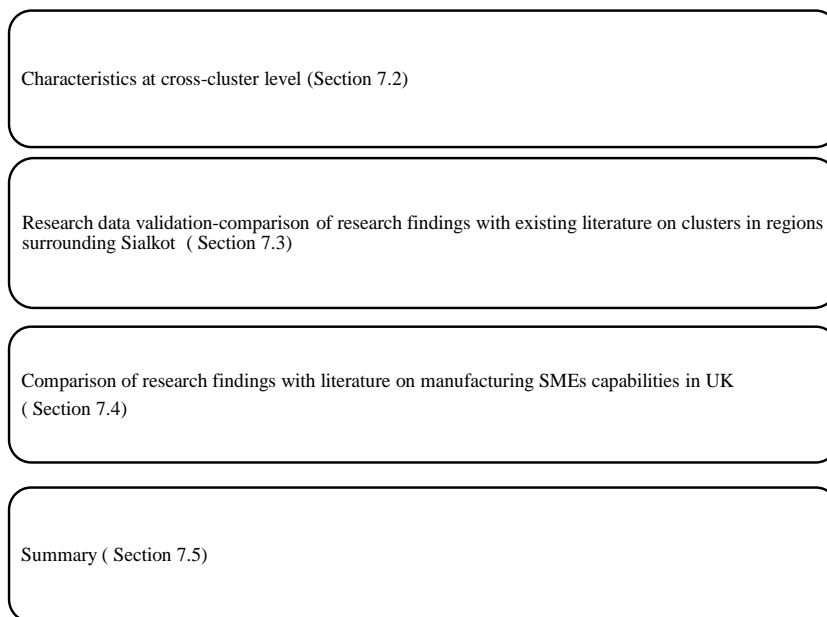


Figure 7-1: Chapter layout

7.2 Characteristics at cross-cluster level

The data from the twelve interviewed firms along with the information from their brochures and websites and extant literature on Sialkot clusters are collated together in this section to identify

common competitive characteristics and TCs of the interviewed firms. Further, various types of CDIs introduced across the interviewed firms are also collated which shows the general focus of SMEs' CDIs for attaining competitive edge. Finally, the role of internal and external factors and actors affecting capabilities upgrading process in the interviewed firms are also analysed in this section.

7.2.1 General competitive characteristics of the interviewed SMEs

7.2.1.1 Cost competitiveness and flexibility

First, all the interviewed firms described cost competitiveness, order flexibility, quality consciousness and close customer interaction as a part of their competitive strategy, also mentioned in SME literature (Ahmad, 2012d, Pakistan, 2012, Singh and Mahmood, 2014). Firm D (Leather cluster) executive states: *'We accept orders as per the firm's operational capacity so as not to compromise on quality.'* Firm I executive (surgical instruments cluster) states their competitive strategy as: *'Quality product and service differentiation.'* All these common competitive characteristics have been described as part of operational production competence in the literature (Vickery et al., 1993, Szász et al., 2015) but from the data gathered it appears that these are the minimum operational capabilities required to be in the business in a cluster, at least for the interviewed firms.

7.2.1.2 Focus on operational improvements

Second, most of the CDIs relate to process or operational improvements (Table 7-1), which generally have been initiated in the interviewed clusters through international customers' feedback. Firms E and G from the sports goods cluster specifically mention international collaboration in improving their products. Also, the sports goods cluster owes its expansion into sportswear to multinationals which started purchasing from Sialkot in early 1980s (Dasanayaka and Sardana, 2010a). Firm I specifically mention that it is original equipment manufacturer (OEM) for a multinational firm based in Tuttlingen, Germany, and the expertise for new products is transferred by the customer. The interviewee also claimed that his firm is a source of new expertise in the local surgical instruments cluster. The literature on the Sialkot surgical instruments cluster also mentions that its technology upgrading happened through joint collaboration with Tuttlingen, Germany (Nadvi and Halder, 2005).

7.2.1.3 Low value-added markets targeted

The interviewed firms are targeting low-value added markets, mostly in North American and Europe, and have not been able to target more value-added markets as also mentioned in literature (Pakistan, 2012). Firm A's (Leather cluster) executive said that they are not able to

move to higher value market such as fashion industry because: *'In the fashion garments industry there are frequent changeovers for which a strong management is required to take immediate decisions, which is lacking at the moment.'* Firm G (Sports cluster) executive stated that they are targeting low to medium market segment. Firm I and J interviewees' stated that their firm manufacture reusable instruments. The literature on Sialkot surgical instruments (Nadvi, 1999b, Nadvi and Halder, 2005) mentions it is manufacturing non-reusable, relatively cheap and high volume instruments as also validated from the Sialkot's surgical cluster website (SIMAP, <http://www.simap.org.pk/>).

7.2.1.4 Firm performance metrics

Finally, retaining and increasing customer base, finding new markets are the measures of firm performance for executives interviewed. Firm F's executive (sports sector) comments: *'Growth should be in money as well as in the firm's image as a responsible firm.'* When the interviewee of firm A was asked how they measured firm performance? He replied: *'By revenue earned.'*

7.2.2 CDIs types and resultant TCs upgrading in the interviewed firms

An analysis of various types of CDIs carried out by the interviewed firms are now discussed (Table 7-1) to categorise the learning capabilities, the level of TIC achieved and the type of TC upgrading achieved- whether process or product, by the interviewed firms.

The first type of CDIs related to improving productivity and quality in the manufacturing process to bring existing manufacturing capabilities in the firms to the level required for targeted international markets. This was mostly achieved through international collaboration and hiring foreign consultants requiring 'learning by training' and 'learning by interaction' capabilities resulting in process improvement.

The second type of CDIs relate to functional integration: upward and downward of supply chain. For upstream integration, interviewed leather goods and sports goods firms installed tanneries and spinning mills for in-house consumption, drawing upon the expertise available in the textile and tannery clusters around the Sialkot region. Thus, interviewed leather goods and sports goods firms displayed 'learning by interaction/ training' capability. For downstream integration, the interviewed leader firms in the leather goods and surgical instruments clusters have been involved in developing a brand name in foreign markets (Mansoor, 2011d).

The third type of CDIs relate to assimilation of manufacturing activities which have been previously outsourced by firms. Firm I mentioned a CDI where a micro firm was repeatedly failing to give a consistent quality in the delivered items. The firm purchased the resources and

developed the capability to manufacture the item with only five percent rejection rate. The continuous quality control problem with micro firms is also mentioned by the firm C and wants the government to initiate some training to increase their quality control in manufacturing operations. The literature (Porter, 1998, Nadvi and Halder, 2005) also mentions that increasing the skills of a constituent of a cluster increases cluster's overall competitiveness.

The second and third CDI types indicate that accumulation of infrastructure is being used by the leader firms, as a competitive tool as it helps them in value appropriation and quality control (Baines et al., 2005, Pakistan, 2012).

The fourth type of CDIs relates to gaining international accreditations. The interviewed firms are exporting to different markets, which require different accreditations. A few firms have invested firm resources in training their employees and changing the firm culture to acquire international accreditations such as 'Fair trade certification' and '510K', which opened new markets and customers for these firms. Also, many of the leader firms were first to acquire different accreditations thus establishing themselves in the new market and enjoying maximum rent appropriation before other competitors caught up (Grant, 1991, Pakistan, 2012).

The fifth type of CDIs relates to process upgrading i.e. increasing the skill contents of existing processes to improve existing products or manufacture new product range for better value-added markets. Only the firms A and F have mentioned CDIs which demonstrate the upgrading of their existing technological capability through in-house learning.

The sixth type of CDIs relates to reverse engineering. Only firm I visibly demonstrated through its CDIs that it has developed a shop floor level 'learning by using' capability. Finally, **the seventh type of CDIs** deals with expansion of operations overseas, and firms F and H have successfully established their manufacturing presence abroad in other developing countries. A similar endeavour by the firm G to run a manufacturing concern in Europe failed.

Generally on the basis of learning capabilities displayed in the above CDIs, we could categorise the general TIC level of the interviewed firms as at acquisition level, where the upgrading in the CDIs generally relate to manufacturing processes (Table 2-3). Thus, the TCs are of basic production level (Lall, 1992).

	CDI types		Learning capabilities required/ displayed: Cohen and Levinthal (1990)	Categorisation of TIC: Lall (1992)	Sources (drivers) of CDIs	Outcome of CDIs	TC upgrading due to innovation: Humphrey et Schmitz (2002)	Interviewed firms involved
1	Productivity and quality improvement-		Learning by interacting/ training	acquisition	International collaboration, hiring foreign consultants	Better quality footballs, hockey sticks	process improvement	A, E, F, G, H
2	Functional integration	Leather tannery, effluent treatment plant	Learning by interacting	acquisition	From other regional clusters	Improved/ consistent quality, bulk volume handling capacity, CSRs	Operational improvement/ integration	A, B, E, F
		Marketing under firm's name			Individual, firm level effort	Better revenues	Operational improvement/ integration	A, B, K
3	Reducing out-sourcing		Learning by doing	acquisition	Weak capabilities of suppliers	Consistent quality	Functional appropriation /process improvement	I
4	Attaining international accreditations		Learning by training	acquisition	Internal R&D, market feedback, foreign consultants	510 K, Fair trade certification	New markets and customers	F, I
5	Fashion accessories		Learning by doing	assimilation	Tacit knowledge accumulated in a firm	Fashion accessories	Process improvement	A, I
6	Producing products given by customers		Learning by searching/ using	acquisition	Tacit knowledge accumulated in a firm	Increasing product portfolio	Process improvement	I
7	Setting up overseas manufacturing concerns		Learning by interacting	acquisition	Better business environment overseas	Establishing operational concerns near export markets	New markets	F, H

Table 7-1: Various types of CDIs carried out in the interviewed firms

7.2.3 Interviewed firms categorisation as leader, follower or reactor type based upon their resources, CDIs and TIC level

Based upon the literature review (Humphrey and Schmitz, 2002, Amara et al., 2008) and data analysis in chapter 6, the interviewed firms' CDIs were classified as: radical, major or minor (Table 4-6). Next, analysis of individual firms' CDIs and timelines helped to identify individual firm's TIC level, as discussed in chapter 6. Further, based upon the CDIs adopted, TIC level and visible resources (infrastructure, machines, employees, accreditations, product portfolio, etc) of each firm, three firm types were identified.

7.2.3.1 Leader firms

Leader firms generally claimed to introduce radical or major CDIs to the cluster and have broad product portfolio. Most of the interviewed firms in the sports goods cluster and surgical instruments cluster have been categorised as leader type, while only firm A in leather cluster emerged as a leader. The interviewed leader firms targeted specific market and customer segments, and have built and invested in capabilities accordingly. For instance, firm A has capabilities which allow it to cater to bulk order customers, which its local competitors cannot match. Firm F has an environment friendly image backed by requisite capabilities. Firm I wants to develop an innovative image. Thus, it has a reverse engineering capability and constantly adds to its product range. Firm E exploited the Sialkot sports goods cluster to a maximum by developing a broad product range with the help of international collaborations. In sum, these firms enunciated a clear business strategy and adopted CDIs accordingly. Further, based on the information provided in the interviews and shop floor visits, the leader firms were generally found to be in robust resource and financial health.

7.2.3.2 Follower firms

Follower firms normally copied CDIs already existing in the cluster and had a selective product portfolio. Firm B copied all the CDIs from the local leather cluster and believes that it cannot grow beyond a certain optimal size otherwise it would become unprofitable. Similarly, firm D has a limited operational capability and absorbs selective capabilities from the cluster.

7.2.3.3 Reactor firms

Reactors firms did not introduce any CDI to the cluster and generally had a limited operational capacity. The reactor firm C could not state a clear strategy and failed to explain how a costly initiative of employing a foreign consultant added to its competitive advantage. Similarly, the reactor firm L mentions not investing in firm capabilities when technology in the surgical

instruments cluster was changing, thus presently affecting firm's production capacity and product portfolio.

In sum, the interviewed follower and reactor firms could be categorised as opportunistic: they don't impart any training to their employees, have a limited product range, and cater to small time customers. Also, the interviewed reactors and followers did not contribute to their cluster capabilities, but have cleverly managed the opportunities available in their respective cluster to maintain an efficient and profitable firm.

7.2.4 External actors influence on interviewed SMEs TCs upgrading process

Drawing upon the findings of chapter 6, this section discusses various external actors (Table 7-2) which influenced interviewed SMEs TCs upgrading. As discussed in the literature review chapters 2 and 3, these external actors constitute the local culture in which firms are operating and were part of the Figure 3-2, which details various factors affecting TCs upgrading process of an SME.

7.2.4.1 SME executive's influence on firm strategy

Much literature has been written on the role of executive in a firm's performance (O'Regan et al., 2006b, Noke and Hughes, 2010, Hsu et al., 2013) and the present data analysis supports leadership influence on a firm's performance. Firm B has a follower strategy because the executive thinks: *'Business does not allow the firm to grow any bigger, which would then become unsustainable.'* Similarly, when firm D executive was asked: what makes a firm more competitive compared to its local customer? He replied: *'Leadership difference and vision.'* Likewise, firm A interviewee thinks that the firm's potential is limited by the structure of the firm, which is highly centralised. Thus, firm strategy, capabilities accumulation, markets targeted which constitute a firm's culture in an SME is influenced by executive's disposition. Therefore, SME executives were interviewed for investigating TCs upgrading process in firms over their period of operation. Recently, Pakistani entrepreneurs have been emphasising the role of leadership in growth of firms and their profitability (Ahmad, 2013a).

7.2.4.2 Business environment

The type of business a firm is in also seems to affect firm's acquisition of capabilities. For instance, the surgical firms did not show any CDIs of vertical integration probably because incorporating even a small steel mill is a costly option. One surgical executive commented: *'Having a local supply of good quality local stainless steel (SS) would help in becoming more cost competitive.'* However, the leather and surgical sector have incorporated vertical upstream integration to varying scales depending upon their business strategy and operations requirement.

Also, the interviewed sports and surgical firms were found to be more aggressive than leather firms. Most of the sports goods and surgical instruments firm were categorised as leader firms. With international collaboration, interviewed surgical instruments and sports firms and their respective clusters are manufacturing items which are used throughout the year; therefore they have shown better growth. However, the interviewed leather firms did not show any foreign collaboration and are mainly manufacturing products such as motor bike garments which are generally used in summer. This sort of performance gap could be closed if foreign and local collaboration is facilitated in the leather sector for technology upgrading and broader product portfolio.

		CDIs	International Customer and market feedback	Vocational institutes	Regional and local clusters	Government/ development agencies
Leather Cluster	Firm A	Foreign consultants	Yes	No	*Yes	No
		Tannery	Yes		Yes	No
		Fashion accessories	Yes	No	*Yes	No
		Marketing	Yes	No	No	No
	Firm B	Tannery	Yes	No	*Yes	No
		Garment manufacturing	Yes	No	*Yes	
		Motorbike boots	Yes	No	*Yes	No
	Firm C	Saddle bags quality	Yes	No	*Yes	No
		Foreign consultant hiring	Yes	No	No	No
		Motorbike garments quality	Yes	No	*Yes	No
	(Group of companies) Firm D	Sports firm	Yes	No	*Yes	No
		Leather firm	Yes	No	*Yes	No
Sports accessories firm		Yes	No	*Yes	No	
Sports cluster	Firm E	Hockey sticks	Yes	No	*Yes	No
		Football	Yes	No	*Yes	No
		Artificial leather football	Yes	No	*Yes	No
		Sports accessories	Yes	No	*Yes	No
	Firm F	International accreditation	Yes	No	No	No
		Foreign consultant	Yes	No	No	
		Foreign consultant	Yes	No	No	No
		International manufacturing	Yes	No	No	No

*In these CDIs, semi-skilled manpower existed in the firm/ cluster

		CDIs	International Customer and market feedback	Vocational institutes	Regional and local clusters	Government/development agencies
Sports Cluster	Firm G	Improved quality control	Yes	No	*Yes	No
		Better quality footballs	Yes	No	*Yes	No
		Cooperation with Adidas	Yes	No	*Yes	No
	Firm H (Group of companies)	International investment	Yes	No	No	No
		Professionals	Yes	No	Yes	No
		International manufacturing unit	Yes	No	*Yes	No
		Invested in windmills	Yes	No	No	No
Surgical instruments cluster	Firm I	Product customisation	Yes	No	No	No
		Reverse engineer a product	Yes	No	No	No
		International accreditation	Yes	No	No	No
		Reverse engineer a product	Yes	No	No	No
	Firm J					
	Firm K	Brand name in Japan	Yes	No	No	No
		Developing presence in Europe, USA	Yes	No	No	No
Firm L	Improvements based upon customer feedback	Yes	No	No	No	

*In these CDIs, semi-skilled manpower existed in the firm/ cluster

Table 7-2: Role of various external factors in the interviewed firms' TCs upgrading

7.2.4.3 International customers and market feedback on CDIs

The literature on the Sialkot surgical instruments cluster support that technological capabilities of the cluster were augmented by collaborating with Tuttlingen surgical instruments cluster, Germany (Nadvi and Halder, 2005, TRTA, 2014a). The literature on the Sialkot sportswear cluster also mention that technological capabilities of the cluster were augmented from collaboration with international manufacturers such as Adidas, Puma, (Dasanayaka and Sardana, 2010a). Accordingly, many firms such as A, E, I and J, mention improving their processes and products through customer collaboration and feedback (Table 7-1).

Further, many interviewed leader firms attend international exhibitions to find new customers, new markets and explore chances of collaboration for new or improved processes or products. The information from leader firms is disseminated in the cluster (local market), from where competitor firms pick up the expertise, as also mentioned in the literature (Nadvi and Halder, 2005, Pakistan, 2012) and acknowledged by various interviewees.

It was observed that among the firms which entered into a supplier-customer relationship did not develop marketing capability such as firms E and J, as supported by Humphrey and Schmitz (2002). Firm E is supplier to an international manufacturer in Europe, which shares its expertise with firm E for new products, and firm E does not independently market its products.

In the Scandinavian countries, environmentally friendly products are a major topic of concern among customers. Exploiting this, firm F is targeting environmentally friendly customers by investing in an environmentally friendly image. Also, all the interviewed firms, especially the leader firms, were paying significant attention to the welfare of their workers, which also serves to the sensibilities of the export market to which they are exporting.

Thus, international customers' feedback and collaboration have played a major role in increasing the existing technological capabilities of interviewed leader firms as shown in Table 7-2 and also supported in the literature (Laforet and Tann, 2006, Pakistan, 2012). Therefore, governmental and regional development agencies should be promoting and sponsoring cluster specific technology transfer from abroad.

7.2.4.4 Role of local vocational institutes in CDIs

All the interviewed firms were dependent upon their local cluster for the supply of semi-skilled workforce, but all the radical improvements came with customers/ market feedback, cooperation and training as discussed in chapter 6 and summarised in Table 7-2. Only interviewed leader firms showed concern about the quality of workforce produced from the local vocational institutes, as firm I's executive commented: '*Existing vocational institutes*'

facilities and syllabus as outdated which could not train the apprentices to the current needs of the local market. It could be due to two reasons: first, they are involved in more knowledge intensive activities, which cannot be sublet out of the firm and hence require more than average skilled workforce. Second, leader firms are in collaboration with foreign customers, an activity which demand certain intellectual and artisan skills from the workers for interacting with the novel knowledge.

Also, no initiative for introducing the experienced (senior) workforce to the new technologies or techniques was recorded in the interviewed firms or found on developing agencies websites. The author was in a firm, where computers with Computer Aided Design (CAD) software installed were lying idle, because the SME executive remarked: *‘Experienced workers (foremen, draftsmen) preferred working with hands.’* Similarly, firm K executive narrates the difficulties he had while trying to map out the manufacturing processes of different items in his firm. He could not make senior workers of his firm understand *‘What is a process? Where one process ends and the other process starts?’*

7.2.4.5 Role of regional and local clusters on interviewed SMEs CDIs

From the data analysed in chapter 6, it could be said that all the interviewed firms benefitted from their local clusters. Various benefits of existing in the cluster were apparent i.e. access to a pool of semi-skilled labour, availability of complementary SMEs to support main SMEs operations, dissemination of expertise from leader SMEs into the cluster, access to banks and trade bodies, which are similar to ones pointed out by Porter (2000) and reaffirmed by others (Karaev et al., 2007, Kadarusman and Nadvi, 2013).

Some leader firms in different clusters also benefitted from adjoining clusters. The surgical instruments cluster assimilated die making capability on CNC machines from automotive sector in Lahore. The sports goods cluster hired experienced people in textile for sportswear manufacture from Lahore and Faisalabad, while the leather goods cluster hired expertise to run its tanneries from Kasur leather tanneries cluster.

There are also a few downsides to being in a cluster. First, there is constant factor or fear of dissemination of expertise in the cluster which can be a deterrent for investment (Caniels and Romijn, 2003, Pakistan, 2012). The present research shows that expertise of leader firms disseminated in the cluster. Firm A tries to retain its core work force with better pay cheques and facilities to limit the dissemination of expertise in the local leather goods cluster. However, firm C hired a worker from firm A to troubleshoot some of its quality problems in leather garments manufacturing. In one of its CDIs, firm G hired special people to stop the expertise from disseminating in the local sports goods cluster. Firm I claims that its workers are hired by

other firms. Firm K openly states its policy: *'We hire the best people from other firms on better wages to acquire new expertise.'*

Second, there were no horizontal linkages, one of the characteristics of cluster-geographically agglomerated SMEs. Such linkages help in resource leverage between linking firms. Thus, the government could be looking towards ways of increasing horizontal linkages among firms for better overall cluster performance.

7.2.4.6 Role of local government and different development agencies

²⁰This research did not find many instances of facilitating cooperation between industrial clusters and the knowledge generation sources by the development agencies as shown in Table 7-2. The government and various development agencies should target increasing TIC level of firms/ clusters which would increase the TCs of firms resulting in improved and new processes and products.

7.3 Research data validation-comparison of research findings with existing literature on clusters in regions surrounding Sialkot

For analytical generalisation, the present research findings are compared with the existing literature on two other regional clusters located around Sialkot: the farm equipment machinery cluster and fan cluster (Rana and Ghani, 2004). First, a brief introduction to the technological capabilities of these clusters is presented and then compared with the existing research findings.

7.3.1 Existing TCs upgrading literature on Gujrat fan cluster

Gujrat, a regional cluster near Sialkot, is home to the largest concentration of fan manufacturers in Pakistan. The Gujrat fan industry cluster has been a source of interest for Pakistani researchers (Qureshi et al., 2004, Rana and Ghani, 2004). The researchers point out that the cluster has a high level of specialisation with vendors manufacturing different components such as casting, fan blades, fan bodies. The raw material for the components is also available locally or from other regional clusters.

The cluster manufactured inexpensive fans for the local market, until a couple of firms' executives visited Japan and imported plastic manufacturing technology for fans. The firms assimilated technology through in-house learning. As the technology diffused in the cluster (Qureshi et al., 2004, Rana and Ghani, 2004), many vendors started offering plastic components to larger firms. The researchers (Qureshi et al., 2004, Rana and Ghani, 2004) point out that larger firms have (procured) machinery which helps them to perform functions which medium

²⁰ Mr Fouzan informed that they simply hold seminars for the SMEs' executives but do not have any plan for long term cluster development

or smaller size firms cannot perform. When a technology diffuses, these larger firms procure new technology for more sophisticated products. Thus, larger firms are the source of new knowledge and expertise in the cluster. Larger firms perform critical operations in-house, which is a consequence of the need to control quality.

However, the researchers (Qureshi et al., 2004, Rana and Ghani, 2004) suggested that for sustained competitiveness, the fan cluster has to continuously look for new technologies and international markets. The researchers recommend exploring linkages with other clusters for finding grounds of common interests and technologies. The researchers (Ibid) further pointed out that fan industry needs guidance in selection, assimilation and exploitation of appropriate technology.

7.3.2 Existing TCs upgrading literature on Daska farm equipment manufacturing cluster

Pakistan is an agrarian country with a majority of its population living in rural areas, which are involved in agriculture. The province of Punjab, especially central Punjab, is a fertile agriculture region and is known for its modern cultivation practices. Several farm equipment manufacturing clusters have sprung up around Punjab, among which Daska is the biggest cluster. It is close to the Sialkot region, and has been the interest of academics to study the effect of government interventions in increasing the cluster capabilities.

Various researcher (Romijn, 1998, Romijn, 2001, Caniels and Romijn, 2003) have worked extensively on the patterns of capabilities acquisition in developing countries clusters. Caniels and Romijn (2003) researching farm equipment manufacture clusters in Punjab noted that progressive farmers who imported new equipment into the country were source of information about new product designs for the local manufacturers. Also, exhibitions held by the government help to spread the information about new equipment in the industry. Thus, apparently, manufacturers developed a level of reverse engineering capability, which helps them to reproduce and repair new products and machinery. They point out that local cluster manufacturers are beset by quality and manufacturing problems, and incremental improvements are being made to rectify the problems.

Pointing out the shortcomings, researchers (Romijn, 1998, Romijn, 2001, Caniels and Romijn, 2003) say there is no tradition of cross-firm horizontal collaboration probably because of a lack of trust among competitors. However, there are vertical relations which are more of complementary nature. There is feedback from the buyer of equipment which helps to improve the equipment. However, the researchers note that there is no technological mapping of the entire exercise, and no government or trade body is involved which could facilitate the process of technology assimilation and improvement. The researchers point that some of the biggest

firms in Daska were approached by the Pakistani Government for technical collaboration in farm machinery prototyping with encouraging results. Also, some institutes have provided skilled manpower, according to the requirements of the cluster. Thus, the researchers sum up by saying that skilled manpower along with progressive firms should be a point of government intervention for technological upgrading of the clusters. Such interventions would help to disseminate new knowledge in the clusters.

7.3.3 Comparison of present research results with the extant literature on clusters around Sialkot

When the research findings are compared to those of literature on farm equipment cluster and fan cluster (Caniels and Romijn, 2003, Rana and Ghani, 2004), certain similarities emerge as shown in Table 7-3.

- i. First, in this research the leader firms (usually larger firms) brought new capabilities to their clusters. The leader firm J is an OEM for a manufacturer in Tuttlingen, Germany and claims to be the source of new expertise in the local surgical instruments cluster. Nadvi and Halder (2005) indicate that larger firms in the Sialkot surgical instruments cluster brought new expertise to their cluster in collaboration with Tuttlingen firms in Germany. Similarly, ‘progressive firms’ (Caniels and Romijn, 2003) found in the farm industry machinery clusters and ‘larger firms’ found in the Gujrat fan industry (Rana and Ghani, 2004) brought new expertise to their clusters. Thus, it appears that leading or progressive firms are generally responsible for bringing new knowledge, expertise and technology to the clusters, and thus keep their clusters competitive through dissemination of new expertise.
- ii. Second, the interviewed leader firms in this research relied on ‘learning by doing’, reverse engineering and ‘learning by interacting’ to incrementally remove the bottlenecks involved in assimilating new technology. A similar trend was reported in the farm equipment cluster.
- iii. Third, among the interviewed leader firms the emphasis is on creating barriers to competition through capital intensive equipment purchase and/ or upstream integration. Similarly, the behaviour of creating barriers to competition through capital intensive equipment purchase has been reported in the fan cluster.
- iv. Fourth, all the imported technologies are mature technologies in more advanced economies. There is no room for improvement in the imported mature technology. However, the manufacturing processes could be upgraded for better and more sophisticated products for markets in other developing economies, as done by firms A and I.

- v. Fifth, this research finds that some firms interviewed have drawn upon other regional clusters for furthering their capabilities. A similar trend has been found in the fan and the farm machinery industry.
- vi. Sixth, studies of the different clusters also indicate the weaknesses of micro firms to supply quality input for high-end manufacturers.
- vii. Seventh, there is no cooperation among the competitor firms, no contact between the clusters and local training institutions and a lack of government strategy to provide for TCs upgrading of the clusters.
- viii. Eighth, the researchers have given various suggestions to improve the technological competitiveness of their respective clusters. The existing literature (Nadvi and Halder, 2005, Bhutta et al., 2007, Fayyaz et al., 2009) on Sialkot has identified the need for upgrading of the TCs but does not provide any recommendations on the mechanism for technological upgrading. Regarding the fan cluster, the researchers (Rana and Ghani, 2004) recommended increasing the capability of technology identification, assimilation and exploitation but do not mention any steps for enhancing the TIC of the cluster which underpins capabilities management process. Romijn and Caniels (Romijn, 2001, Caniels and Romijn, 2003) have recommend increasing technological capabilities of 'progressive firms' in a cluster with the premise that capabilities from the progressive firms would percolate into the cluster, thus increasing the overall competitiveness of the cluster. However, the literature review in chapter 3 and this research findings show that leader/ progressive firms are inimical to the dissemination of their expertise to their local cluster to protect their competitive edge.

	Existing literature on Gujrat fan cluster	Existing literature on farm machinery manufacturing clusters	Interviewed SMEs
Firms bring expertise to the cluster	Large firms	Progressive firms	Leader firms
Sources (drivers) of innovation	Large firms which buy technology from abroad	Progressive farmers which purchase new technology from abroad	International customers and expositions, competitors
Shop floor scope for innovation	Assimilate the adopted technology	Reverse engineer the new technology	<ul style="list-style-type: none"> • Adopt new processes and products • A few improved the acquired capabilities for improved processes and new products (Firm A,F)
Collaboration among the firms	Non-existent	Non-existent	Non-existent
Collaboration with academic or R&D institutions	Not mentioned	Few instances mentioned	No interviewed firm mentioned any collaboration with any academic institution
Researchers suggestions for increasing cluster competitiveness	<ul style="list-style-type: none"> •Explore linkages with other regional clusters •Guidance in technology selection and exploitation 	<ul style="list-style-type: none"> •Increase the skill contents of the local workforce •Target progressive firms for technology upgrading 	<ul style="list-style-type: none"> •Increase learning capabilities of the cluster, which underpins TCs upgrading of firms •Moving scope of GoP initiatives to tacit knowledge generation and exploitation in clusters

Table 7-3: Comparison of present research analysis with extant literature on TCs upgrading in regional clusters around Sialkot

7.4 Comparison of research findings with literature on manufacturing SMEs capabilities in UK

A limited comparison is made between the research findings on capabilities management in SMEs in Pakistan with the TCs literature on manufacturing SMEs in England, as shown in the Table 7-4. In the present research conducted, the SME executive owners were asked about their firms' competitive advantage and capabilities underpinning it. The leader firm executives were successful in identifying their firm's competitive advantage, articulated a strategy for exploiting the business environment, and CDIs and capabilities were aligned with the firm's professed competitive priorities. All the interviewed firms were manufacturing mature products and competition was on providing quality product range at competitive prices.

However, it was observed that even when definitions of capabilities and competitive edge were explained to the interviewed executives, they (usually leader firms) related it to their operational efficiency and infrastructural capabilities which smaller firms in the cluster did not have. Similar confusion with capabilities and competitive edge definitions and concepts with SME executives in England are also reported by Bhamra et al. (2010). They interviewed (mostly senior managers) manufacturing SMEs for their professed capabilities and competitive advantage, and found that most of them stated organisational functions such as R&D, sales, quality as their perceived competitive advantage. The interviewees were also not aware of any available tools or techniques which could be used to identify any technological competitive edge in their organisation. The researchers (Bhamra et al., 2010) think that more time is spent by the organisations on mastering tools and techniques, which provide immediate benefits such as JIT and SMED. A similar trend has been observed in the interviewed clusters, where development agencies are promoting (and SMEs are receptive to) quality and productivity tools, which show immediate visible manufacturing and financial benefits. However, how much this contributes to long-term sustained competitive advantage is very much uncertain.

	Interviewed leader firms in Pakistan	Literature on manufacturing SMEs in England
Sources of innovation in process and products	Customers, market feedback	Customers, market feedback, internal R&D, academic cooperation
Types of innovation	Process or product technology adoption and assimilation	Process or product improvements
Awareness of competitive advantage	Yes	Yes
Awareness of capabilities and competitive advantage concepts	No	Yes
Awareness of tools and techniques used for identifying capabilities and competence	No	Need to be educated more

Table 7-4: Comparison of research analysis with the existing literature on UK manufacturing SMEs

Thus, developed country SMEs managers have an idea of capabilities and competitive advantage, although not clear. The managers are working towards achieving distinct competitive advantage compared to their competitors, but apparently lack the ability to identify tools to streamline their efforts. However, in this research, apparently developing country SME executives still need to be introduced to the capabilities and competitive advantage management topic. Even a few papers written by local researchers while exploring for capabilities of Gujrat fan industry (Rana and Ghani, 2004) treat competitive advantage associated with infrastructure, which competitors firms do not have. They start with Prahalad and Hamel's (1994) concept of competitive edge but end up only discussing manufacturing capabilities of different firms in Gujrat, without any indication if they possess any distinctive competitive advantage.

Researchers in England (Laforet and Tann, 2006, Oke et al., 2007, Noke and Hughes, 2010) identify incremental process and product improvements as the main focus of innovation activity, and market anticipation, customer focus, leadership as the drivers of innovation. This research also reveals market anticipation, customer focus and leadership were the drivers for incremental improvement in existing processes and products.

Also, the literature (Cetindamar et al., 2009b, Haeussler et al., 2012) defines the scope of TM in manufacturing SMEs as continuous innovation for new processes and product improvements,

with active involvement of academic and regional development agencies. In developing countries, the scope of TM has been described as capabilities assimilation from abroad and their improvement for better value-added processes and products (Morrison et al., 2008, Parrilli et al., 2013), but in the research conducted SMEs were more involved with capabilities acquisition, with no visible sign of assimilation and innovation of acquired capabilities.

7.5 Summary

In this chapter, the interviewed clusters were cross-compared to identify common competitive characteristics, types of CDIs carried out and characteristics of identified categories of firms: leader, follower and reactor. From cross-cluster analysis it becomes clear that competitive characteristics such as high productivity, quality and cost competitiveness are common across all the interviewed SMEs especially leader firms. Therefore, these characteristics can be said as the minimum criteria for being in the business in a cluster but not a source for sustained competitiveness, as soon all the competitors assimilate/ learn these characteristics, especially in a cluster. All the interviewed firms benefited from existing in clusters, something also supported in the literature (Kadariusman and Nadvi, 2013). Further, various external factors affecting capabilities upgrading process were also identified. Based upon the data analysis of chapter 6 and chapter 7, the next chapter consolidates the contributions of the research at theoretical, managerial and policy level.

8. Contributions and Recommendations

This research explored TIC levels of low-tech, manufacturing SMEs in Sialkot to understand how the TCs of interviewed firms could be upgraded for better value-added processes and products. Further, the research validates and adds to the existing TC upgrading literature on manufacturing SMEs in Sialkot, and suggests new avenues to firm executives and policy makers for upgrading firms' and their respective clusters' TCs. This chapter's layout is shown in Figure 8-1.

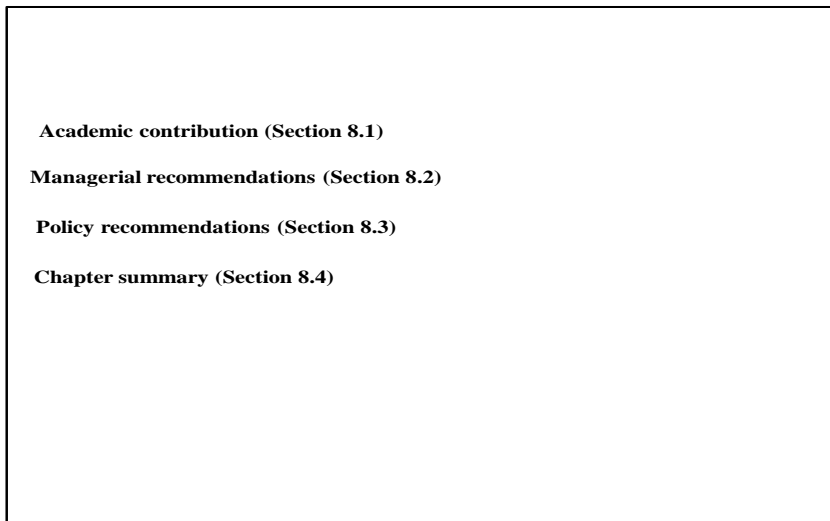


Figure 8-1: Chapter layout

8.1 Academic contribution

8.1.1 Development of a TIC assessment model to investigate the TIC level of manufacturing SMEs existing in clusters in Sialkot

The assessment of the TIC level in firms and sectors help policy makers to design mechanisms to focus resources in areas of greatest need through the appropriate selection of policy mechanisms as well as a targeted design of policy. Various TIC models discussed in the literature review chapters generally define TIC and then propose a methodology to assess a firm's TIC through various indicators for TCs management. However, generally, these TIC models give a cross-sectional view of TIC level of a firm / sector at any given time. Recently, academic literature has stressed to take a longitudinal view of TCs management to better understand the mechanism of innovation acquisition and exploitation in a firm. Further, these

TIC models are generally designed for developed economies where emphasis is on new knowledge generation and exploitation for sustained competitive advantage.

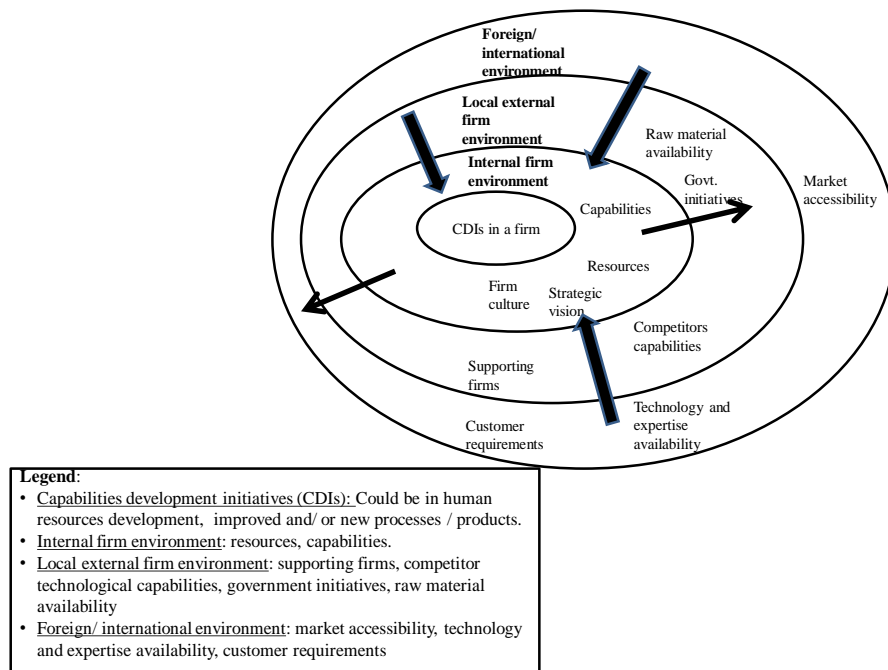


Figure 8-2: TIC model

Therefore, this research developed a TIC level assessment model which, instead of taking snapshots, took a retrospective, longitudinal view of TCs management (upgrading) process in the interviewed firms. The TIC assessment model analysed how individual CDIs (process) was acquired in a firm, and how successive CDIs were acquired in the context of firm's inner and external environment (processual view). The model identified the TIC level of interviewed firms through CDIs, which the interviewed firms had initiated over their operational life. The identification exercise helped to categorise whether the firm was in the acquisition, assimilation or innovation phase, and what type of CDIs were being taken (Table 7-1), as discussed in chapters 6 and 7.

8.1.2 Amendment to Lall's (1992) model

The TIC model, qualitatively, identified the level of TIC existing in interviewed firms as per Lall's (1992) categorisation. The tool showed that most of the interviewed firms acquire/ possess basic operational (production) capabilities, are trying to integrate along the supply chain but have not been able to upgrade their acquired TCs for improved processes and products (Table 7-1). Also, the interviewed firms acquired their basic production capabilities from abroad or from each other for improving quality and productivity (Table 7-2). Thus, generally,

as per Lall's model (1992) the interviewed firms are in the TCs acquisition phase (Table 2-3). Further, based upon interviewed firms' resources, their CDIs, business strategy, existing capabilities, product portfolio (Table 4-8), interviewed firms were categorised as leader, follower or reactor (7.2.3). Hence, Lall's model (1992) was amended for Sialkot specific interviewed clusters, as shown in Figure 8-3. The modified model shows that within the acquisition stage, categories of firms exist with different TCs and characteristics. Therefore, firm managers and policy makers need to identify each firm's category in order to take more informed decisions to provide a better enabling environment for TIC and thus TCs upgrading.

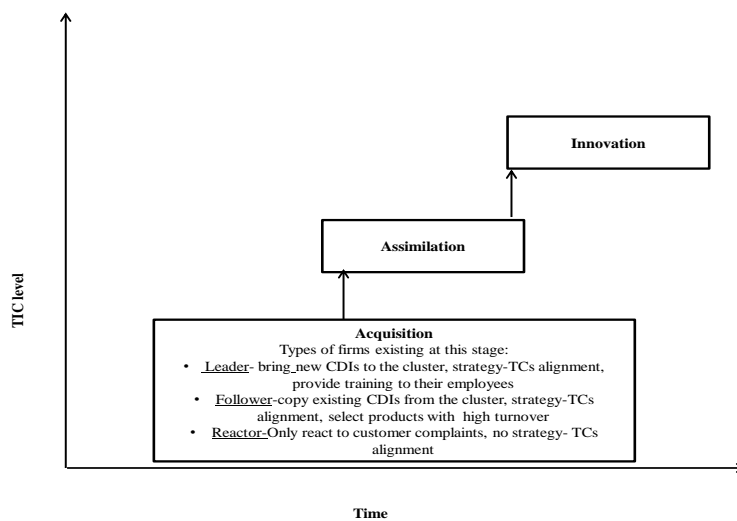


Figure 8-3: Amended Lall's TIC model (1992) at acquisition stage

8.2 Managerial recommendations

Several managerial recommendations could be enumerated. First, most of the interviewed firms termed quality, cost competitiveness, close customer interaction as part of their competitive edge. Thus, it can be said that these could be the minimum operational criteria to be successful in a business over the long term in a cluster. Second, executives need to ask that apart from these operational characteristics, what else should separate their firm from competitors and the firm should try to develop that 'what else' capability. Third, the firm executives measured their firms' performance in terms of number of customers, markets accessed but they were not addressing competition at the international level, although this was also not the agenda of the research.

Fourth, firm executives were not aware about technological capabilities and technological competitive edge concepts, and they defined their firms' resources as part of their competitive

edge. Therefore, managers need to be educated about the TCs management (upgrading) process: identification, acquisition, assimilation, development and exploitation of firm specific technological capabilities. Fifth, the time line helped to see if successive CDIs are aligned to a firm's business strategy and have contributed to firm's technological competitiveness. Therefore, firm managers should be using this time line tool to map his/ her firm's technological capabilities contributions to their firm's competitiveness. Further, CDIs and time lines would also help managers to see if their firm is a leader, follower or a reactor and if they have structured their firms accordingly.

8.3 Answer to the main research question of the research: policy recommendations for TCs upgrading of interviewed firms and their respective clusters

To understand intra-firm knowledge accumulation and TC upgrading through internal R&D and external linkages, researchers have suggested taking a broad-based approach to the innovation process which includes input from suppliers, customers, competitors, consultants and development agencies (Edwards et al., 2005, McAdam et al., 2007, Morrison et al., 2008, Pietrobelli and Rabellotti, 2011).

In the context of export-oriented SME clusters of Pakistan, the GoP and various international agencies have carried out various technical and policy level studies to study the strengths and weaknesses of these clusters, and have made various recommendations, as discussed in section 5.4. Keeping in view the existing technical and policy reports and our research findings, this section gives recommendations for practical interventions for TCs upgrading of interviewed firms and their respective clusters. In general, at policy level government should be talking to all the cluster stakeholders, such as trade bodies, SME executives and development institutions, in one language - technological capabilities upgrading and exploitation. Correspondingly, a regional capabilities roadmap and its milestones may be developed in consultation with all the local stakeholders. The possible role of various stakeholders is discussed below.

8.3.1 Role of supporting micro and complementary firms for TCs upgrading in the interviewed Sialkot clusters

Quality control and supply chain management were the areas in which previously outsourced operations were internalised by certain interviewed firms, as commented by firm I's executive: '*We bought the machine and started manufacturing our own components as our supplier could not provide consistent quality.*' The incorporation of certain manufacturing processes due to weak manufacturing capabilities of the suppliers is also mentioned by Nadvi (1999a) in his research on surgical instruments clusters in Sialkot. The executive of firm C also talks of weak quality control in micro firms. The technical and policy documents on export-oriented clusters emphasise on quality assurance, productivity (Ahmad, 2013f, TRTA, 2014b, TRTA, 2014a).

This research further highlights that for SMEs to achieve consistent quality, micro firms in clusters also need to be supported so that they can constantly provide quality inputs to larger firms. Therefore, increasing the capability of micro (supporting) firms would help to increase the competitiveness of exporting SMEs and by extension their cluster.

Further, all the manufacturing firms need raw materials and the research indicated that across the interviewed firms, the interviewees argued (for instance firm C's interviewee) that availability of quality local raw material would increase the cost competitiveness of local businesses. Therefore, the government could support industry manufacturing raw material for these export-oriented firms for cost competitiveness.

8.3.2 Role and scope of development agencies for TCs upgrading in the interviewed Sialkot clusters

8.3.2.1 Present role of development agencies

In Pakistan, various developmental agencies have been specifically established to facilitate SMEs. SMEDA and TUSDEC generally work on providing market access, standardisation, technology upgrading, and project feasibility reports for SMEs, as discussed in section 5.3 in Chapter 5. The existing TCs upgrading literature on Sialkot discussed in section 5.4 or the research CDIs data also do not indicate inter-firm cooperation for TCs upgrading. Additionally, SMEDA's or TUSDEC's websites do not provide any information on cross-cluster cooperation for knowledge and technology sharing.

Further, these development agencies work at clusters' level with the help of foreign donor agencies to improve quality control and standardisation (Zaidi, 2006, Ahmad, 2014d). UNIDO and European Union have done extensive work on cluster development in Pakistan in general and on Sialkot clusters in particular (Khan, 2012). UNIDO's focus (UNIDO, 2011) has been aligned with the research findings, where interviewed firms are more focused on acquiring technology to improve quality of their existing products and processes. However, this focus of local and foreign development agencies is not a sure recipe for sustained competitiveness at international level (Pietrobelli and Rabellotti, 2011).

SMEDA and TUSDEC also have set up Common Facility Centres (CFCs) (Ahmad, 2012c), a theme imported from developed countries, in different industrial clusters to provide the latest technology to resource constrained SMEs. However, it is not clear how these would be fiscally sustained in the long run, when a similar role could have been played by vocational institutes already established in the industrial clusters. Having the latest machinery and training at the institutes would have resulted in better trained manpower, benefitting the local cluster as also

suggested in the literature (Porter, 1990, Ahmad, 2015). Apparently, CFC is a duplication of job/ responsibilities which burden the already scarce resources of a developing country. Therefore, the ideas that are brought from other countries should be transplanted and implemented according to local conditions and with a relevant vision.

8.3.2.2 An agenda for development agencies

The research exhibited a few shortcomings of the interviewed firms. Some of the interviewed firms relied on few customers, others did not do active market research, some had a misalignment between business strategy and operational attributes, and still others displayed a reactive rather than a proactive approach to their business. One executive did not invest back in the firm resources for new technology and the lack of investment now inhibited the firm's efforts to expand its product range. Finally, there was no inter-firm collaboration reported in this field research. Such shortcomings could be the initial agenda of the development agencies when contacting different firms and clusters.

Further, in this research those SMEs were interviewed which are part of global value chains (GVCs). A few of the interviewed firms were trying to move into marketing their own products (Ahmad, 2013d), some were supplying to independent foreign customers, while others are a part of a foreign supply chain. These findings are similar to those identified in the existing literature on Sialkot clusters (Pakistan, 2012, UNIDO, 2014a), which helps in research data validation. Firm E explained that if the government helped in technology acquisition from customers, as also recommended in government technology policy (Pakistan, 2012), they (SMEs) could be in a better position to target better value-added markets. Therefore, this could be another possibility that should be on the agenda for development agencies.

8.3.3 A roadmap for TCs upgradation of clusters and their constituent SMEs

New knowledge generation capability is one source to manufacture better value-added processes and products to access higher value-added markets (Pietrobelli and Rabellotti, 2011, Li and Liu, 2014). But, generally, the interviewed firms were not involved in knowledge generation activities such as R&D and reverse engineering, nor are governmental development agencies facilitating any such initiatives (Pakistan, 2012). From the research findings, it could be recommended that for sustained competitiveness a first step towards TCs upgrading could be that firms move to become original equipment manufacturers (OEM) of their product portfolio. It would involve identifying the TCs and the associated know- why knowledge required for becoming OEM, as commented by the executive of firm C: *'Indigenise design and pattern making facilities, which are presently being done by the customers for better value addition and competitiveness.'* This activity could help create a TCs upgrading roadmap for the cluster.

Accordingly, local government institutes and vocational training centres could engage with clusters for increasing their relevant innovation capabilities.

The development agencies could develop a roadmap of collaboration with aim and objectives, and milestones to be achieved. And in the above scenario, the TIC assessment model could be used to provide input to TCs upgrading policies for SMEs and their clusters. Such collaboration could be started as a pilot study in any specific cluster, and the results could then be extended and adapted to other clusters' contexts.

8.3.4 Role of TIC assessment model as input for technology policy on TCs upgrading for manufacturing SMEs

The GoP's recent technology policy (Pakistan, 2012) underscores the importance of and supports technology capabilities upgrading in SMEs. However, the report does not mention how the technological needs of SMEs and their clusters would be identified, and how this technological upgrading is to be achieved. The technology upgrading exercise through technological import does not contribute to the knowledge generation and exploitation capability at state, industry and firm level, which is necessary for sustained growth and performance (Wu et al., 2010, Brehm and Lundin, 2012). The first step towards knowledge generation and exploitation is the identification of existing innovation capabilities of firms and factors affecting TIC level (Wu et al., 2011, Wei Wu et al., 2012).

Also, the technology policy (Pakistan, 2012) recommends identifying progressive firms in clusters to target them for upgrading of TCs. However, a word of caution. Firms with varying levels of TCs were found among the clusters, thus it could be said that 'one size fits all' cluster level policies followed by GOP and SME development agencies (Ahmad, 2013g) could not be implemented. Rather, individual firm's capability levels and requirements need to be identified and policies tailored accordingly, if a cluster's competitiveness is to be sustained (Rush et al., 2013).

The TIC assessment model developed in this research identifies firm level innovation capabilities. Thus, the model could be used as a tool to identify the CDIs carried out in firms, the nature of TCs upgrading and the TIC level in the CDIs taken, and the factors affecting these CDIs in the context of firms' business strategies and resources. This would help to paint a macro picture of the level of TIC and TCs existing in a cluster, which could then be used as an input while devising policy level recommendations for TCs upgrading at firm and cluster levels.

Further, the TIC assessment model developed in this research could be used to identify progressive (leader) firms in a cluster. Their practices could be used as a benchmark for other

firms to follow in the cluster. Also, these progressive firms could be made part of any government initiative for upgrading of TCs of firms and their respective cluster.

In sum, the government could facilitate customer-firm collaborations to acquire TCs involving greater complexity, at a faster pace, for better value added processes and products. In this context, the TIC assessment model developed in this research could be used to identify the TIC level and the TC needs of firms to give input on policies for facilitating TCs transfer from customers to SMEs at Sialkot. Further, the SME development organisations could help facilitate inter-cluster and inter-firm collaboration with the aim to support initiatives which result in new knowledge generation and upgrading of TIC level of interviewed clusters. Finally, an inevitable outcome of the TCs upgrading initiative at policy level is the creation of new stimuli for restarting the cycle as continuous innovation is one sure way of maintaining competitive advantage.

8.4 Summary

The TIC assessment model helped to determine the TIC level of the interviewed firms and identified various factors affecting TCs upgrading, which were used for policy level recommendations for TCs upgrading of interviewed firms and their respective clusters, the aim of the research. Further, the research findings and analysis demonstrated that SME executives need to be informed of capabilities and competitive edge concepts and of different tools and techniques available for capabilities management, and their short and long term benefits to firm competitiveness. In the next chapter, the research questions are answered along with this research's limitations and future avenues of research.

9. Conclusions

9.1 Introduction

Literature review in chapters 2 and 3 helped to answer research objectives. Chapter 4 sees the development of a TIC assessment model, the aim of the research. Chapters 6 and 7 analyses the research data of the interviewed firms in context of their respective general characteristics, discussed in chapter 5. The last chapter (section 8.3) explained the main research question. This chapter answers the four sub-research questions, discusses the limitations of the research and finally the future work. Figure 9-1 shows layout of the chapter.

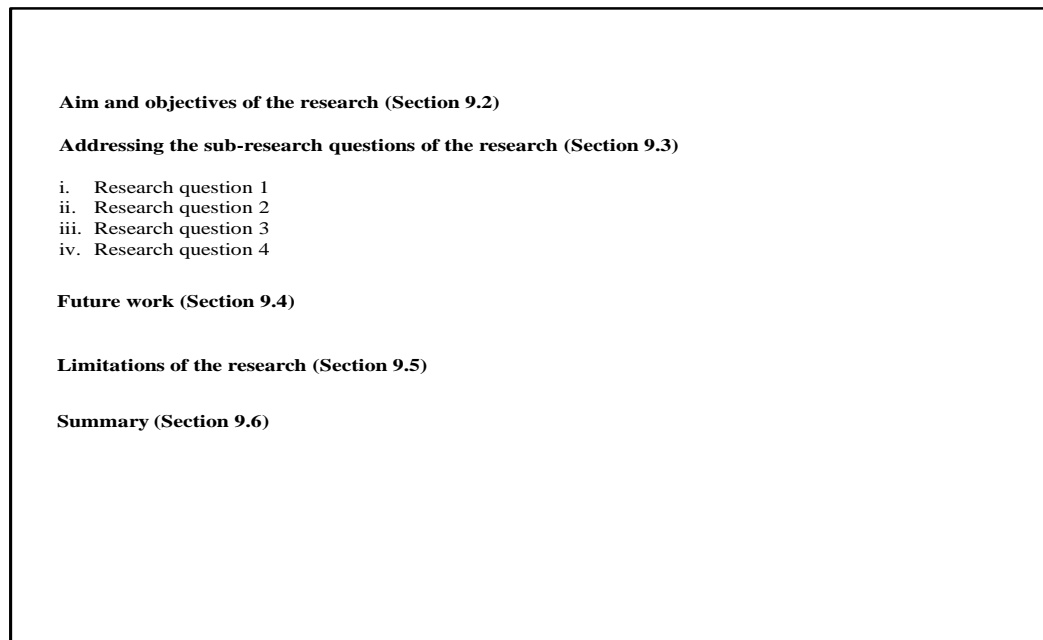


Figure 9-1: Chapter layout

9.2 Aim and objectives of the research

In the present era there is no permanent competitive edge, as competitors soon catch up (Chen and Miller, 2012). Therefore, with changing technological capabilities, firms have become aware that they continuously have to fuse their existing and generate new technological capabilities for innovative processes and products. A literature review carried out on the scope of TIC assessment models for developing countries revealed that generally the models describe the level of capabilities required as firm move from acquisition, assimilation to innovation stage (chapter 2). However, these models do not describe a method for evaluating existing

technological capabilities of a firm. Thus, addressing this research gap, aim of the research was to define and empirically test a TIC assessment model to identify interviewed firms' TCs, their underlying TIC level, and various actors and factors which affected interviewed firms' TCs upgrading process.

9.3 Addressing the sub-research questions of the research

This research was conducted in low-tech SMEs in Pakistan, a developing country, to explore how they are managing their technological capabilities to stay competitive and what could be recommended for their TCs upgrading for sustained performance. The research gives useful insights into how interviewed firms exploited internal and external resources and capabilities for long term competitiveness. The data analysis carried out in chapters 6 and 7 help to answer research questions, as described below.

9.3.1 Sub-research question 1

What are the competitive characteristics and the level of technological capabilities of the interviewed manufacturing SMEs at Sialkot?

9.3.1.1 Competitive characteristics of SMEs

The interviewed SMEs, whether leader, follower or reactor (section 7.2.3), generally described their competitive characteristics as productivity, quality, volume flexibility, cost competitiveness, close customer interaction (section 7.2.1), which is also described in the literature for SMEs on Sialkot (TRTA, 2014b, TRTA, 2014a). The interviewed firms have been in business for a minimum of around twenty years. Therefore, from the literature review and research findings it could be claimed that for long term presence, these competitive characteristics are a qualifier to be in business in a competitive cluster.

9.3.1.2 Level of TCs of interviewed SMEs

Mostly the interviewed firms are manufacturing oriented with efforts focused on improving the quality and productivity of their shop floor operations. Some leader firms have also carried out upstream functional integration along the supply chain for value appropriation which adds to cost competitiveness, order flexibility and better quality control. Thus, in general the interviewed firms have basic level production TCs (Lall, 1992) and have not improved upon any acquired technological capability for better value-added processes or products (section 7.2.2).

9.3.2 Sub-research question 2

What's the role of cluster(s) in supporting interviewed Sialkot firms' competitive characteristics and technological capabilities?

In the research carried out, existing as a part of a cluster comes out as an important factor underpinning the competitive characteristics of interviewed SMEs (section 7.2.4). The research findings showed that existing in a cluster helped the interviewed firms by employing a contractual workforce to meet seasonal demands or sub-contracting non-critical operation. The cluster also acted as a scanning tool for the latest threats and opportunities and helped reduce the cost incurred on workforce training. These findings are supported in the literature on clusters (Nadvi and Halder, 2005, Kadarusman and Nadvi, 2013).

In this research, leader, follower and reactor firms were identified, with leader firms claiming to bring new expertise to the cluster, which were then copied by follower and reactor firms in the cluster. Thus, a symbiotic relationship between a cluster and its constituent firms was found in this research. Cluster helps its constituent firms through economies of scale and scope, while the leader firms bring new knowledge to the cluster for its continued regeneration and competitiveness. Similar leader firms have been identified in other regional clusters of Pakistan, which claim to introduce new expertise to their clusters (Caniels and Romijn, 2003, Rana and Ghani, 2004).

9.3.3 Sub-research question 3

What types of CDIs and resultant technological upgrading happened in the interviewed Sialkot SMEs to sustain/ improve/ diversify their technological competitiveness?

Section 7.2.2 collectively represents the sources, types and focus of CDIs carried out in the interviewed SMEs across interviewed firms (Table 7-1). The interviewed leader firms are also involved in infrastructural consolidation as a source of competitive edge against local competitors. The focus of most of CDIs (Table 7-1) was to acquire expertise to improve existing technological capabilities of firm for manufacturing products to requisite international quality standards. Therefore, it could be said that firms are involved in process/ operational improvements of the existing manufacturing practices.

Most of the TM literature relates to industry in developed countries, where the focus of capabilities management literature is new knowledge generation and exploitation. In developing countries, the scope of capabilities management literature has been defined as acquiring technological capabilities from abroad and then assimilating, upgrading and exploiting the acquired capabilities (Cetindamar et al., 2009b, Wu et al., 2011). However, the interviewed

firms' CDIs have not generally shown signs of upgrading and exploiting the acquired or existing capabilities for improved or new better value-added processes and products.

9.3.4 Sub-research question 4

What are the internal and external actors and factors which influenced or could influence interviewed Sialkot firms' technological capabilities upgrading?

This research's data points out various factors which could be used for TCs upgrading of interviewed firms and their clusters (Table 7-2), as discussed in section 7.2.4. First is international TCs transfer. The interviewed surgical instruments cluster and sports goods cluster have benefitted in terms of expertise transfer from foreign customers (Nadvi and Halder, 2005, Dasanayaka and Sardana, 2010a, TRTA, 2014a). A few interviewed firms exhibited quasi-hierarchical relationship (Humphreys et al., 2005) with international customers, which facilitated transfer of expertise to the firms. However, the interviewed leather goods firms did not mention any such international collaboration, which may be a reason for the cluster's limited product range. Therefore, international technology transfer should be facilitated by the government, as also enunciated in recent GOP's technology policy (Pakistan, 2012). Second, the majority of the interviewed leader firms were critical of the training and facilities provided in the local vocational training centres as it did not fit their needs. Thus, these local vocational training centres should be aligned with the local cluster's needs.

Third, many firms especially leader firms complained of a lack of capacity of micro firms to continuously supply quality products, because of which they had to internalise certain operations. Thus, capability building of these micro firms should also be the focus of government policies and academic institutions. Fourth, identification, access and assimilation of proper technology were also a factor which consumed a firm's resources and time. Therefore, SMEs development agencies such as SMEDA and TUSDEC should be facilitating this aspect in collaboration with local/ regional vocational institutes.

Fifth, the research showed that the role and scope of government policies, development institutes' and interviewed firms' emphasis is on 'economies of scale and scope' while the literature has shifted to increasing the knowledge content of technological capabilities for improved or new processes and products (Morrison et al., 2008, Kadarusman and Nadvi, 2013). Further, this research revealed that executives did not have a concept of firm specific capabilities and competitive edge, and associated firm resources with competitive edge.

Thus, in view of the above mentioned factors, there is a need to shift the overall policy focus to increasing/ upgrading technological innovation capabilities of manufacturing firms and their

respective clusters which would help in TCs upgrading for improved processes and products for targeting better value-added markets.

9.4 Future work

The output of the research is a TIC model to help identify tentative points of intervention at firm and cluster level for their TIC and TCs building. Now some recommendations are made for future work.

- i. At cluster level, the research findings were compared with research findings of other regional clusters and many identical problems across clusters were identified. Similar studies could be extended to the other clusters of Pakistan to identify the technological problems faced by them. The input from these studies could be used to help policy interventions. In this research, interviewees measured firm performance through indicators such as customers retained, new markets and customers won and not by innovation success. However, firm executives need to be sensitised to the urgency of successfully acquiring and exploiting new TCs for developing technological competitive advantage at international level.
- ii. Further, this research did not interview academia working with the SMEs nor their current topics of interests and cooperation with industry. A future avenue of research could be to look at these issues and see if the problems flagged by interviewed executives in this research are similar to the ones being addressed by academia, especially in export-oriented manufacturing SMEs. Such research would help to develop a broader consensus among the academic community on the problems faced by manufacturing SMEs, which could be used as input by the government on SME development policy.
- iii. The literature (Thorpe et al., 2006. p 264) mentions the tendency among SME entrepreneurs to become locked into previously successful patterns of activity. The interviewed reactor firm executives appear to have been victims of such ‘myopic foresight’ (Ibid). The literature review in chapters 2 and 3 shows that an entrepreneur’s influence on his or her firm as its changes from leader to reactor or other category has not been much discussed. A study of the characteristics of owners of leader, follower and reactor SMEs will offer a template to better understand the behaviour of owners in managing the affairs of their SMEs.
- iv. Also, the literature review shows that increasingly the concept of ‘technological innovation capability’ and competitive edge has been linked to ‘dynamic capabilities’ for new products in hi-tech SMEs such as IT, electronics, telecommunications (O’Regan and Ghobadian, 2005, Macpherson and Holt, 2007). However, the majority of the manufacturing SMEs are low-tech, where incremental innovation is more important

(Brophey and Brown, 2009, Ismail et al., 2011). Therefore, more literature should be addressed to linking TIC with technological capabilities management for improved processes and products in low tech SMEs, where incremental innovations are dominant (Spithoven et al., 2013).

- v. The elements of the constructs of the research model have been drawn from general literature review on SMEs which are part of international value chains in developing countries. As the model shows, being part of international value chain comes with certain challenges-suppliers must meet the demands of lead firms such as prices, timely delivery, compliance with international standards, CSRs (Kadariusman and Nadvi, 2013). To meet these challenges, local firms must constantly upgrade their TCs through sustained, targeted CDIs in the context of their existing TCs, business strategy, markets and customers targeted (Humphrey and Schmitz, 2002, Pietrobelli and Rabellotti, 2011). Thus as future research this model could be tested in other developing countries on SMEs which are part of international value chains.

9.5 Limitations of the research

9.5.1 Focus on the successful CDIs

The focus of this research was to conduct a retrospective, longitudinal analysis of the capabilities upgrading process in SMEs existing in clusters. For field research, those firms were identified which were perceived to be competitive, measured through how long they had stayed in business. Selected SME executives were asked about the CDIs taken to improve their capabilities and firm competitiveness. The study principally includes those initiatives which were successful. However, during the interviews executives were asked questions and were not interrupted. So if they mentioned some failed attempts or attempts to trying to develop some future capabilities, it was duly recorded and made part of case study reports. Thus, a few case study reports mention failed initiatives. Also, during the interviews, the researcher came across a couple of firms which started as leader firms but owing to their strategy were failing and were now categorised as reactors. Thus, more instances of failing firms and less successful CDIs would have made managerial and policy recommendations more robust.

9.5.2 Cross-validation of the TIC assessment model

Abductively, a technological TIC assessment model has been developed. However, the time constraints did not allow the researcher to go back to Pakistan and conduct a larger survey of SMEs in the same clusters to validate/ improve the tool and its results. The validation could be the part of future research. Also, the firms studied could be followed on their future capabilities development pattern so that a more longitudinal data is achieved.

9.5.3 Firm selection criteria

For data triangulation, along with semi-structured interview, data from shop floor visit and firm performance reports are considered important in the literature. In the Western world the economy is generally better documented and statistics of firms are available, and generally up to-date. Research in developing countries such as Pakistan faces many challenges, primarily because the economy is largely not properly documented, and the government data is not recent and does not usually present true picture (Malik and Kotabe, 2009). Also as found in the research, firms are a bit wary of people coming to them and discussing anything relating to financial matters. Therefore, identifying competitive firms purely on financial basis was not possible and firm age, size, product portfolio and reputation of the SME executive among the peers were decided to be the indirect criteria for firm selection criterion.

9.5.4 Number of interviews conducted

The interviewed firms were a 'sample of convenience'. There are no official indicators available on government or trade bodies' websites to identify performing SMEs. Therefore, the help of people working in government development agencies was sought to identify high performing firms. The researcher was based at Islamabad/ Rawalpindi and the research clusters were in Sialkot, about 250 miles away. Each round trip along with boarding and lodging cost the researcher dearly. Also, in any one go, firm executives were phoned and when the maximum number of executives was available a round of interviews were planned. Although each round of interviews lasted over two to three days, even then the researcher would fail to interview a few executives, as they would be preoccupied with customers, or for some other reason (they were usually on foreign tours for attending expos). Thus, lack of official data on performing firms, their accessibility and financial constraints affected the number of interviews conducted for this research.

9.5.5 Number of interviewees per interview

Also, the researcher was planning to interview more than one person in a firm, as also recommended in the literature (Bryman, 2012, Rowley, 2012). But the research data shows that interviewed SMEs had a flat hierarchy, with their executive overseeing/ managing business and technology strategy, marketing, finance issues, as also mentioned in local literature (Marri et al., 2007). Plus, the executive was the one, in most of interviewed cases, who was running the firm for the last few decades and was in a position to give a holistic picture. Interviewing a greater number of firms and multiple interviews in the same firm would have added to the data's richness and the research conclusions.

Thus, given the small size of the sample, the research findings are indicative rather than conclusive, although they point to some fairly consistent results regarding the levels of TIC among the interviewed firms and challenges facing them.

9.6 Summary

In the present era when technologies are continuously changing, a firm should be able to continuously reconfigure and rejuvenate its capabilities to stay competitive. Among other things, innovation capability underpins growth and sustained performance. Much of the innovation capability literature relates to developed countries. TIC models related to developing countries address capabilities required for moving from acquisition to innovation stage without mentioning a methodology for assessing existing innovation capability of a firm and factors affecting innovation capability upgrading, as discussed in chapter 2. Further, much of innovation literature on SMEs is quantitative, is on hi-tech SMEs and does not describe the dynamics involved in making a CDI successful in context of a firm's environment, as discussed in chapter 3. This research gap was addressed in this research.

Therefore, the aim of the research was to develop a TIC assessment model to assess the innovation capability level in low-tech, manufacturing SMEs existing in clusters, in Sialkot, Pakistan to give policy level recommendations for their continuous TCs upgrading for sustained technological competitive edge. A retrospective, longitudinal TIC assessment model was developed in chapter 4. Case study methodology was employed to help take a broad view of the internal and external factors affecting TCs upgrading process in a firm. To operationalise the research constructs, various research tools were devised from the literature review and research data analysis. Also, to help increase validity and reliability of the research, a multi-level research design, multiple data collection methods, an interview protocol and various types of data analysis techniques were employed. The information from the semi-structured interviews was used to populate the research tools. The research design (multi-level) helped to create a literal replication of research results at firm, cluster and cross-cluster level, while comparison of research results with extant literature on TCs management on Sialkot regional clusters helped to externally validate the research.

As per the research design, CDI, firm and cluster level analysis were carried out in chapter 6. The analysis helped to ascertain interviewed firms' competitive characteristics, types of CDIs taken, and TIC level firm at cluster level. The analysis was supported by the literature review conducted in chapters 3 and 5.

Further, as per the research design defined in chapter 4, cross-cluster analysis in chapter 7 was carried out to identify common competitive characteristics, types of CDIs carried out, TIC level and categorisation of interviewed firms to help answer the RQs. The analysis of chapter 7 was

supported by the literature in chapters 2, 3, 5 and 6. The analysis of chapter 7 helped to delineate policy level recommendations in chapter 8. Thus, the research methodology adopted in chapter 4 helped to maintain a chain of evidence between the literature review and the research aim and objectives on one hand, and field research tools, methods of data analysis and the results achieved on the other hand.

The interviewed firms defined 'economies of scale and scope', functional integration and close alliance with customers as their competitive advantages. The interviewed firms, especially leader firms, appeared to be cost competitive in the low-tech sector and seemed to be content with their success. They have optimised their operations for resource productivity, quality and cost control. Further, the local government developmental agencies also appear to favour initiatives which yield immediate/ short-term results such as access to new markets, availability of courses on improving productivity, quality and gaining international accreditations. As a consequence of the interviewed SMEs emphasis on short term gains, they appear to be stuck in the low-value market and displayed neither the methods nor the resources to move to higher value-added markets. The TIC model developed in this research has identified interviewed firms TIC levels and the factors affecting them. This model could be used continuously on a larger scale to find more robust results, which may well be used as regular input for policy formulation for continuous upgrading of TCs of SMEs for their sustained technological competitive edge.

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APPENDICES

Appendix A	Interview protocol
Appendix B	Transcripts of leather cluster interviewed firms
Appendix C	Transcripts of sports goods cluster interviewed firms
Appendix D	Transcripts of surgical instruments cluster interviewed firms

Appendix A

Interview Protocol

An introduction of research to the SME executive

This research is about how export-oriented, manufacturing, small and medium enterprises (SMEs) of Sialkot develop their manufacturing competence to stay competitive at international level. The aim is to target those SMEs, which have shown growth in the last five years in terms of revenue, value addition, capital investment in new manufacturing technologies, new markets/ products etc.

I want to discuss as how the competitive edge of the firm is managed, which would be explored through a few questions. First, what factors decide the business strategy of the firm i.e. competitors, suppliers, customers, firm capabilities. Second, what is/ are the manufacturing competences/ technological capabilities of the firm? Third, note down the details of the few CDIs (Table 1), which were taken in line with the business strategy of the firm to improve firm's manufacturing competence and resulted in new or improved processes/ products.

Prompts for the researcher:

- a) Explain purpose and nature of the study to the respondent
- b) Tell how or through whom respondent came to be selected
- c) Give assurance that respondent will remain anonymous in any written reports growing of the study, and that this responses will be treated in strictest confidence.
- d) Interviewer is interested in respondent's opinions and personal experiences
- e) Respondent is perfectly free to interrupt, ask clarification of the interviewer, criticize a line of questioning, etc.
- f) Interviewer will tell respondent something about himself-his back ground, training, and interest in the area of inquiry.
- g) Interviewer is to ask permission to tape-record the interview, explaining why he wishes to do this.

	1	2	3	4	5	6	7	8
	Idea Generation (along with why initiative was necessitated)	Idea Screening/ Assessment	Benchmarks for the initiative (financial or technical)	External support/ changes required to support initiative	Internal Changes required to support initiative diffusion in the firm	How the experience helped building soft skills (competence) of the firm	How the experience helped building hard skills (competence) of the firm	Outcome of the activity in terms of better quality, less cost, more reliability, product differentiation, product range etc
Competence development initiative	Who/What indicated an improvement/ enhancement of the firm performance in process, product or capability e.g. outside / inside feedback	What facets were taken into consideration before approving the improvement/enhancement e.g. business strategy, manufacturing capability, immediate or future needs etc.	Targets defined e.g. sales growth, operating profits, market share, new product introduction etc.	Technology adoption, greater supplier/ customer integration, cooperation with a competitor etc.	Changes in process technology, routines for manufacturing, quality control steps, and staff training required to support innovation diffusion.	The learning from the cycle in terms of experience in technology selection, assimilation of technology, supplier customer interaction, enhancement in staff's expertise & mutual coordination, project management, product integration/ assembly etc.	How the whole initiative added to the manufacturing capability, supplier/ customer relationship, better quality, reliability, repeatability, manufacturing cost, operational efficiency, competitiveness of the firm.	

Table 1: CDI framework

Interview format

This section describes the general layout of the semi-structured interview. However, proposed sequence for the questions in a semi-structured interview may be subject to change during the course of the interview.

A. General overview of the Organisation

1. What does the company do i.e. its business, product range?
2. The history of the company i.e. how did it start? What is its present state? How many major customers does it have? What is its approximate share of the export?
3. Organisational structure, manpower employed background of the SME executive etc.

B. Business environment of the firm:

4. Is the product market competitive, stable, changing etc?
5. Are the product associated technologies stable/ changing?
6. Competitors, suppliers and markets-are they demanding and what is driving the change?
7. Anything else you would like to add?
8. What is your business strategy (e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products)?
9. What factors influence business strategy of the firm (e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers) (rate them in terms of importance, if possible)?
- 10.How do you measure your firm's performance (e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines)), (please rate in terms of importance, if possible).?

C. Main body of the interview: Covering the main purpose of the interview in what the interviewer considers being a logical progression.

- 11.What is your manufacturing competence? That is why customers prefer your products? How you are better than your customers (it could be due to firm's quality, reliability, new product development, successful replication etc)?
- 12.How do you sustain your manufacturing competence (e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications)?
- 13.The history of CDIs which might include process re-engineering, new equipment purchase, HR management, or with one involving all three- which resulted in enhancing manufacturing competence (competitive advantage) and helped differentiate the product (s), capture new markets/ businesses:
 - a. What were the factors which initiated a CDI?
 - b. What were the phases in a CDI i.e. planning, implementation and review?

- c. What were the activities and sub-activities in each phase?
- d. How were the phases and activities interlinked and monitored?
- e. How internal and external environment influenced CDI during execution?
- f. How were company resources mobilised to support CDI?
- g. How did the CDI benefit the firm and enhanced its competitive advantage?

Discuss the initiatives one by one, and follow the framework- for the breakdown of the activities and the different phases in an initiative as shown in Table 1.

D. Tapering off:

- 14. In retrospect, what you would like to do better?
- 15. What future challenges does the firm face?
- 16. How does the presence of competitors affect firm's performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc?

Finally, a visit to the facility to see the things which the company has done along with supporting documents, company reports, clippings etc.

List of activities for every interview

1. Background information on the SME/ interviewee, through website, Chamber of Commerce etc.
2. Checklist of documents to be taken for the interview:
 - List of interview sequence papers.
 - MP3 recorder along with cells (check for battery strength) and ensure proper functioning before start of each interview. Use mobile phone as a standby.
 - A note book for taking notes, while interviewee is speaking.
3. Things to be produced at the end of the interview:
 - An audio recording.
 - Interview notes.
 - A summary of observations, if facility is visited.
 - List of documents given by the interviewee/ firm, which could include organisational structure, history of the firm, main products and markets, product brochures, performance report, reports on the initiatives taken, company mission statement, business strategy etc..
 - A case study report.
 - Transcription of the interview

The company documents and shop floor visit help to validate interview findings. Maintain a log of the progress of the project: such as how ideas are progressing, frameworks are changing.

Terminologies used in the interviews

Business environment of a firm: Comprises of “behaviour of customers, competitors, suppliers and technological changes in the sphere of interest of a firm” (Gregory, 1995, Phaal et al., 2004).

Competitiveness of a firm: “The ability of a firm to produce a battery of associated goods and services more effectively than their competitors while meeting stakeholder expectations on sustained basis”(Momaya and Ajitabh, 2005).

Capabilities development initiative (CDI) : is defined as the initiative taken by a firm involving human resource training, new process or product technology absorption/ development or improvement, which add to a firm’s capabilities and result in innovations in processes and / or products (Li-Hua and Khalil, 2006a)

Manufacturing competence or technological capability of a manufacturing firm, in simplest terms, is an interplay of its assets (machines, softwares, patents, etc), skills (human expertise, better planning, environment scanning, etc) and knowledge (tacit, written, reports, routines, procedures, etc).

Manufacturing competence of a firm is supposed to give a firm three advantages: First, a source of competitive advantage in terms of product distinction, new markets and businesses. Second, competence of a firm should be exploited in more than one product/ business. Third, it is hard for the competitors to imitate the competitive advantage (Prahalad and Hamel, 1990)

Production process: “is the system of process equipment, work force, task specification, material inputs, work and information flows, and so forth that are employed to produce a product or service” (Garcia and Calantone, 2002)

Resources of a firm: “Physical assets, intellectual assets, cultural assets” (Hafeez et al., 2002).

Appendix B

Transcripts of leather goods cluster interviewed firms

ASTON UNIVERSITY

Interview Transcript

Firm A
Leather goods cluster

Interviewer explains the purpose of his visit and requests for an interview. The interviewee agrees for the interview to be recorded.

1. What does the company do i.e. its business, product range?

At (00:05), interviewee tells about the products, which include fashion and motor bike leather garments, leather gloves (both fashion and working). Upholstery leather, leather rugs, and latest addition this year is leather belts and bags. The last three (fashion accessories) are recent initiatives.

They don't have brochures of their products (00:06:30) except for motorbike garments, which are sold in U.S by Leather field through a marketing company (First Manufacturing Company, FMC) (a brochure has been provided).

2. The history of the company i.e. how it started, its present state, how many major customers, its approximate share of the export.

The company started in 1988 and since 1990 the company has been winning Pakistan export trophy for largest leather garments (fashion and motor bike garments) export (00:10:30). Twenty years straight. The company has a share of 10-11 % of total leather garments exported from Pakistan (00:11:30) in 2008.

3. Organisational structure, manpower employed background of the SME executive etc.

We are headed by a CEO, while different departments are headed by directors /general managers/ managers (00:12:00). There is a cross-functionality of responsibilities as well. If someone is looking after purchase, he might be giving input to production department as well. Lines are not clearly drawn (00:12:35).

4. Is the product market competitive, stable, changing etc.

The firm does not feel that locally they are threatened or is there any competitor because the volumes they are handling cannot be handled by other local competitors(00:12:58). Leather Field has largest tannery in South Asia (13:40).

5. Are the product associated technologies stable/ changing?

Product associated technologies are almost stable; minor changes (00:14:10).

6. Competitors, suppliers and markets-are they demanding and what is driving the change?

Markets are demanding w.r.t. leather quality, styles which change frequently and seasonally, timelines are strict, price does not matter much (00:14:30). With respect to the quality of the product, customers are satisfied, not 100 %, but around 80-90 percent they are satisfied. We have trained personnel and proper checks in place for ensuring quality. We ensure quality of raw material used and follow the international standards. We try to exactly replicate the samples provided by customers (00:15:30).

7. Anything else you would like to add?

With respect to regional competitors in quality i.e. China, Vietnam, some are better than Leather Field, some are not (00:15:50). With respect to value addition, LF is in middle to lower middle (in fashion garments), not even in higher middle (00:16:04). In motorbike, LF has an edge (00:16:30) because there is not much change in motorbike garment and people have developed manufacturing competence in it. In fashion garments, there is frequent changeover, for which a strong management is required to take immediate

decisions, which is lacking at the moment. In motorbike, LF is in middle to higher middle range (00:17:00).

LF is competing in volumes and are not dealing with top brands like Marks and Spencer, whose quality criteria they cannot qualify. Since we are dealing in volumes so if some orders do not come to them, orders go to South Korea because they are good in this sector (00:17:30). We do not have much local competition (at the best 70-30) because we deal in volumes which local competitors cannot (00:18:15). Mr. Ansari states: we are a bit different from the rest of the lot (local Sialkot competitors) (00:18:25).

8. **What is your business strategy** e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?

LF is putting emphasis on more customers, new businesses, and new markets and reducing production costs. However, not much influence is on serving a niche market or improving manufacturing processes and products (00:18:30). From my personal experience, people are not receptive to change. One reason could be low educational skills of people, and they fear that they might not be able cope with the change-thus being rendered redundant (00:19:30). For CDI, proprietors of LF brought South Korean master trainers to train local people on stitching, cutting etc and these foreigners were paid handsomely-compared to Pakistan's wage level. Firm people started questioning the investment (00:19:50). However, the people trained by South Koreans have become an asset and source of competitive edge for the firm. However, the system of transfer of expertise has stopped for the last six to seven years and the reason being for such practice can be "we think we have learnt enough" (00:21:00).

9. **What factors influence business strategy of the firm** e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, etc (rate in terms of importance, if possible)?

Market anticipation, and Customers and suppliers input- in that order of importance (00:21:30).

10. **How you measure your firm performance** e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines,) (rate in terms of importance, if possible)?

Increased sales only, (no matter existing or new customers)- dollar value earned and number of pieces(unit occupancy, overtime claimed) (00:22:50).

11. **What is your manufacturing competence** e.g. why customers prefer your product/ products? How you are better than your customers such as quality, improvement, new product development, successful replication?

For manufacturing competence, interviewee replied: volume business in a short time-short lead time, consistent quality, and cost effectiveness (00:24:50).

When asked to define quality: (00:25:55), the interviewee replies: styling (stitching, leather quality, and they can manufacture products which other local competitors cannot) and customer required quality. Interviewee describes: human resource quality available with them is not available to other local competitors. These personnel have been with them for more than a decade and these have been trained by South Korean master trainers (00:26:45). Firm's raw material sourcing is very strong (00:26:55). Therefore, they are able to maintain a consistent quality

in all of their shipments. Basic difference is of artisans available with LF as machines are simple and not counted as an asset. The quality available with them is because of craftsmanship (00:27:10). However, interviewee admits that local competitors are working on this aspect (00:27:30).

12. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications?

Through retention of artisans and strong sourcing of raw materials (00:28:00). Any raw material demanded by customer to be incorporated in a product is sourced from anywhere in the world and at the same time timeline is also tried to be met (00:28:30).

13. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/businesses. Each CDI would be analysed for the following:

At this stage, when researcher shows interviewee CDI table and a few details required, he exclaims that it is a long time consuming process. Researcher reassures him that it would be done quickly and researcher would be doing the entire fill in the blanks (00:29:30).

An example of process-reengineering (00:30:00) on both motorbike and fashion garments:

First, in LF they used to cut leather with scissors, next they moved to cutting with cutters on scratch less tables. Therefore, initially if they were cutting two pieces, now they could cut thirty pieces. This action was initiated by South Koreans. [While describing this CDI, interviewee made it clear that he would not tell everything because of confidentiality reasons (00:30:33)].

Next, LF made some changes in methods of stitching (00:30:59). South Koreans told them that they could do few processes simultaneously thus saving time.

Next, they were on piece rate (00:31:15). One or two people would make an entire jacket. Then chain system was started where artisans were working in a line and that chain would produce 100-200 garments in one day, increasing per machine efficiency.

Work was carried out on leather averages (00:32:10). If previously a jacket was made from 35 feet, was now being produced from 30 feet.

Changes were introduced in finishing, which reduced wastage and reduced cost (00:32:15).

When asked about shop floor efficiency (00:32:45), interviewee says : they do not have rejection. If they have 4000 piece order, they cut 4002 leather pieces. At times few panels may get wasted (00:33:15). They measure shop floor efficiency by counting number of pieces produced at the end of the day and leather consumed against target (00:33:35). Both of the factors effect cost since the employees are on fixed salaries so if different lines are working of different efficiencies for similar items than some lines are not as productive as others.

14. **In retrospect, what you would like to do better?**

(00:35:00), time and motion study for every jacket and work on leather and garment R&D. When asked about the templates which foreign customers bring with them for LF use, interviewee replies that they only give AutoCAD drawings and templates are generated in-house (00:36:20).

15. What future challenges firm face?

Scarcity of Human resource and there is no training (00:37:25).

16. How the presence of competitors effect your performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc.

They do not focus on competition but keep an on market anticipation and what customer wants (00:38:10). They are doing a bit of environment scanning i.e. garment units, expos, tannery visits (00:39:20).

17. A visit of the facility to see the things which the firm has done along with supporting documents, company reports, clippings etc.

No effect of law and order situation. Scarcity of labour. (00:40:00)

Finally, interviewee, upon being asked, positively responds that their business has grown in the last twenty years (00:40:55). In 2008 they produced one million garments.

Researcher Comments

Apparently, interviewee is not prepared to discuss CDIs but to an extent which is generally public and common knowledge.

Interviewee is an employee (General Manager) of the firm. Since interviewee is a business graduate (from a very prestigious business school) he has no problem in understanding the questions and their context.

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Interview Transcript

Firm B
Leather goods cluster

Firm executive states (00:02:00) : In Sialkot, fashion and motorbike leather garments are made, however the major industry is of motorbike leather garment, which is skill based and manual, not mechanised. The production is manual based upon artisan skill, which is present in Sialkot. Stitching machines are there but depends upon the skill of the artisan to operate them. There is skilled labour in Sialkot and in a single household there will persons trained in surgical instruments, leather making, football making and even housewives are skilled artisans (00:03:25).

Researcher is defining manufacturing competence of a firm and how it gives competitive edge with respect to local and foreign competitors (00:03:35). While researcher is explaining different terms and terminologies, Executive continuously makes hmmm sounds, which researcher is taking as a sign that Executive understands what researcher is explaining (00:05:00).

1. Is the product market competitive, stable, changing etc.

Firm Executive says: it is competitive, firm started in 1971. Customer feedback is important. They do not have a brand name, manufacture for someone else. These customers give them training and take products on competitive prices. Customers provided them with samples and they manufacture accordingly (00:06:00). Executive is describing his position as competitive (00:07:00) that's why they are able to export. Their product is competitive that's why they are able to sell in the international market (00:07:10). The raw material, leather, is cheapest in Pakistan compared to world market prices which makes leather products competitive (00:07:15).

2. Are the product associated technologies stable/ changing?

Executive says: product is ever changing because the trends, events are changing. There is a demand for quality, durability and more fashion oriented products now (00:08:00). Changes in the product are protection; international standards have to be followed (00:08:1).

3. Competitors, suppliers and markets-are they demanding and what is driving the change?

Executive says : customers are demanding, as he has said before (00:09:15). They have their own brands, and R&D but mostly it is customer feedback.

4. What is your business strategy e.g. serve particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?

Executive says: serve particular niche ,more customers by broadening product range, new business and new markets, reduced production costs are the factors which we keep in mind while running business(00:09:45).When asked about what market niche they target, Executive replies: new items, those items which are lacking in manufacturing,(00:10:15). They keep profitability in view and stress on those products which sell, along with bringing in new products (00:10:35). When asked about how they reduce production costs, Executive replies: productivity, purchase, (00:10:45). When asked about shop floor efficiency i.e. minimum rejection, jacket made out of less material, Executive replies about packing department, buttons on garments through machines, 95% work is manual. On new items, automation will be done

5. What factors influence business strategy of the firm e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, etc (rate in terms of importance, if possible)?

I attend exhibitions, observe trends of big brand names and copy them (00:12:45). When asked about human resource (HR) training, Executive replies: availability of trained HR is natural in Sialkot and someone should do a PhD in this as well i.e. Why this trained manpower is present in Sialkot and not in any other city? Why football, motorbike garments, musical instruments, surgical instruments are made in Sialkot and not in any other city? (00:13:20).

Executive says : ethically speaking they are doing nothing special; it is the skill of the artisans which is earning them money and profits (00:14:20). There has never been an artisan strike in Sialkot, artisans and labour are satisfied, nobody sleeps hungry (00:14:40). It is the skill of the artisans, which is making Sialkot business progress (00:15:00).

6. **How you measure your firm performance** e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines,) (rate in terms of importance, if possible).

Customer satisfaction results in increasing their business. If there is customer satisfaction then there is a demand for their items which results increase in revenues, export increases (00:15:20). Customer satisfaction means satisfaction with quality, and product.

I cater to both new and existing customers (00:16:00). When asked about increased sales to both new and existing customers, Executive replies: I made a mistake of catering to one big customer and refusing to others in 1980 and learnt the lesson that when big customer goes down, we also go down (00:16:30). To make new customers we go to exhibitions, put up stalls and attract new customers. Every year their customer increases (00:16:40).

7. **What is your manufacturing competence** e.g. why customers prefer your product/ products/ How you are better than your customers such as quality, improvement, new product development, successful replication.

Executive replies mainly quality and reliability on manufacturers (00:16:55). The old customers doing business with Sialkot have been doing it for so long that they know price range, etc. It is mutual trust between old customer and us, since we have been doing business with them for so long that payments are secure through letter of credit or advance and customer knows that they will get the quality. Therefore, the credibility of the manufacturer also plays very important role in the eyes of the customer.

Materials, stitching, accessories used, in short everything as per sample is defined as quality (00:18:15) as per agreement.

8. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications etc?

Through artisans skills, new machines from time to time, customers input, new products (00:18:50).

9. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/ businesses. Each CDI would be analysed for the following:

When asked what sort of CDIs taken to improve manufacturing competence, Executive replies: embroidery machines, press machines, leather being made is

different in quality, tannery integration for cost reduction. Owners involve themselves in work (00:19:00).

Chain system is there but artisans define it for themselves how to divide work, group works efficiently, most of their employees are on piece rate. There are salaried employees as well (00:21:20).

10. In retrospect, what you would like to do better?

Self-starter in business, learnt with time, no regrets, and happy (00:23:00).

11. What future challenges firm face?

China was a competitor, but it is becoming expensive so no longer a threat. However, utilities and socio-economic conditions of the country are a worry. They have to improve themselves to expand (00:24:00).

12. Market anticipation for the future change (00:25:00), why executives fail to see.

Executive agrees that this case exists citing the example of wooden sports goods, mechanised football, surgical tools only very basic, industry is stagnant. In motor bike, there is a niche market, people who enjoy bikes and need leather garments. The orders are in small quantities so SMEs fit in perfectly against the demand. You cannot grow bigger otherwise become unprofitable.

Executive narrates Sufi Khurshid (00:28:20), who changed the trend in Sialkot. Initially people were traders, he made manufacturing a skill. Executive's customers are of small scale, they do not let their customers know to other one. Everyone is working individually and his success is his own. But executive narrates that this is the philosophy of SME (00:30:00): entrepreneurship and efforts of the executive. Executive states: there is no academic relationship with the universities (00:31:20). Also, We started motorbike leather boot item, but due to lack in technology adoption lagged behind (00:36:27).

Researcher comments

Executive glosses over CDI initiatives question and only mentions tannery initiative. At (00:36:27), he mentions a new product initiative which has run into trouble because of slow adoption of technology compared to competitors. This initiative was never mentioned when specifically asked about.

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Interview Transcript

Firm C

Leather goods cluster

This is an extensive interview, stretching more than one hour. At times interviewee is receiving calls but the recording is still on so there are differences between time intervals. I initially explain the purpose and nature of the study to the respondent.

While explaining the purpose of study, Executive agrees that they are competing at both local and international level (00:00:35). When researcher states that he has based his research upon manufacturing competence since all SMEs are manufacturing items sent from abroad, executive agrees (00:01:20).

When speaking of input from customers (00:02:20), Executive points out : this is harmful as well as they become use to spoon feeding and do not do any of their own R&D, market research, inquire about market trends with the result if customer finds any item cheaper in China, India, Bangladesh etc, he switches over there. Since manufacturers are not playing at front end, they cannot command the price which commodity is actually fetching in the international market (00:03:10). They do not know what are the fashions and trends since they are not directly observing the market, therefore they cannot tap the market directly (00:03:35). Since they are not at the front end (00:04:40) therefore what the customers say they do it, this is in reply to when researcher tells Executive that “manufacturing competence leads to competitive edge, which should give new businesses and markets”.

1. What does the company do i.e. its business, product range?

We are manufacturing motorbike leather and textile (called kurdura) garments since 1996 (00:05:00). Since 1996, we are doing what customers are demanding. But this is the problem with Sialkot, they do what customers want. He cites example of Saga sports, who made it really big but his enterprise was a one man show. When he died, his enterprise collapsed with him.

2. The history of the company i.e. how it started, its present state, how many major customers, its approximate share of the export.

3. Organisational structure, manpower employed background of the SME executive etc.

Executive believes that (00:06:30) on the whole Sialkot is no longer competitive, they are lacking in technology. Executive cites his yesterday's phone conversation with his customer of last sixteen years as why he was reducing order placement with him for the last three to four years and the customer had some very solid reasons like prices are not competitive, especially quality is not good. New products are not being made, China produce products of good fittings, Vietnam is good in raw materials availability (00:06:40). Kurdura has not been developed in Pakistan, all the raw material is coming from China (00:08:30). Engineering and manufacturing side is weak, there is no R& D (00:08:40). Executive welcomes if a report could be submitted as how they can be competitive in international market (00:09:10). Executive says that leather is very cheap in Pakistan and in other Muslim countries. China and India import leather from other countries and do value addition, which original countries fail to do, they are much more efficient in using leather, and do their own designing and pattern making, more productive (00:09:40). Other countries in leather export are treating this field as an industry and have industrialised their production methods while in Pakistan we are still with (ustad) artisan and (shagird) apprentice (00:10:43) era. When researcher explained to Executive about CDIs and the instances researcher would be inquiring about. On development of human resource (HR), Executive replies they are going to utilise the pool of artisans which is available around them i.e. in

Sialkot. Executive quotes the example of pattern masters, who are usually illiterate and expert in old methods of developing patterns on drawing board and strictly against using computer soft wares. Many firms have purchased computers, which are lying idle because nobody uses them (00:13:45). Executive narrates his conversation with the pattern master of his own firm about using computers for developing patterns and the pattern master replies that these computers are not successful (00:16:00). Executive kept a South Korean person for improving the quality at his firm for about one year at around US\$ 2000 per month (00:17:00). Executive laments that around 50% of the raw/treated leather is exported without any further value addition (made into garments) and thinks that government should look into this aspect and try to discourage this export(00:23:15). Executive cites the example of China, where government has provided infrastructure in industrial zones to promote export, which is lacking in Pakistan (00:24:30). Executive is the sole proprietor of the firm (00:26:45) and has recently installed a compressed natural gas (CNG) station as well.

4. Is the product market competitive, stable, changing etc.

Customer is not very happy, he has the orders but does not want to give orders to him or to Pakistan (00:28:53). Executive's customer has not only tried him but also other suppliers in Sialkot but now is considering buying from Vietnam, Indonesia, China (00:29:00). Executive says: reason for customer dissatisfaction and moving to other countries is that their overall quality is better which includes patterns, fabric, leather (00:29:15).

5. Are the product associated technologies stable/ changing?

It is slow changing, there is no everyday change in leather, sometimes it is in dull shade, sometimes in bright colour (00:30:00). Upon asking the question again, interviewee gives example about a die he wanted to get made in Pakistan, the mould from which he wanted to use in leather garments (00:30:35). Upon many unsuccessful attempts he tapped China and the die was immediately delivered (00:31:10). The point Executive wants to emphasize is that his job is to manufacture garments but the associated industry to support the garment industry is not there to give them support and edge in business (00:32:00). Executive further quotes the example of zips being made in Pakistan which are of not good quality (00:32:12). Executive states that their competitors are not locals but other foreign competitor countries, which are progressing as a whole (00:32:44). Executive says that to these countries they have educated labour which is not available here (00:32:57).

6. Competitors, suppliers and markets-are they demanding and what is driving the change?

Their customers are demanding (00:33:00).

7. What is your business strategy e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?

When asked about business strategy, apparently Executive is not clear and then finally says : first I do not go to exhibitions to put up my own stalls, which exporters should be doing. He did not go before because his customers are there as well , which they would not like (00:33:50). To find new markets and customers, Executive thinks he should start attending foreign exhibitions plus he thinks that he will learn as well from the experience (00:35:00).

At (00:36:30) when researcher tells interviewee that researcher is going to interview few more executives in leather sector, Executive offers his help in

contacting them. Executive informs that general manager (Production) at Firm A, while another executive at firm B. Executive agrees to help in contacting these persons.

8. **What factors influence business strategy of the firm** e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, (rate in terms of importance, if possible)?

Researcher asks the question along with pointers and explains what he means by each pointer (00:38:15). At (00:40:10), Executive points out that academia and industry are not aligned and in collaboration.

9. **How you measure your firm performance** e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines,)(rate in terms of importance, if possible).

When asked about measuring firm performance, interviewee (Executive) measures by increased sales but there is no distinction between existing and new customers. However, Executive laughs that his sales are going down for some time now (00:45:55).

10. **What is your manufacturing competence** e.g. why customers prefer your product/ products/ How you are better than your customers such as quality, improvement, new product development, successful replication.

For manufacturing competence, customer services, individual services, small orders are accepted, are flexible with order quantity (00:47:40).

Executive tells about a newsletter which he started publishing on leather sector activities in Sialkot (00:49:50).

How you are better than you competitors here in Sialkot, interviewee replies: customer service, customised service, urgent delivery (00:50:00).

11. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications?

Whatever input is from customer, they are advising customer if this can be done with the product (00:51:30).

12. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/ businesses. Each CDI would be analysed for the following:

For process re-engineering (00:52:10) Executive quotes: saddle bag for motor bike. I hired a person from another firm and he specified the machines to be procured from Taiwan and how product is to be stitched and raw materials to be used. The problem was identified by the customers, who were not satisfied with the quality of the saddle bags being produced. To keep the customer, I invested in machines and human resource. The investment paid off and firm got more orders for that product (00:55:00). There was no problem with the local people, I trained people on machines (00:55:50). Executive took the initiative as a forward looking executive, he claims not to feel shy of taking risks (00:56:25). Executive cites the examples of machines he bought to improve the quality of stitching (00:56:30).

Executive feels that he is trying his best but is not able to satisfy the customer's quality requirements (00:56:50). Executive even asks: how you think quality can be improved, given the information he has shared with me (00:57:00). The person hired guided all the changes (01:05:00).

Executive says that not all initiatives give desired results. He cites the example of South Korean person hired from his meagre resources. But in Executive's eyes the investment failed to give desired results (00:53:40). Korean person made them punctual i.e. to come to the firm on time, maintain discipline (00:54:10).

Executive has done executive MBA from Lahore University of Management Sciences 2007-2009 (LUMS) (00:59:45).

13. In retrospect, what you would like to do better?

Executive feels that should have gone to exhibitions and should not have stuck up his capital in miscellaneous investments (01:05:35). Then you do not have money for the actual business e.g. when money is stuck somewhere than you cannot attend exhibitions.

14. What future challenges firm face?

Quality of the product, competitiveness in production is not same as China (01:06:32).

15. How the presence of competitors effect your performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc.

Initially, Executive was wary of the local competitors but with time the relationship with customers has developed to the level where local competitors are no longer a threat (01:07:20) since shifting to a new supplier is not easy.

When asked about shop floor efficiency like reduced rejection, the results of purchasing new machines, improvement in quality- do they measure it, Executive replies: there is not much attention on this aspect (01:08:20).

16. A visit of the facility to see the things which the firm has done along with supporting documents, company reports, clippings etc

Visit to the Factory (20-02-2011)

Researcher visited the factory on the invitation of Interviewee.

The factory is located outside the premises of city, in a village. The executive has acquired a large area for factory premises. Residential quarters for the work force are also available. The factory is newly built and is multi-storied. It has different sections, for motorbike garments, leather gloves, saddle bags etc. However, many rooms were empty i.e. the factory is not operating at full capacity.

The machines did not appear to be brand new, as if they have been imported second-hand. The pieces of a product are cut by hand against a template. Then they are stitched and checked against dimensions. This follows in a chain until final product emerges and checked for quality specifications. Afterwards, product is again checked before packing and despatch.

It appears run of the mill job. There is not much innovation. Design and dimensions of a product (garment) is provided by the customer. They have develop templates and cut individual pieces accordingly. These pieces are stitched on commonly available machines. The artisans should know to expertly cut pieces as per templates, and stitch them properly on machines. The trained artisans are available locally in Sialkot region.

The package products are sent to customers abroad, where customers sell them to individual clients. Any complaint of a product/ returned piece of client is relayed to manufacturer and

amount deducted from payment. Manufacturer than ensures to remove that defect in next lot by suggestion from customer and local artisans. *However, when asked if interviewee kept any record of complaints received and how they were rectified, answer was a negative.*

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Interview Transcript

Firm D

Leather goods cluster

The interview was conducted on two dates. First one and half hour interview on the afternoon of 06/01/2011. Second on 07/01/2011. Again interview on 07/01/2011 is divided into one slot of four minutes and other of about thirty three minutes. This was due to business matters, which Executive had to attend to from time to time. After (44:20, the interview taken on 06/01/2011), the interview is specifically about leather garments, which Executive is looking after. Before (44:20, the interview taken on 06/01/2011), he generally talks about general business interests of Firm D.

1. What does the company do i.e. its business, product range?

Firm was established in 1963, offers a range of products to its international clients. Its business units (BUs) include leather garments (related to motor sports), hand stitched footballs, and sportswear. The main selling products of the firm have been changing with times (32:00, the interview taken on 06/01/2011), and depends upon the economic conditions in foreign countries. Example quoted is of hand woven carpets, which are luxury items, are not on the buyers list in present hard economic conditions. At present football and sportswear (gloves, punching bags, dresses,) are selling well.

It exports 100% of its manufactured products. It sub-contracts some of its manufacturing activities outside the firm. At present Executive is heading leather garments, his brother is heading football, while nephew is heading fitness articles manufacturing (42:00).

2. The history of the company i.e. how it started, its present state, how many major customers, its approximate share of the export.

Executive established a hand stitched football firm in 1963, which still continues and is an area of competence of the firm. Executive's brother joined him in 1967.

The other two businesses, leather garments (LG) and sportswear (boxing, martial arts sports accessories) is a spin-off of the football business. On one of his business trips abroad, he was asked if he could make leather motor bike leather garments. He brought back the samples and successfully replicated them. Thus slowly interviewee moved into leather field and the quality improved for acceptance at international level. (However, from the manner of speech of interviewee it is obvious that he is not the one introducing leather garments manufacturing to Sialkot 18:45). The company moved into sportswear, as this sector became profitable.

Initially, they were flexible with their order quantity. However, they slowly started paring it down and now serve only few niche customers (34:00). They export most of their products to Europe (35:00).

Even executive accepts badges order from abroad, get them manufactured locally from small time manufacturers and export them. These small time manufacturers do not have enough resources for export so they do their business through intermediaries (43:00).

3. Organisational structure, manpower employed background of the SME executive etc.

The firm has three directors for three subsidiary firms. Each firm employs on its floor 50-60 employees. Executive has a master's degree, the rest of directors could not be approached for information.

4. Is the product market competitive, stable, changing etc.

On quality versus price basis, executive considers Sialkot's leather garment industry best in the world (44:35). Although similar products of higher quality are being made in South Korea, Italy and China but on quality versus price basis, Pakistan offers the best choice (45:00). Quality includes aspects such as look, raw material quality, fitting.

5. Are the product associated technologies stable/ changing?

Leather garments depend upon the artisan skills (45:00, the interviewee quotes the examples of biscuit making where machines do all the work). In this work, artisans are working on leather with the help of machines. The quality is the result of both artisan skills and machines used (46:50). They are using "Jockey" make machines from Japan.

As per executive: Hand stitched ball is artisan skill, however machine stitched balls market has surpassed hand stitched balls market. Efforts are underway to penetrate that market. Motor bike leather garments industry is also based upon artisan skills, so there is not much threat there as well. Recently, sportswear manufacturing has become a big business in Sialkot.

6. Competitors, suppliers and markets-are they demanding and what is driving the change?

Customers are the one, who are driving the change. They bring new ideas, new products to be developed, feedback on the products produced and how to improve the quality.

Local competitors are trying to outdo each other on quality rather than only prices (49:40).

7. What is your business strategy e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?

Serve few particular niche customers (53:43), in the past they used to serve quite a few customers but now they have restricted themselves to few customers, who order large quantities (maybe retailers, wholesalers etc). Despite this policy of niche, business has grown (54:14).

8. What factors influence business strategy of the firm e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, etc (rate in terms of importance, if possible)?

The interviewee does not believe in too much product diversification or increasing customer base (55:35). He believes that only big customers should be targeted as small customers are not worth the effort and consume a lot of time (55:40). Customers input are most valuable. They are the best teachers (56:30).

Interviewee narrates the story (23:00) as how he moved into different businesses. He was on a business trip to Austria, where one of his clients asked him if he could manufacture ski gloves as per specimen given. The interviewee got the gloves made as per specimen and was awarded order of thousands of ski gloves. Similarly, the same client was looking for some handmade carpets for his home. Executive suggested him if he could supply them. The client agreed and the firm supplied them and as a result came into carpet business with the Austrian client.

9. **How you measure your firm performance** (57:50) e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines) (rate in terms of importance, if possible).

Through revenues earned (58:55). For new product development, as they go to their customers they suggest new products (specimen provided (58:30)) as old products go out of fashion or become obsolete.

10. **What is your manufacturing competence** e.g. why customers prefer your product/products/ How you are better than your competitors such as Quality, improvement, new product development, successful replication.

Quality and continuous improvement (1:01) (1:02:55) in products, and reproducing the specimens provided (1:02). In short quality and price is the competence of the firm (1:09:30).

The interviewee firm is better than local competitors, because of their quality consciousness (17:37 on 07/01/2011 recording of about thirty three minutes). They even inspect the bags for packaging for proper printing quality. Interviewee associates secret of business success to quality (18:00 on 07/01/2011 recording of about thirty three minutes). Interviewee narrates the example of his father, who had the capacity to manufacture 250 footballs per day and would not accept any more order on any given day so as not to compromise on quality. (19:49 on 07/01/2011 recording of about thirty three minutes). In the same vein, Executive accepts orders as per his firm's capacity so as not to compromise on the quality.

Raw materials for the products is local and foreign (20:25 on 07/01/2011 recording of about thirty three minutes). Leather and thread is locally made. Other than zips and some breathable lining, most of the items in leather products are locally produced.

Executive narrates example of a local firm working for Adidas. A customer went to the firm with an order, but was turned down as the firm did not want to compromise on quality by taking on extra order which would put extra pressure on their resources (50:00). On the same principle, firm does not compromise on quality and does not go into price wars with other companies (50:40).

11. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications?

When asked about sustaining manufacturing competence (1:05), which are quality and cost, the interviewee replied "constant control over production". For machinery (1:06:25), they keep on scanning the international environment and select the machines on the basis of their firm's product requirements (1:06:43).

For increasing artisan productivity (1:07:20), interviewee mentions government sponsored technical institutes. There is no indication of in-house training.

Continued input from customers also helps in improving the products (1:08:40) (1:09:40). When multinational companies like Nike, Puma, Adidas came to Sialkot they trained their suppliers on best practices, production methods, etc which were then disseminated to the rest of firms in Sialkot. Further, the unorthodox method of passing of skills from generation to generation is another reason of sustaining and improving artisan skills.

Football manufacturing sector in Sialkot is hand stitched, depending upon artisan skills. Pakistan has a share of around ninety percent of world's hand stitched football. Pakistan is slowly moving into machine stitched football. (Here, the interviewee does not appear very enthusiastic about the machine stitched balls compared to hand stitched balls 13:34).

China and other countries which are leaders in machine stitched balls, are slowly losing their competitiveness due to their rising manufacturing costs (The interviewee is hoping to win the machine stitched football share through price war not manufacturing prowess 13:42).

(Interviewee talks about artisan skills in hand stitched balls, which is not anywhere else in the world 15:00)

12. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/ businesses. Each CDI would be analysed for the following:

When interviewee is asked about specific CDIs, for human resource (1:10:45) he again mentions government sponsored institutes as the training ground for the artisans. When asked how they improve the skill of their artisans (1:11:50), the interviewee replies that fresh inductees from these technical institutes bring new skills which are imparted to the existing manpower. (This is a very highly unlikely scenario, because these technical institutes impart only basic skills while the skills are developed and honed on the factory floor.). The interviewee mentions (1:13) that at times they send their employees to technical institutes for training.

Foreign customers come to their firms with their own designs, templates and teach them how to make the product. The expertise is transferred and slowly the quality of the product manufactured improves (1:13:30).

At (1:13:35), interviewee mentions machines they have purchased for punching football pieces. However, this example goes in the sports sector, therefore researcher asks him about leather garments example.

At (1:13:55), interviewee mentions about the importance of templates which foreign clients bring with them for new products to be produced, as an example of improving the manufacturing competence (This confirms the statement made by Mr. Fauzan (SMEDA facilitator) that leather garment is an artisan skill not much depending upon machines). However, this is not an example of improving manufacturing competence but simply of improving an existing or introducing a new product.

For machines, they rely on Jockey (Japanese made 01:25 on 07/01/ 2011 recording of 04 minutes). They try to accommodate the customer specs in their products.

Executive talks about the process re-engineering which was carried out (04:40 on 07/01/2011 recording of about thirty three minutes) a foreign customer from Germany, who practically directed how his production line should be run (in and around year 2000, 06:09 on 07/01/2011 recording of about thirty three minutes). He met this customer in Germany in 1997, when was doing a motor bike leather garments stall there. (06:31 on 07/01/2011 recording of about thirty three minutes). Productivity, lowering of production cost, quality (including factors like look, feel, fitting) improved as result of these efforts. (07:45 on 07/01/2011 recording of about thirty three minutes)

Executive has an annexe at his residence especially built for these foreign guests to accommodate and entertain them during their work at his firm (16:40).

When asked about artisans contribution to production, quality improvement (22:49 on 07/01/2011 recording of about thirty three minutes), interviewee confirms the importance of feedback of artisans.

When asked about steps taken to reduce production costs (26:55 on 07/01/2011 recording of about thirty three minutes), interviewee comments that it cannot be reduced but will increase with time as cost of doing business increases with time. However, interview does not talk about reducing defects, improving efficiency, reducing turnaround time etc.

13. **What future challenges firm face?**

Executive is very much optimistic about the future prospects of Sialkot, provided socio-economic, political, and law and order situation of the country improves (51:05). At (11:00 on 07/01/2011 recording of about thirty three minutes) Executive states that innovation process continues. Presently, football export has seen decrease but has been replaced by sportswear. This has led to further increase in export volume.

Executive feels Sialkot's leather industry is very strong and has not to worry from China or India. (24:00 on 07/01/2011 recording of about thirty three minutes). Interviewee links the position of leather industry's position to abundant availability of cheap leather in Pakistan, which has fourth or sixth largest livestock in the world. Secondly, the level of expertise in artisans available in Sialkot is not available anywhere else.

14. **How the presence of competitors** effect your performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc.

At (14:49 on 07/01/2011 recording of about thirty three minutes), the interviewee takes competition as a healthy influence on quality of product. Interviewee emphasises on healthy competition.

15. **A visit of the facility** to see the things which the firm has done along with supporting documents, company reports, clippings etc

Researcher's observations on statements of interviewee

The interviewee or his firm is not supplying to multinational firms like Nike, Adidas, Puma because at (51:30) when researcher asks him about continuous improvement in quality through better manufacturing practices, interviewee is not sure and replies ambiguously, "yes, they are quality conscious (51:44)".

The firm strives to get different certifications which are required for export purposes (53:00).

The firm is making good sales as at (59:00), he talks supposedly about sales increase from 5 crore to ten crore (625,000 \$ USD to 1.35 million USD, with 1USD= 80 Pak rupees) of sales.

At (59:30), researcher and interviewee agree that Sialkot industry is weak at scanning the horizons for new threats. The prime example is of sports goods (hockey sticks, squash and badminton and lawn tennis racquets etc) which have shifted from wooden to graphite and since Pakistan is not in graphite manufacturing, so a big market has been lost. At (1:00) interviewee agrees that technical performance should be the aim of SME executives but in whole of interview, interviewee has impressed upon artisan skills, cheap labour as their assets. Secondly, Sialkot football sector failed to catch the wave of mechanised football market and are strong only in hand stitched football market.

At (1:04:40), the interviewee claims that they have introduced new products by themselves and as an example quotes the football, which originally started from

being made of twelve pieces and now being made from less pieces and says, "we have done it by ourselves". Here, there might be misunderstanding between interviewee and researcher. While interviewee is talking about product improvement; researcher is talking about an entirely new product developed? Secondly, since these products are to be exported so at times the changes in products are stipulated by customers or regulations of international bodies like Federation Internationale de Football Association (FIFA) etc.

AT (16:20 on 07/01/2011 recording of about thirty three minutes), researcher asks if he considers SMEs in Sialkot caters to small orders, which China cannot due to economies of scale. Interviewee agrees that it is the flexibility of SMEs which help them survive. To reduce overheads, all SMEs sub-let the jobs and keep only essential activities to themselves. This helps in generating employment downstream as well. Interviewee gives a good example that if Karachi, biggest industrial city of Pakistan, has exports worth 1 billion USD \$, than may be thirty thousand people may be benefitting from it. However, if Sialkot has exports of 1 billion USD \$, than one hundred thousand people may be benefitting from it. Statistically, Sialkot has the highest per capita income in Pakistan.

When interviewee was asked about what makes a firm more competitive compared to its local competitors, the answer was "leadership difference and vision". The example quoted is of Saga Sports, whose owner brought Nike to Sialkot but after his death his company simply waned away.

Firms do not design the garments, the design and templates come from the customer.

Visit to the shop floor

A visit to the shop floor was made around noon (7/01/2011). First shown were rooms for raw material storage. A little away from it were the packaging area, where ladies were packing the finished products.

There were a large number of finished footballs, boxing gloves waiting for packaging. They had been stamped with firm's own name. Seemingly, any work did not require fancy machines. The machines appeared to be brand new and were being used for stitching purposes. There is a central office for handling of indenting, purchasing, marketing etc. I was shown simple dies and templates for printing on products. Generally, premises were clean.

Appendix C

Transcripts of Sports goods cluster interviewed firms

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Interview Transcript

Firm E

Sports goods cluster

I have explained the purpose of my visit and now executive of E is talking.

My father started this business in 1951 (00:00:28). From the very beginning, he had travelled a lot, studied the industry for the products sold in Europe. He felt the need that industry in Sialkot needed quality improvement, new technologies need to be introduced. Sialkot was producing junk, relying on cheap raw material and manpower (00:01:07). With the results the products were low standard. Therefore, when firm was started in 1951, we started contacting people on international level (00:01:40) and convincing them that future is in Pakistan. If technology is transferred, than quality products being manufactured in Europe could be manufactured in Pakistan, with its skilled and cheap workforce (00:02:06). In 1957, father met foreign customer, from Denmark, who was executive of an international firm (00:02:10). However, in 1957, foreign customer (FC) was not happy to transfer technology idea (00:05:00). He was happy with his production in Denmark under his supervision. Father kept on meeting him during international expositions. During the time, father started producing football in Sialkot using stretched leather expertise, which he learnt while his tour to Europe (00:05:28). First, FIFA approved football in Sialkot was produced by our firm (firm E). FIFA approved for international matches (00:06:14). So we started exporting these footballs (00:06:41). However, that ball was inferior to what foreign customer was producing (00:07:28). E became good friends with Select sports. Trust between the business partners is of essence (00:07:52). Meanwhile, foreign customer shifted to Hungry because of rising production costs in Denmark. In 1975, E again met Select sports, and convinced FC to come over and see local facilities and labour expertise (00:09:28). By that time, FC was fed up of Hungry because of bureaucratic delays. FC came in 1975, gave cut panels of football to the workers. Stitching quality of panels impressed FC (00:10:07) and agreed to transfer technology. In 1976, synthetic leather technology was transferred to a firm in Sialkot (00:10:28)-first in Sialkot. Till then, Adidas was sending synthetic panels for stitching but technology was not transferred. No regular agreement was there but just on a handshake, technology was transferred. (00:11:08). Football and handball, volleyballs-inflatable balls, complete technology which was not in Sialkot. One benefit of this transfer of technology was that our trained workforce went to other firms all over Sialkot and now Sialkot is exporting millions of inflatable balls (00:11:28). Major chunk of world market of hand stitched footballs (over 70%) is being made by Sialkot (00:11:51). SS whole team came over to train our workforce (00:12:00). About materials developed. In parallel, E went into partnership with another foreign firm (00:12:28). Father used to meet them in England and invited their director over to Pakistan. They agreed to transfer hockey stick manufacturing technology to E (00:12:45). That was a formal joint venture. My father was not relying on a single product but used to say that full Sialkot potential should be exploited (00:13:12). Cricket balls was a dying industry in Sialkot. E brought a person from England to train the local workforce (00:13:39) which are being used in test and county matches. Others are also manufacturing cricket balls in Sialkot. Still, our edge is that we continuously improved our assimilated technologies (00:14:12). Technology in 1975, changes which occurred, FIFA changed criteria for football specifications, have followed them and based upon our R&D (00:14:37) we are manufacturing balls which are being used at international level and in Danish football league matches. Based on the reason of our R&D, material development, specifications.

When asked by the researcher that attention was not paid to the machine stitched football market, executive replies: Hand stitched ball is of best quality (00:15:47). Machine stitched is lowered end ball, toy ball. International first division ball is hand stitched ball as machine stitching is much weaker (00:16:19) than hand stitching. Machine stitching is getting popular because of low cost, but hand stitched forms major chunk of (00:16:43) football market. However, machine stitched is increasing its share because of low cost even at lower medium range. Firms have started manufacturing machine stitched footballs. Of course, if you don't follow changes happening, than you are left behind (00:17:03). Machine stitched, in Sialkot,

overall three or four firms have started manufacturing on large quantities. However, China still has the edge. Material used (soft foamy leather) is local production (00:17:28) in China. We are importing it from China. We are trying to manufacture it locally but they are still expensive (00:17:53) while leather for hand stitched football is manufactured in Pakistan. We are hopeful that we will grab a part of machine stitched market from China (00:18:00). Third technology which has been introduced is thermo-moulded football (00:18:16), which is moulded, vulcanised in machine like basketball. Adidas developed it from Thailand. In the recent world cup, China produced it. Thermo-moulded is still inferior to hand stitched football (00:19:00). Adidas decided to develop thermo technology since 2002 for the world cup. But still thermo-moulded ball quality is inferior to the hand stitched ball (00:21:00). Production is slow and will take a lot of time and effort to make production cheaper for economies of scale. Adidas has transferred technology of thermo-moulded football to a firm in Sialkot (00:21:28). Promotional footballs are usually machine stitched and form a large chunk of the market, which Pakistan has lost (00:21:53). But hopefully we would gain the market again in 2-3 yrs time. Reason being that labour is getting expensive in China along with materials (00:22:10). In Pakistan we still have cheap labour, which is quick to learn and we are developing local materials as well. However, in thermo-moulded market, it would take time (00:22:28), maybe more than 7 years. SIDC is a step in right direction (00:22:42). It is public-private partnership example, where latest technologies are being acquired to maintain edge in football industry. SIDC is a collective effort over 100 firms of Sialkot (00:23:46). We also want to invest in composite products for a public-private partnership venture. Thus, Sialkot has taken a lead, where at firm level and collective level, efforts are being made to promote the technical edge of industry. Sialkot chamber of commerce is a very dynamic institution (00:24:11). We discuss what technologies are latest in the world and how they can be acquired (00:24:28).

Researcher asks executive about firm's business strategy: My father had a vision that will manufacture quality products and target top and medium level products (00:24:36) because in cheaper range there is price fluctuation and more competition (00:25:00). We cater all the range (00:25:21) but focus is value addition. Use good material, better technology for better quality and good price. When top teams are using your product than whole range of product sells (00:25:34). This is our main focus. The business success lies in close cooperation (00:25:47). We are dealing with selected customers' not large number of customers. We meet them couple of times in a year and discuss their requirements (00:26:46). They bring their market studies and give world trends. We are in manufacturing and new materials and technologies are scanned by us. They concentrate on marketing and we work on product development. We introduce new materials in different products which are introduced in different markets by our customers (00:28:23). The feedback of different markets tells us. There is this close coordination, which is our strength (00:28:28). Probably this level of cooperation does not exist between other firms and their clients in Sialkot (00:28:43).

For future challenges, technology changes are the biggest challenge for Sialkot e.g. as in football (00:29:21).

Technology for rackets in squash, badminton changed overnight (00:30:00). Firms had the order ready with them and their foreign customers refused payment. These firms went bankrupt. Many firms in Europe went bankrupt. People which introduced composite rackets suddenly sky rocketed.

To avoid similar debacle again at SCC&I, we study those technologies which are phasing out and new technologies which are on the horizon (00:30:51). In 2008 I was president SCCI and observed that there was no contact with academia (00:31:20). We started collaboration universities for technology upgradation and management training (00:31:43). We have established a sports manufacturing group, which has visited Engineering department at Loughborough university, England (00:32:03). We are proactively seeking future technologies.

When asked what tools are used for scanning and selecting technology, executive replies: in Today's world (00:32:28) communication is so fast: First all latest information is available on internet, secondly Sialkot people travel abroad a lot. On all exhibitions we are present. Even now my elder brother is in Germany for an exhibition (00:32:57). We exhibit our products, observe our competitors, talk with players how they find our products. This is the edge with Sialkot, they travel widely (00:32:28) and thus stay updated with opportunities and threats. My father travelled Europe in 1950's. Travelling helps to find new customers, sales, technology (00:33:37). Africa, North and South America, Europe are visited. Production costs are increasing in other places and if manufacturers in other markets could be convinced that such products could be manufactured in Sialkot at cheaper price (00:33:58) than a competitive chance is give to make the produce. We are proactively seeking new technologies so as (00:34:45) not to be caught off-guard. We are working to keep our edge in football, composites in hockey sticks, rackets are being made. These things have started in Sialkot. Sportswear is a big field (00:35:12). New technology has been introduced in sports wear e.g. performance fabrics. We source them from different countries. Pakistan is trying to develop and there is not much govt support. We have moved a proposal with the govt. to develop such garments. There is a huge potential in sportswear (00:35:50). Sports Shoes we could not penetrate the market, although some firms in Sialkot have tried it. China has edge in it (00:36:06) with good technology and cheap labour. In our firm, we are using technology as an edge (00:36:49) but in China Labour rate has increased recently for skill force workforce is around Rs 30000 to 40000. This edge will stay for foreseeable future. Labour intensive jobs will stay in Pakistan due to cheap labour force here (00:38:03) due to increasing growth. Textile industries in Faisalabad employ new technologies along with cheap labour for competitive edge (00:38:43). We have also edge of cheap raw materials e.g. cotton (00:38:57) . Raw material price increase is forcing us to introduce technology. I prefer to give employment to people as well. Pakistan has a big population (00:39:43). Our focus is quality and if there is a minor difference between human and machine output, there is no need to employ machine (00:42:01). In medium to low range, this much quality does not affect much other than at top range. Although, our workforce is illiterate but very quick to learn (00:42:56). We call experts over to train our workforce. Increasing productivity through lean management concepts is another area (00:43:13). We have given targets to universities for product development (00:43:49) both at firm and chamber level. For example for football stitching, we are trying to develop a machine a prototype for hand stitching. If the project is successful than worker's productivity will almost double. Similarly, for material testing procedures, we are approaching universities as well as developing alternate materials for our requirements. We have approached universities as they have expensive machines but they are working in isolation with no connection whatsoever with the Industry (00:45:27). We are desirous that there should be a regular contact with the universities. Sialkot exports 98% (00:46:06) of its products. We are competing internationally and international challenges made us to look towards our universities for solutions. We are not relying on local industry. This may be an advantage or disadvantage to Sialkot industry. When a technology becomes obsolete, we cannot fall back on local consumption for support. So we have to be on our toes to confront future challenges.

ASTON UNIVERSITY

Interview Transcript

Firm F
Sports goods cluster

Initially, researcher describes the research purpose to SME executive and requests firm brochures.

Interviewee's account

Interviewee starts now (00:03:00). In Sialkot sports goods, the largest volume product is balls (football, handball, basketball, volleyball) (00:03:43). I have the indicators (00:04:00) of why people are competitive in Sialkot and especially why we are competitive in industry. I will give you my feedback, which will be especially on my firm (00:05:00) and will also be about general Sialkot industry. Unfortunately, inflatable football industry is not growing in Pakistan (00:05:14). 70% of the world market about inflatable balls is with Pakistan as per Government of Pakistan, but data from Europe indicators 15% share of football industry. Although football industry involves some technology but overall is labour-intensive (00:06:00). There is not much of technology involved in football manufactured in Sialkot. Therefore, being competitive on technological grounds is out of question (00:06:30). Rest is quality consciousness of firm and firm's CSR (corporate social responsibility) focus. High performing Sialkot firms (00:07:00), since 2000, have been putting emphasis on CSRs. Example can be given of Saga sports. Its CSRs initiatives are considered as a role model in whole of Pakistan generally, and in Sialkot particularly. Second is quality consciousness and sustainability of quality and productivity. Our company has the same two (00:07:40) qualities. In 1997, we were first fair trade signatory (non-food products) agreement in Sialkot. We benefited from it (00:08:50). Fair trade code of conduct benefits the worker directly. Worker strengthening, welfare, benefits, development. Since benefits started coming to the workers, their commitment to the firm increased and our quality increased (00:09:25). This helped firm to further CSR initiatives. We comply with all Social codes of Fair trade on sports industry. Our other (00:10:00) products include garments and apparel on which world responsible accredited production (WRAP) code of social conduct applies. We are complying to it as well. Organic textile code of conduct, we are complying to it as well. Customer trader partnership against terrorism (CTPAT) is for export to America and we have fulfilled that criteria as well (00:11:00).. We have also achieved OSHAS 18001, Environment 14001 certification. Workers feel secure due to application of these aforementioned codes and their commitment to the firm increases. This helps in turn addressing customer concerns on shop floor (00:12:00). Here, Executive talks about cleanliness at firm and feels proud about it (00:12:30). Most of our products involve manual work and firm look might appear as it is not a hi-tech industry, which it is not (00:12:45). All individual pieces being produced are checked (00:13:20) for quality purposes. 100 percent inspection, Therefore, the reason for greater human involvement. The firm environment also helps to retain skilled manpower as well (00:13:52). "When prompted about being competitive at international level, executive replies"(00:14:14) I find myself competitive at international level because some customers are responsible and others are quality conscious. Conscious communities are Scandinavian, Italy, Germany and UK respectively. They look into where the product is coming from, how it is made, if any child labour is involved. For example in Uzbekistan, cotton picking is done by children and even President joins. But still some countries have put restrictions on them (00:15:39). Italy community is very conscious about wages (00:16:10), how the product is made etc. When we started trading with Italy in 1997, certain criteria were defined about manufacturing of football, wages to the stitcher etc. They proved to be such a success that these criteria were later incorporated in standards of FLOWCERT in 2002-03 (00:17:00). Because of these things, we find ourselves competitive. "When executive is prompted about competition from China, Vietnam, and Thailand, he responds" (00:17:34) they have strength in synthetic products. I have this stand that there should be cooperation and linkage between industry and research institutes. These research institutes should be aware of the latest products coming in the international market, and identify firms which can produce such products and determine at what cost to be produced (00:17:50). Unfortunately, such institutes do not exist in our country

and there are not much chances in next 5-10 years (00:17:50). Therefore, we came up with a solution of our own, which products we can be competitive in e.g. cotton we can be in against China and India. Majority of cotton yarn has been exported to China and India. Till now, we have been targeting those products in which we can be competitive (00:18:50) e.g. organic cotton and fair trade certified products, in which China has failed to compete with us. But we are not sure of the future, and might have to look for alternatives if China comes in this field as well. Every industry should have the capacity to diversify (00:21:00). If diversification is not there, factories will soon be closed. In 1998, keeping diversification in view, we went towards sportswear. In last five years, internationally sports and fashion has been mixed. A person would be wearing a sports garment i.e. shoe, shirt, jacket etc. In 2001-02, we came in footwear (00:23:15). Fair trade organic sneakers in the world are made by Talon enterprises (00:23:40). So this is another example of competitive advantage. We established in 1990 (00:23:50). We would be going for diversification in football (00:24:53). There are few firms, which have performed well in machine stitched footballs like AWAN sports, Forward sports, Talon sports (00:24:50) We are now producing machine stitched football, which qualifies FIFA inspected level requirements (00:25:00). WE can monitor all the requirements in house. Hand-stitched footballs could only be made 5-6 balls per day, while 35-40 balls per day productivity for machine stitched balls (00:25:40) per person. So bulk production in-house is possible addressing child labour issues. Next frontier is mechanised football, which requires no stitching. Process used in this sort of football is patenting. Therefore, we cannot use this technology in Pakistan (00:27:00).

“When prompted, what factors influence business strategy” executive replies (00:27:26): all factors have weightage, customer feedback is very essential, HR is again invaluable.

“When asked how you measure firm performance?” executive replies (00:28:19): Sale is ultimate indicator that u have grown. Next, to whom you are selling. If a customer is price conscious and does not care how the product is made. We might sell to him and make profits but then we might not implement CSRs. Growth should be in money as well as firm image as a responsible firm.

Manufacturing competence is quality and CSRs (00:29:40).

When prompted about recent CDIs, executive replies (00:30:00): We have gone into:

- Vertical integration of garment manufacturing including dying, knitting etc,
- Cotton is certified
- Development of machine stitched footballs.

Bladder of football of latex and butile are continuously for quality and continuous improvement.

When prompted about SIDC, executive replies (00:31:40): The concept of SIDC is to bring technology to Sialkot for all to use.

For producing machine stitched balls (00:34:11) master trainers from China were hired and stayed for six months.

For apparel production expertise (00:35:40), Lahore has got the expertise. Srilankan management has been hired by them. We hire from Lahore skilled workers and management for transfer of expertise.

For problems with Sialkot industry (00:37:00): Mostly industries run on specific orders which have to be delivered within certain time period. Therefore, it is difficult for majority of firms to hold on to their employees and also implement CSRs. However, we employed CSRs. This leads to increased expenditures.

For future challenges, firm (00:39:14) executive replies socio-economic conditions. The price fluctuation with local raw materials, along with fuel prices etc affect international competitiveness.

The presence of local and foreign competitors (00:40:23): is a healthy impact, keeps you on the move for business growth.

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Interview Transcript

Firm G
Sports goods cluster

After explaining the background of the interview by researcher, interviewee starts speaking (00:02:52).

Mainly, it is football business; hand stitched same to others in Sialkot. Firm is in the business since 1975. Initially, we started as Sublime sports in 1969. Changes are automatic. Initially, at that time there was no concept quality, football was a toy and England (00:04:22) was the main market, more than 90 percent of the exports. Before partition, Sialkot was the only place manufacturing football. There were leather balls at that time. When we started this company in 1968, before I (firm owner) went to Germany on training. It was a great exposure (00:05:52). I saw what customers wanted. I observed that if a product is aesthetically pleasing, it is preferred with respect to other products. There was no care in this aspect in Sialkot at that time. Price was of more important element. So we tried to improve cosmetics. Secondly, there were some common complaints with the ball (00:06:40):

- Ball is not round
- There is a leakage through foot bladder,

So we decided to improve cosmetics, packaging. We were not manufacturing but exporting at the start of our business. We came just as traders. There is a division of labour in Sialkot. Exporters are very large but manufacturing is small. Everybody is a born exporter here. There were established companies at the time we started. (00:09:15). We started with a few priorities: We checked the ball, checked for leakage, proper stamping, packaging. Did not have many large customers. Our one customer was in Germany, who bought from quite a few sources in Sialkot. However, in few years' time, he stopped buying from others and started buying from us. Cosmetic aspect, leakage less, quick claims refund and how you deal with the customer (00:10:00) were the reasons for winning over the customer. Second, market principle is how u deal with customer. At that time there was the practice that if there was a quality complaint the lot shipped, company would ask (00:10:44) for more order from the customer and would settle the claim in the new order. However, I decided to break this practice and emphasised that the reason for complaint should be investigated and promptly settled (financial and technical). It is the prerogative of the customer to stay with us or put more orders with us! In short, we analysed the weaknesses of the sector and try to improve upon them (00:11:40). As our performance improved and the German customer grew confident of us. This company was itself manufacturing football in Germany, high end. They proposed that you do the stitching (00:12:59) as stitching was of good quality in Sialkot. They started sending us pieces for stitching. Now confidence is building up. Next they thought that leather is available in Pakistan, so why not prepare leather in Pakistan. They decided to send their technical person to help us to prepare good leather to make ball here in Pakistan. Then we entered "quality manufacturing" (00:13:48), selling at a very good price. At that time, no one was manufacturing ball of that quality in Sialkot. To keep the secret and expertise within the company, we hired deaf and dumb people (00:14:20). We trained them. It was leather time. In the meantime, we tried to establish contact with Adidas in Germany. They were not interested (00:15:40). They were interested in shoes and were not interested in balls, which they would get from Spain. Due to changing political environment in Europe, Adidas had to look for manufacturers elsewhere and their first choice was us. Thus, this is a continuously evolving situation. We had an agreement with Adidas in 1975. Stitching for a company in Germany was a factor for them to have confidence on us. We were stitching balls for Adidas for few years and volumes were high. It is a matter of confidence, which customers put on us (00:17:52). In due course of time, trust is build. Adidas started buying low end balls from us. We were already in quality, we could give them better service and quality. Next in , Adidas said that instep of sending leather, they would send sheets . Thus, relationship is building up. Skill was available, cutting was available. Adidas sent its quality control person ((00:19:42).), which stayed over here for six, seven years.

On the spot inspection for checking stitching. He himself was a stitcher, would motivate the people to improve the quality and skills. We were paying workers more than the market was paying, as we were getting better price. That's how the skill was slowly transferred (00:20:32). If you go to Forward Sports, it is No. 1 supplier and we are no.2. We remain in quality (00:21:02). Quality is our hallmark. Medium to high quality is our range (00:21:31). "Our line is traditional but we started to do some untraditional work (00:21:38) through collaboration". Price is also there as a competitive factor, customer will pay a little higher price, if you give them quality and a better service. We consider ourselves relatively expensive. We have attended seminars on cost cutting (00:22:31) through less wastage of material, minimisation of wastage. Cutting knives were there, but how to cut so as to get more balls per sheet (00:23:02). Lean philosophy, different lectures by Adidas to sit together. We (00:24:19) learn a lot from these moots, from Adidas. Customers tell us their choices and preferences. If you ask them, they will tell you a lot.

Everybody wants to go to a good buyer (00:25:20). Everyone is coming up with different quality and products. Material has to be sourced, local and import. However, to switch from one supplier to another is not feasible for customer-for few pennies. This involves certain risks (00:25:52). R&D is material testing, printing, cutting.

At international level, how you are feeling your position (00:27:00), researcher asks. Interviewee replies: one has to stay competitive and alert to threats, since you are in the open market. Go to exhibitions sell products. Exhibition is a big source of learning (00:27:52). Sellers and buyers are there. Identify sources, customers, new threats. There is mutual interaction. If you have a good customer with you (00:28:41), chances are that you will get a new customer very easily. For example if you have Adidas or Nike as you customer that means that you are a good supplier and others will trust you.

What is your business strategy (00:28:52), researcher asks. Interviewee responds: We have added sports wares. For threats, world cup is no longer hand stitched football. Collectively, we are establishing SIDC funded by Government. Machinery and equipment and building are in process to make mechanised balls. It will be open to all the industry here. There will be trainers at SIDC. The threat is to football market and we are losing. Machine stitched balls are also a threat. Volley bally of good quality is laminated, not hand stitched. Once this centre starts, we will come into this market as well. Basketball will also be made in this SIDC. Volleyball, football, basketball, bladder for the football. Some companies are doing at individual level. But the sector as a whole was being affected and govt. Agreed but management will be run by the private sector.

How you measure your firm performance? (00:37:11). Customer satisfaction is the key, new products is sports ware, capacity is the issue for increased sales. Sialkot (00:38:17) lives on export business. First effort is to retain current customer, to keep them satisfied. Secondly, for new customers we got to exhibitions, personal contacts etc. However, socio-economic conditions are affecting our business.

Why hockey sector did not take the initiative (00:40:38). Now, they are mEng composite hockey. There is also a small company. SMEDA is working with them to improve in this regard.

We started with quality (00:41:48). Initially, when expertise was not there, we defined cosmetic appearance as our quality. If customer leaves it will be for two reasons: quality is not good and price is not competitive, in-time delivery, service is not proper. Market does not favour anyone. confidence and quality (00:42:49) that we offer, which helps us to stay in the market. Nobody is married to anybody. Business is business.

Future challenges (00:44:00) are diversification, quality improvement. Maybe we will go in sports shoes

Researcher Comments

Executive considers himself as a pioneer for bringing quality manufacturing to Sialkot. Hiring of deaf and dumb people is an indication that knowledge was new to the cluster. Partnership with German customer helped them to increase their stitching capability. Adidas further cemented their capabilities. Being part of Adidas supplier team, firm is invited at suppliers moot, where experts deliver lectures on productivity, lean manufacturing etc. They also go to exhibitions to keep an eye on the market.

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Interview Transcript

Firm H
Sports goods cluster

Interviewer explains the purpose of the visit and then interviewee says that he would give an overall view of the sports goods cluster of Sialkot and of his firm; if any questions are still left, I can ask them later on.

District Sialkot is basically cottage industry. Since last forty years, these different industries have been here mainly leather, surgical and sports garments.

Work which has been around for 40 years, people get to hang of it. People were taking initiatives in Sialkot on their own. No institutions were developed here for development of these industries. People were not educated. We have been here for last three generations. First generation took the initiative and established the firms. However, first and second generations were not educated and did not evolve with the corresponding world industry. At international level, people were educated and running firms scientifically. The second generation at Sialkot was lacking. Pakistan is not short of resources, including human resource, is present in Pakistan but have not been properly exploited (00:03:40). Our competitors, China, Bangladesh, India, increased their education level while our stayed stagnant. Our biggest dilemma is that our entrepreneurs did not learn to run enterprises professionally at international level (00:05:11). When third generation, us, we started realising our problems (00:05:30). I have 2000 workers, 85% are not school going. Majority of floor worker has not been trained in any institution before coming over in my firm to work (00:06:00). I have been not trained for the job I am doing. We do not know the basic technique and science how to run an organisation. To further compound the problem, we did not allow the professionals to work with us (00:06:56). We did not have the vision, foresight. We did not know the benefits of employing professionals, costs are reduced, productivity increases (00:07:40). We did not have the capacity to realise that a professional helps in decreasing costs and increasing productivity. Still, for the next 25 years we don't have a skilled work force at managerial, supervisors or worker level (00:08:48). There are no programmes; no resources allocated and even nobody is serious about the issue. Let's say that district Sialkot has an export of \$1000 million for SMEs. For 40 years, if this SMEs had properly been handled on scientific grounds, this thousand figures could have been ten thousand million! For example I have highlighted areas which cause the problems: lack of information on. how to make a product, how to produce quality, how to increase efficiency, how to reduce cost because of which we cannot compete internationally (00:10:58). We have the resources but they cannot be put to proper use. People who somehow improve upon some of the issues highlighted above, they become progressive (00:11:42). However, I along with the firms you (researcher) have interviewed do not consider successful (00:12:04). All of us do not have an individual sale of more than 2 billion Pakistan rupees, which would come in few million USD. If you consider Taiwan, Bangladesh, Srilanka, India there would be numerous organisations with sale over USD 100 million. We are lagging this much (00:12:40). Our biggest resource is human resource is being wasted. I have advertisement for hiring for my (00:13:40) firm. I have thousand operators and need thousand more! But I cannot find suitably skilled workers in whole of district Sialkot. I can tell you about people in Sialkot, who are illiterate and have no skills. This is the waste of human resource and I need skilled people. To add insult to the injury, the govt. Training Institute teachers are so ill-trained that even I have volunteered to train them(00:14:40). This is the dilemma of SMEs of Sialkot. I need 1000 skilled workers, and what govt offers is pathetic. I am the only among the few, who offer training to master trainers, who can train others. The fundamental measures of training for progress are: SMEs should be entrepreneurs, who should be visionary, risk taker and take advantage of an opportunity (00:16:04). The present third generation (interviewee) are preparing their next generation along the needs of the business. They are getting best education and we are imparting training to them also. Next, we need higher skilled (00:16:40) management. For example, I have twenty managers trained by me. If I get them training from LUMS University, it will require expenditure. However, if I don't do it, their vision will not expand than they will not produce the given results affecting my business. Me and my family's vision is expanding but my team's

capability is not increasing than you cannot produce the required efficiency (00:17:40). Their training or fresh people need to be motivated to gain managerial skills for running an industry. This sort of education is lacking in Pakistan. At supervisor and skilled labour level, the problem is even greater (00:18:40). There is no shortage of resources but they have not been exploited. Resources are HR, law & order, roads, electricity. But there is no functionality between them. Now, why the people you (researcher) have interviewed have been categorised as successful (00:20:24)? As I said earlier, they managed to overcome somewhat the difficulties mentioned before. Like in 2000, Karachi, Faisalabad, Lahore professional team textile team and paid them three million a month. I knew that there is an opportunity at international level (00:20:58), and a product can be made at competitive price and marketed and there is market for it as well. Personally, I did not know anything of textile. I told my hired team that these are my targets. This professional team established the infrastructure, human resource was trained, and latest machines were imported (00:21:40). This professional team stayed for six months. It's been now twelve years, my profits increase by 100% every year. You know the reason why? I did few things: My ultimate product cost was same at international level, my waste was zero, my human resource efficiency increased with the result that (00:22:58) I started competing with China, India, Sri Lanka, Bangladesh. Thus, I used professional skill to exploit the opportunity; I bought technology which was not in Pakistan. Vision was given by my senior management, which decided which products to produce and marketed in which country. Our strongest weapon is marketing (00:23:42). What is marketing? The sector you are in, which product can you produce, which your competitor in China can produce. This is the reason I am among the progressive firms. I have my problems. I am not an educated person, trained on scientific lines. However, my next generation could manage better (00:25:24). The dilemma and tragedy of the country is that there are not enough opportunities for ordinary people to realise their full potential (00:25:32). For the last ten years, the sports garment unit has been running successfully and growing 100% annually. In the last two years, I have gone into livestock. I have not expertise for it. But I hired professional team. I am successfully running that business (00:27:24). Interestingly, you (researcher) might think that what I have to do with energy sector? In 2015, we will be first manufacturer of wind turbine in Pakistan (00:27:35). I have spent USD one million on it. We will be the first in Pakistan, whose prototype will be ready in Germany. What I have with different projects. I have to make my sales to USD 200 million by 2017 (00:28:24). How that is possible? When I will sell 1.5 MW wind turbine for 20 million, that will be possible. We have everything, in terms of resources (00:28:50). What is diversification? Everybody is diversifying in the same field, add another product to list of products (00:29:36). This is not diversification. Firm started in 1996. You started a project with certain investment and goals (00:30:24). At the end successful rolling of project, you have achieved your goals and profits. Now those profits should be invested in some other venture! (00:30:24). I have five units, entirely different from each other: Sports articles, livestock, meat and flower exporter, and wind turbine. I have one unit in South Africa (00:31:00) and I am sitting here. I started in 1996 and this is 2012. People have been working in Sialkot for the last 40 years and I have achieved all that in span of 16 years. My target is to employ 15 thousand people in next five years (00:31:39). My strongest resource is human resource. My wind turbine workshop requires 3772 people for producing three wind turbines in a year. 2020, all the wind turbine manufacturers are booked. If you give an order now, you might get a turbine in 2021. This is the marketing (00:32:52): What is required in the market? However, we are not risk taker, does not exploit opportunities, we are not visionary (00:33:24). In Sialkot, in all sportswear firms (00:33:54) there are people, who have been trained from my firm. I have trained three thousand people in last 14 years. I am producing 30,000 garments every day (00:34:24). My colleagues ridiculed me I brought consultants at high price. Workers trained by my master trainer are now in every other firm. This is the job of the government (00:35:40). I still need people. Executive does not have (00:36:00) firm brochure

Appendix D

Transcripts of surgical instruments cluster interviewed
firms

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Interview Transcript

Firm I

Surgical Instruments cluster

Researcher Comments

The person started telling the story of the company. I initially explained him the scope of my research. From now on SME executive is describing his firm:

Company initial start-up history

Firm is a very unique Firm (00:01:38). They started as a regular surgical instrument firm. Were just a face in the crowd with no distinction, everyone was doing the same thing. By luck, God wanted us to be, our customers were electro-surgical instruments manufacturers and they used to do value-addition to our instruments. Suppliers asked us to do a few operations in Pakistan. I replied that we don't have the technology, material or the know-how to do it in Pakistan. However, the idea got planted in my head! (00:03:40). I moved back in 1996 from states (Houston) to Sialkot. I was not satisfied with what we were producing, ordinary person in the crowd. My other brother was already in Pakistan looking after the firm, which was started in 1987. (00:05:00), There were some specifics we had to meet from customer side. Thing was customised as per customer specification, from the start. At the start we had only one customer. I did not want too much business or too many customers but satisfied customers and controlled growth was our aim (00:06:08),! We were, in 1987, one room operation, had limited resources! My father gave rupees 35,000/= for starting this firm. No loan from any firm/ bank. We wanted to do business but not make money (00:08:00). Surgical instruments were in their family since 1972. Other brother graduated from university and they started business together. He was in USA. Aim was to have a controlled growth for having a satisfied customer, resulting least marketing cost, resulting in repeat business and customer will not go to any other customer. Product quality, service – differentiation would be here and they are (00:10:04) are still doing business with the same customer/ firm. This firm has been bought three times but each new owner retained us as the supplier. From 1987 to 2011, and they form a big part of their business. In 1990, business expanded: constructed four rooms, one office and three working rooms. Further, they made eight rooms. By the time executive came back, in 1995/6, office block had been made but they still had one customer (00:12:16).

Till here, executive call it part-I of the story and now is starting part-II of the story.

From 1995 till date (History of CDIs).

I learnt a little bit about electro-surgical instruments during my stay in USA, and no one know about it in Pakistan but had decided that we would work in this direction but had no resources, knowledge, and infrastructure. From 1995-1998, we spent a lot of money on R&D (00:14:03). In the meantime, we made a separate small building for this electro-surgical product. It required knowledge in powder coating technology, plastic technology, epoxy, assembly- which nobody knew in Pakistan. I had some idea from the visits I had at the customer facilities. We finally came up with a product. We were happy 'because of our lack of knowledge, or ignorance about the quality of the product (00:15:15). At this moment, you may call it sheer luck , someone asked from USA if we can make bi-polar forceps instrument. They sent us drawing and specifications and we sent the product of hard work of three years. They said it was worthless! (00:015:58) (Both the executive and interviewer share a big laugh here). Now, we asked them why it was worthless, Customer pointed out the shortcomings and we improved the shortcomings. Finally, the product was approved by the customer and we were ready to ship the product. Now we came to know that we cannot ship product as it falls under class-IIIB category and has to be approved by FDA (00:16:42) for 510K certification. Without 510K certification, one cannot sell or commercialise the product in USA. They did not how to get the approval (00:017:11). In the meantime, majority of Sialkot people said you would be a failure and I accepted as a challenge that we would do it (00:018:28) During all this process, we were going through very emotional state, sometime euphoric and sometime down. I knew a FDA consultant in USA about 510K and he was bit pessimistic about the qualification. Anyway, it took 2 and half year and USD\$ 40,000 to get certification, but that taught me a lot – in 1999. First

company in Pakistan history and we learnt a lot during the process (00:21:14), we were ecstatic. As we were developing the product, we wanted to promote it. We have only one customer at that moment (as this story unfolds). As they were manufacturing this product, they wanted to explore the market as well. Therefore, in 1996, we exhibited products in Germany. In that exhibition, few Pakistanis came and said what u have done, colouring forceps. There was no business realisation and again in 1997, and 1998. People came and showed interest but practically no business for three years. We were very disheartened (00:24:56). By 1999, we had our doubts, if we should go to the exhibition! But still we went one more time. By this time we had 510K approval but apprehensive why things were not clicking. People ask and we give satisfactory answers. But 1999 proved to be the best year. A person came to them and said he has been watching (00:26:32) them for the last three years to see if they would survive. Secondly, he asked what sort of international approvals/ certificates they had for their products. Upon seeing 510K approval from FDA, he said let's do business (00:26:33)! So two forceps lines: one for USA and one for European, functions same but designs different: At the exhibition, they explored the market and what people were exhibiting. We saw an ocean of products and technologies, so we decided that we specialise in this field –electro-surgical products (bi-polar forceps).

We had no components about plastic moulding. We imported material from USA. We sub-contracted someone to make plastic casing required for bi-polar forceps. But eventually decided that we would do vertical integration, do plastic moulding by ourselves, buy our own machines (00:29:38). Today, we have a whole department with sixteen machines working. If production is in-house, quality can be maintained. Otherwise subcontracting does not assure quality. Main reason for doing vertical integration was to assure quality. Even they were providing material to the subcontractor (00:31:17) but were not sure if he was using the same material.

It was 1998 or 1999; an Italian came with a finger-switch pencil (at the exhibition) and asked if they could make it- an elctro-surgical instrument? We had no idea about the product but took the product and said give us some background about the product. He said this is a non-reusable product and china is the biggest supplier to the world (00:34:30). By this time we were a bit stable, we took the project. We opened up the product and started reverse engineering. We started with the most difficult part and eventually came up with the product i.e. some in source and some outsourcing for consistent quality and costing for the customer.

Whatever product we make, we took Germans or Americans as standard, competition (00:36:47) and do not consider Pakistan manufacturers as competition. This is very important for an organisation: It should realise which market firm is in, who is the buyer and who is the competitor (00:37:15). Without knowing your proper competition you fail. Nobody will buy the product. The competitor, does he also considers you as competition (00:39:26)? Business is moving very fast. We have an object, since 2000, we have to develop three products at MEDICA every year. The customers are very happy (00:41:15).

Coming back to the switch, they bought first moulding Swedish m/c of 1968 model- made a lot of noises. It was a learning curve, they invested some, learnt, breakdown then sold it and brought a better Japanese machine. Slowly, now they have sixteen machines all the time! Finger switch is a successful. People ridiculed at the start of the project but we took up this challenge and did it. But in surgical instruments, “Made in Pakistan” has a better standing than “Made in China”. We ended up selling in China. We are producing 4000 pieces per day. We cannot keep with the demand and have to say no to the customers (00:44:32). We have kept adding new things to our product range.

Cables (00:45:00) made of silicon materials from an English company. We went into partnership with it and gave them forceps in trade for silicon cables for connecting instrument and generators. Somehow, we were selling more cables than they could provide. So we decided upon manufacturing our own. Now we offer 25 different kinds of cables.

Bipolar artery sealer, our own design. We are the fourth in the world to manufacture it (00:46:32). Most recent, (00:47:00) is also very hi-tech is bipolar scissor. They are the third in the world. Product line is wide. We sell to both US and European market.

People recognise us in the world. Our competition knows us, acknowledge us and we respect our competition (00:49:14). We respect each other. Keep your competition alive, which has taken you from point A to point B. When executive came back to Pakistan, they had only one customer, now they export to all the major countries of the world (00:51:06). Europe, America, Far East, Australia, Saudi Arabia, Egypt etc.

Business ethics (00:52:58): First an honest effort, than reward comes. There should be integrity so that people should respect you, even if you incur loss. Customer has paid one rupee and you give him product of one rupee or 105 paise but not of 95 paise. Should be honest with the customer and there should be no compromise on quality. The moment you compromise the quality (00:54:30), you will be out of the business. Workforce should be motivated to improve quality every day. There is no pinnacle; you have keep going up and up and up.

Product selection for engineering, marketing (00:57:00), and launch depends upon the executive. Sometime customer requests, sometime we decide, Pakistani (01:00:00) companies are without R&D, have been living with few things and that's their pinnacle. Businessman in Sialkot is hesitant to invest in HR, materials, technology, infrastructure and think about ROI without thinking what amount they have invested. Techno Instruments assembly line is A/C. Worker comfort is thought of. There is no investment on HR in conventional firms.

Finger-switch should be sterilised, a requirement of the customer.. Initially, firm used a government agency. But the customer asked me if the providing facility was certified. Firm requested but government agency did not listen. EO sterilisation in-house ,they incorporated. Fully computerised, no human error involved, as per American standards. People ridiculed them but now they sterilise for the local customers as well. Steriliser is expensive. Investment in production technology, materials, HR for continuous competitiveness. We automate, we try to use the machines (01:06:00) to increase productivity and cost of production lowers. Machine is an investment , which pays in the long run. If we have a mould, after sometime, we make a new mould so that there is a value addition. New design, aesthetic sense of the cable along with the quality.

We do not compromise on quality. Businessman in Sialkot is not educated and people employed are not committed (01:09:00). They are now trying to implement ERP, although no customer has not asked for it (proactive). They are investing more than one million into it. We took the decision as business is growing , operations do not grow out of control. Businessman cannot foresee. Business needs reinvestment and if you don't do it, it will dry up (01:11:00). Always, providing equipment for the ease of workforce as well. Resources should be invested back and than see the results. Businessman should invest in HR. Future Challenges: (01:15:00) executive replies "Constant innovation", Firm electric car, 'that will be the future. Firm is looking at new technologies i.e. ceramics, MIM can we do it. Everything was achieved through internal R&D.

A machine, wanted it and searched for it everywhere. I was searching internet, saw something which caught my eye (01:17:00, postpones the daily staff meeting because of the interview). Manufacturer was from Korea and elder brother was in Seoul. Asked my brother, and brother said that this is the machine we were looking for the last six years. When asked the company to operationalise the m/c, company asked 4000 dollars, we did it by ourselves.

Finger-switch blade is in large quantities (01:19:00). Initially, it was outsourced but rejection rate was 50 percent. Inspection and testing was not reliable. To improve quality, the bought the machine and in-house started the production. 5000 pieces are produced without rejection. This is an example of return on investment.

When into a new (01:22:00) territory, one has to find answer to every question. Have to discover each and everything, which is a difficult task. Search! The other path is simply copying other person, hire his people on higher wages etc but this business would not be successful in the long run. Mental strength, failures, difficult path. Failure is the first step towards success! There should be commitment, inner strength for success otherwise people would tire out and leave. Technology is right up there, it has to be acquired, assimilated. It is all question of taking up the challenge. Energies are not directed. Top (01:28:00). Commitment, vision should be there, approach should be there and adherence to the principles and integrity.

A visit of the facility to see the things which the firm has done along with supporting documents, company reports, clippings etc.

Visited the factory, which was neat and clean. Saw the EO steriliser, assembly line, moulding machines, finger-switch blade machine. Interview information matched with the facts on the ground.

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Interview Transcript

Firm J

Surgical Instruments cluster

Interviewee was kind to give the interview. He had a heart by-pass sometime back and was recuperating. He is a trail blazer, does not read books or take inspiration from others. However, he was very well dressed, nice suit, expensive Rolex watch and had expensive cars parked outside his office. As per executive, he is in surgical business for the last 40 years (00:20:12). Interviewee is a college dropout.

1. **What does the company do i.e. its business, product range?**
Any type of everyday hand held stainless steel instruments (00:05:58).
2. **Is the product market competitive, stable, changing etc.**
Firm does not feel threatened from any competitors, local or foreign (00:06:30), in the market segment, we are operating. We have a strong business and will stay strong. We may not selling products worth millions of dollars, but the product range, quality and quantity, is very broad. We are part of supply chain of a company, which is second largest producer of surgical instruments.
3. **Are the product associated technologies stable/ changing?**
Technology never stays the same; it keeps on changing (00:08:52) very fast.
4. **Competitors, suppliers and markets-are they demanding and what is driving the change?**
5. **Anything else you would like to add?**
We have one of the highest levels of customer service (00:21:40).
6. **What is your business strategy** e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?

Focus is on manufacturing. Do not go to exhibitions and whatever money have is invested back into business (00:10:00). Europe made products are expensive to produce and end market consumers are not ready to buy expensive products. Reason is cut health care costs: they cannot cut on doctors, they cannot cut on machines, so where they cut-only on instruments. Therefore, German scissor is more expensive than one made in Pakistan. Quality of Pakistan scissor is same or even better. So we thought all those surgical instruments companies, which have the customers (00:12:46) cannot cut the costs. But we can be their original equipment manufacturers (OEM), we have better chance. So we work as OEM. It is a win-win situation. They give us the technology, I buy the equipment and invest in human resources and get better prices as I have no competition.

7. **What factors influence business strategy of the firm** e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, etc (rate in terms of importance, if possible)?
Our strong position (00:15:00) in instrument supply chain and there is going to be a market for us. If you have a good product, it will always sell. World population is growing, so market will expand. When someone gets more affluent, he looks after his health. Market will always be there and there will be no recession in this market.

It is a labour intensive sector (00:17:00). There are a lot of opportunities in it, but people stay away from it. Chinese can come into it, but their direction is very much unclear.

8. **How you measure your firm performance** e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines,), etc (rate in terms of importance, if possible).
NO business (00:19:00) can sustain without introducing new products, continuously. Have to make your business sustainable, you need innovative ideas, new products, improve your production efficiency, develop your human resource and improve your quality management system.
9. **What is your manufacturing competence** e.g. why customers prefer your product/ products/ How you are better than your customers?
a) Quality, improvement, new product development, successful replication etc. I have a good knowledge of instruments (00:22:22). Other day, I was talking to my hall supervisors (who have been with us for last fifteen years) that they have to learn management of HR. We have tremendous pressure of timeline, deliveries on time. They took it from Toyota on time. Supplier has no place for storage. Why the world is changing and why the customers are pushing us. Probably, our customers have further customers. Higher management wants to see numbers. If someone has to be fired, it looks bad. This all is under customer service. To protect the jobs over there. Business is not just manufacturing (00:25:39) money. It is perfectionism. Set your goals very high, work to achieve it and money will follow you. But if you run after the money, you will end up nowhere. It is combination of (00:26:05) each and everything and also human nature, sociology i.e. how to motivate the people, retain the customer, communication skills. Everything is possible. You should have best of knowledge and then add conscience to it.
10. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications etc?
Thirst for the technology, introduction of equipment as good as possible, continuous improvement of the production processes (00:28:29) and look for the weaknesses of the competitors and continue to look for it. Look for the market demands as well.
When asked about assimilating expertise for new equipment introduction, (00:30:06) he says: we invite the experts over to transfer the expertise. We have connections with tool makers, local and abroad, for tools manufacturing.
11. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/ businesses. Each CDI would be analysed for the following:
12. **In retrospect, what you would like to do better?**
As such, I think I am a very happy man. (00:37:00). There is no regret. With modest education, my parents were in sports and my company has no liability, 300 million rupees capital. We are operating in Pakistan and cannot grow beyond certain limits –domestic companies. So I am quite satisfied and happy.
13. **What future challenges firm face?**
Deteriorating Pakistan's social setup (00:39:31). It is affecting every part of our society. They do not want to take responsibility. It is going down very, very fast.

14. How the presence of competitors effect your performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc.

I do not have any competitors. I just (00:41:39) focus on my own activities.
If my customer goes to someone else, it is my fault.

15. A visit of the facility to see the things which the firm has done along with supporting documents, company reports, clippings etc.

Researcher Comments

Four elements: raw materials, equipment (CNC machines etc), technology (is the knowhow), human resources. Any company which wants to move forward has to focus on these elements (00:01:56). He is talking in the context of Pakistan, issues and environment in Pakistan (00:04:08).

When asked about how he thinks about increasing clientele (00:31:39), since he is not going to exhibitions, interviewee replied that because of his quality products he was invited to a top exhibition in Germany.

Also, his customer is second important player in the supply chain and they refer customers to him. This is how we expect our business to grow (00:34:48). If our customers are buying 1000 products from us. When they realise that I am cheaper, better quality, service is better so they shift orders from other places to us. Similarly, they transfer expertise to us as well. Even if we don't understand, we ask them to demonstrate it to us.

I am (00:35:50) few of those Pakistanis, whom customers take to their factories and show the process and technologies, because they know that I will not be their competitor in the market. We do not go to the exhibitions (00:36:21), we do not compete them. We are their supporters, their arms.

Interview Transcript

Firm K
Surgical Instruments cluster

1. **What does the company do i.e. its business, product range?**
Very broad stainless steel (SS) product range. All are hand-held tools and mostly non-reusable.
 2. **Is the product market competitive, stable, changing etc.**
Very competitive, cut-throat local competition (00:03:03).
 3. **Are the product associated technologies stable/ changing?**
Changing in the sense that (00:03:57) a lot of machinery and material was already in the market but is only recently being used for surgical industry e.g. CNC was being used for dies or product manufacturing- in local automobile sector. It has become a standard practice in surgical sector as well.
 4. **Competitors, suppliers and markets-are they demanding and what is driving the change?**
Customers are demanding (00:05:00). However, there are two types of customers: those looking for quality, other looking for cheaper products. Only few firms can provide consistent quality products.
- 3 **What is your business strategy** e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?
We differentiate on quality (00:06:03). If you want to buy cheap, do not come to us. Whatever is in our hand, we try to improve it consistently. Some customers left, when we increased prices. But they came back because could not find the quality elsewhere.
Second facet of business strategy is updating technology (00:07:27). Initially, dies was manufactured by hand, now on CNC. Time cycle shortened. Also, labour strategy has to be addressed. Labour is very skilled but illiterate. Record keeping is very difficult. IT plays a big part in export-oriented firm. Product development is at the heart of business strategy. We produce quality products and charge for it.
5. **What factors influence business strategy of the firm** e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, etc (rate in terms of importance, if possible)?
All factors (internal and external)(00:09:10) influence strategy. Sometimes, other industries affect our industry. CNC were first used in automobile industry, from where it was experimented in surgical industry. However, major problem is lack of skilled labour (00:09:53). Available skilled labour is aged, while other portion is young and inexperienced. There is no training institute. This is a skilled job. There is no system of skill transfer. Government setup available is old-dated (00:10:30), with old machines. We are competing internationally in real-time. When these apprentices come here, they are certainly shot 50 years ahead. They start learning here. When he entered into the business, after doing his MBA (00:11:35), he proposed a training department in the firm. His father said, "That's a very good idea. You will train a person. Other firm will say, oh! a person trained by Firm K, here is additional Rs:500, come work for us. We will not be a factory but a training institute (00:12:00)." I accept this problem but this should not us from imparting some sort of training to the work force. There is critical shortage of skilled workforce in Sialkot. These are some of the problems, which are holding us back (00:12:56). In government institutes, they are given theoretical knowledge but no hands-on experience.

6. **How you measure your firm performance** e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines,), etc (rate in terms of importance, if possible).
By sales, customer satisfaction, profit margins, customer retention (00:13:57) and turnover. We do yearly surveys as well. Some return detailed surveys, with response from the hospitals as well. Some commendable responses have been framed on the office floor. Where lacking we try to improve as well!
7. **What is your manufacturing competence** e.g. why customers prefer your product/ products/ How you are better than your customers?
Quality, improvement, new product development, successful replication etc. First, China tried to get SS market but failed (00:15:37). Major items of Sialkot surgical industry is SS, a bit of brass and titanium. Our products are very technical. I heard from one of our big US customer that he went to China to buy products similar to ours but then affirmed that he would never buy from them again because of quality (00:16:44). The quality is very good, very labour intensive work. China is very good in plastic moulded instruments (00:17:18).
Our company has international brand name synonymous with quality. If you go to Japan, we have our own office there, we are selling with the firm name (00:17:41). Some of our competitors in Japan put our name on their instruments and sell them. In Germany, we have our own office. We are not selling by our brand name over there yet. Ours is consistency in quality.
8. **How you retain your work force (00:18:10):** Cultural / religious loyalty and monetary benefit.
9. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications etc?
10. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/ businesses. Each CDI would be analysed for the following:
- What are the factors which initiated CDI?
 - What are the phases in a CDI i.e. planning, implementation and review?
 - What are the activities and sub-activities in each phase?
 - How phases and activities are interlinked and monitored?
 - How internal and external environment influence CDI during execution?
 - How company resources were mobilised to support CDI?
 - How CDI has benefited the firm and enhanced its competitive advantage?
They implemented ERP (00:26:50) system. **Dies** (00:21:20): Still some instruments through die forging, they are skipping hand forging and changing to lathe and CNC machines. This result in CAD drawings, a steel block, on machine, finishing and product is ready. This has reduced time. There is a problem with our industry that we cannot deliver on time (00:22:58). There a quite a few reasons for that. Vendor delivered late, die was late made. CNC technology was there, they get it from outside.
11. **In retrospect, what you would like to do better?**

IT and machinery (00:24:20). But most important is skilled manpower, which is lacking. People with degrees are there but not with hands on experience. Problem solving skills are not there.

12. What future challenges firm face?

Socio-economic conditions, including utilities. Steel to be used (00:30:55) has to be imported, which greatly increases the cost. There are capable steel vendors in Pakistan, which if given govt. Patronage can manufacture export-quality SS here. But present SS in Pakistan is not of acceptable level. For disposable SS products, they are buying from (00:35:10) from selected local vendors. Re-usable is Japanese and French material.

13. How the presence of competitors effect your performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc.

Presence of competitors (00:36:25) has a healthy effect also. It helps you improve. If a competitor does some improvement, we come to know of that through our workforce. We improve accordingly.

14. A visit of the facility to see the things which the firm has done along with supporting documents, company reports, clippings etc.

Majority of the products going to US is non-reusable (00:30:16). Initially, they were exporting huge quantities to USA. But then they shifted to quality and although few pieces are going, but there quality is excellent.

ASTON UNIVERSITY

Interview Transcript

Firm L

Surgical Instruments cluster

This is the only firm which did not allow the interview to be recorded. Therefore, interviewer took notes while interviewee spoke.

1. **What does the company do i.e. its business, product range?**
Limited gynaecological and obstetrics products.
2. **The history of the company i.e. how it started, its present state, how many major customers, its approximate share of the export.**
It was established in 1987. Exports 100% of its products.
3. **Organisational structure, manpower employed background of the SME executive etc.**
Hayat, owner, is a graduate.
4. Business environment of the firm:
5. **Is the product market competitive, stable, changing etc.**
Product market is very competitive.
6. **Are the product associated technologies stable/ changing?**
Recent advances in surgical instruments have greatly increased the scope of advanced manufacturing technology.
7. **Competitors, suppliers and markets-are they demanding and what is driving the change?**
Customers are demanding.
8. **What is your business strategy** e.g. serve few particular niche ,more customers by broadening product range, new business and new markets, reduced production costs, improvement in manufacturing processes and products?
9. **What factors influence business strategy of the firm** e.g. customers and suppliers input, market anticipation, firm's physical assets, human resource and knowledge gained of the manufacturing processes over time, feedback / assistance of suppliers/ customers, etc (rate in terms of importance, if possible)?
All pointers are their consideration
10. **How you measure your firm performance** e.g. increased sales (to existing and new customers), new product development, customer satisfaction, new businesses, improved shop floor efficiency (e.g. less scrap, improved quality, less rejection, less setup time of machines)(rate in terms of importance, if possible).
Through revenues earned
11. **What is your manufacturing competence** e.g. why customers prefer your product/ products/ How you are better than your customers.e.g. quality, improvement, new product development, successful replication etc.
12. **How you sustain your manufacturing competence** e.g. through import of new technology, improving existing technology, experienced labour force, greater collaboration with suppliers and customers for product specifications?
13. **The history of competence development initiatives (CDI's) in process re-engineering, new equipment purchase, and HR management, along with one instance involving all three-** which resulted in enhancing manufacturing competence and helped differentiate product(s), and capture new markets/ businesses. Each CDI would be analysed for the following:

14 In retrospect, what you would like to do better?

Invest more in technology and increase product range.

15 What future challenges firm face?

Liquidity crunch, lack of latest machines

16 How the presence of competitors effect your performance in terms of search of better technology, lower costs, improved quality, new products, alliances etc.

A visit of the facility to see the things which the firm has done along with supporting documents, company reports, clippings etc.

Visit to the shop floor was not possible.