CHAPTER – 7

SUMMARY AND CONCLUSIONS

This Ph.D. project was undertaken to systematically explore technological change and innovation, and their impact on development in two industrial clusters in India, namely the Metal Art-ware cluster of Moradabad, U.P. and Textile cluster of Panipat, Haryana. A major concern of the project has been to develop a theoretical and methodological framework for exploring technological capabilities and dynamics of innovation and technological change, both at the level of firms within the cluster, and at the level of cluster which interacts with a variety of actors and agencies in its environment or neighborhood. The study has incorporated the special challenges thrown by a decade of economic reform and to identify the strengths of industrial clusters which have made their survival and growth possible in the ongoing phase of globalization. The core concern in this regard has been to find answer to the question: Whether these clusters are surviving mainly due to labour cost advantage or due to innovation and technological up-gradation taking place in them?

Systematic scrutiny of literature has shown that despite considerable attention given to industrial clusters in India and other countries by social science scholars in recent years, little attention is paid to developing a comprehensive analytical framework and analytical tools to understand the dynamics of technological change in the clusters. The studies on industrial clusters have paid little attention to the concepts such as technological change, innovation and technological capabilities and the interplay of these factors underlying the dynamics of change. Given this, a major task and effort in this project has been to formulate appropriate framework and methodology to undertake empirical research on two clusters mentioned above. The exercise of developing a framework via systematic literature review was very challenging, and at the same time, very rewarding. Challenging, because it involved the task of bringing together literature (on industrial clusters, technological change, technological capabilities, innovation and development) of what appeared to be rather disparate, but quite relevant to disciplines/sub-disciplines in the context of clusters. Retrospectively, the exercise was quite rewarding in that one was able to find a road map for the empirical research for two case studies. Without such a road map it would not have been possible to carry out empirical research in an analytically
meaningful way. It was also a fruitful exercise because the study was able to focus upon the key problems and issues concerning technological change and innovation.

This chapter, on summary and conclusions is constituted in terms of three parts. The first part is a short summary of chapter 2, which was mainly devoted to develop appropriate framework for the study. This part identifies the conceptual and theoretical streams and the leading studies in them, which were relevant for the theoretical framework. Summary of the main methodological contributions and their limitations also constitutes a part of this chapter.

The second part of this chapter presents a summary of the main findings emerging from two case studies. It brings out the similarities and the differences in the nature and extent of innovation and technological change taking place in the clusters. It presents a comparative view of the role played by intra-cluster resources, external factors and the government in initiating and facilitating the process of innovation and technological change in two clusters. Further, it compares the overall impact of technological and organizational changes of the technological and organizational changes on the key variables of development; quantity and quality of employment.

Finally in the third part some policy implications emanating from two case studies are spelt out. This part of the chapter also has a section on suggestions for future research arising out of this Ph.D. project.

7.1 THEORETICAL FRAMEWORK

Theoretical underpinnings to understand innovation and technological change and relate it to development in the context of industrial clusters has been an eclectic exercise in the sense that not one discipline or sub-discipline in social sciences is sufficient to understand the complexity involved. Essentially, articulation of appropriate theoretical framework was possible through drawing from economics of technical change, innovation studies, cluster studies, and science and technology policy studies.

Technological change and innovation can be defined and understood as different concepts referring to different activities and processes at the analytical level. However in the context of two clusters the two concepts are used in some what synonymous manner. This is done on the basis of understanding created by evolutionary perspective, which shows the
distinction between (technological) innovation and technological change could be artificial.\textsuperscript{460} This is also due to the fact that the small firms in the clusters chosen for the study are users of mature technologies developed elsewhere rather than creators on new technological knowledge, which is usually associated with the concept of innovation.

The term innovation is seen as a multidimensional concept, which encompasses technological innovations: radical and incremental, organizational innovations and market innovations. Conceptualization of these types of innovations entailed review of literature on evolutionary economics and innovation studies.

The term development, in this study, goes beyond the concept of economic growth and incorporates elements relevant to human development, particularly availability of decent work. The dimensions concerning decent work included in the study are; employment, wages, and environment.

As the main study is devoted to industrial clusters, the very notion of clustering and the ideas on dynamics underlying economies of agglomeration (advantages and disadvantages) is drawn from relevant theories in different disciplines.

In exploring the role played by technological change and innovation and the way in which technological capabilities are built, both at the firm level and the cluster level, various theoretical perspectives from literature on economics of technological change and innovation studies were useful.

At a broad theoretical level of understanding, technological change is seen to be embedded in three essential components; a) Role of entrepreneur, b) Stimulus to change, and c) Technological capabilities. They are dealt at length in section 2.4. Theoretical underpinnings to role of entrepreneur are drawn from Joseph Schumpeter and some important contributions from innovation studies.

Within the main stream traditional neo-classical economics, the idea of stimulus to technical change is associated with market pull. But theoretical literature on economics of technological change, within the tradition of mainstream economics, has brought out two competing perspectives - supply push and demand pull perspective for explaining what initiates the process of technological change. This project has drawn on the writings of Jacob.

\textsuperscript{460} Detail of this argument is available in section 2.2 of chapter 2.
Schmoolker, Grilches, Vernon and others to prepare a theoretical framework which allows understanding the role of both demand pull and supplying push factors.

The third component of technological change, that is technological capabilities, is drawn from evolutionary economics, which is particularly relevant to technological change. The idea that technological change and innovation is a cumulative process and the emphasis on interaction between various relevant actors/agents has been of fundamental importance to the theoretical and empirical exploration. Firm level studies on firm size and innovative activity have drawn attention to firm level technological capabilities; particularly in understanding the difference in technological capabilities of large and small firms within the clusters. Cluster studies were helpful in extending the idea of technological capabilities to intra cluster and inter cluster analysis. Going beyond the existing literature, the contribution of this thesis has been to bring in the perspective of technological capabilities of a cluster and the way in which various elements of cluster level resources such as infrastructure and knowledge institutions in the immediate neighborhood of the cluster impact upon the technological capabilities and hence on the dynamics of the cluster as a whole. The task of weaving together concepts and perspectives to enable relevant framework has been accomplished in Chapter 2.

7.2 SUMMARY OF MAIN FINDINGS FROM TWO CASE STUDIES: A COMPARATIVE VIEW

Empirical research in the two case studies of clusters was governed by exploration of 11 key hypotheses, as depicted in Table 2.1 at the end of chapter 2. Much of the concluding discussion and main findings are spelt out with reference to these hypotheses.

7.2.1 Nature and Extent of Technological Change

The two case studies clearly show that the extent of technological change and innovation taking place in these clusters is not very significant (H1). However, it would be incorrect to infer that there is no innovation or technical change at all. Some of the important findings with respect to this important aspect are spelt out below.

Some insights of Moradabad cluster in the empirical research clearly indicate that:

(i) Product/raw material changes are the dominant forms of technological change taking place in the cluster. The most dominant form of technological change is raw material change. Post reform period is dominated by fast diffusion of new raw materials like iron and aluminum, which have been replacing brass.
(ii) The cluster has seen very little change in process technologies. Though in isolated instances some big firms have introduced machine based change in process technologies, their diffusion is very slow, except in the case of minor changes.

(iii) Much of the technological change taking place in the cluster can be termed as incremental change.

(iv) Almost all the changes are confined to first layer of firms; the exporters. Most of the second and third tier firms are untouched by technological change. In some stages of manufacturing such as molding/sand casting, which are performed at the house hold units, the process technology has remained unchanged for centuries.

(v) Even among the first tier firms the pace of change is very low and uneven and the significant changes are confined almost exclusively to medium sized and big firms. Small and small firms have been able to introduce only minor changes.

Some insights for Panipat cluster, in the empirical research indicate the following:

Though Panipat also indicates the evidence of limited technological change, the cluster level explorations reveal that the extent of technological change taking place in Panipat is significantly higher as compared to Moradabad. Secondly, there is significant difference in evidence with respect to hypotheses H2 (Two clusters are likely to reflect the predominance of incremental or minor innovation rather than the radical or major innovation) and H2a (Product/raw material based innovation is likely to take precedent over process innovation in these clusters) between the two clusters. Four most significant differences in the extent and nature of technological change emerging from the two case studies are:

- While raw material change is the main form of technological change, followed by product changes in Moradabad, Panipat provides significant evidence of change in process technologies.

- While changes introduced by most of the firms in process technologies in Moradabad are incremental or minor changes, changes introduced by several firms in Panipat fall under the category of significant changes.\(^{461}\)

\(^{461}\) Significant change' is not 'radical change' or incremental, but falls somewhere in between. For lack of any other conceptual category the term 'significant change' is used in this project. Detail discussion on this is provided in chapter 359.
• While Moradabad has seen little change in the profile of machinery and equipment, in Panipat there is significant level of machine based change.

• Unlike Moradabad, diffusion of new process based technologies has been fast in Panipat.

Though among the sample firms which include only the end producers, the percentage of firms introducing product and process changes is not very different in the two clusters, there are very significant differences in the meso level picture. At the aggregate level change is much more significant in Panipat. Firm level surveys in the both the clusters provide evidence of a large number of firms introducing product and raw material changes. Though the firm level studies in both the clusters lend support to the sub-hypothesis that product/raw material innovation is stronger vis-à-vis process innovation, the evidence at the cluster level is somewhat different. While in Moradabad the process technologies used in the cluster have seen little upgradation, Panipat, on the other hand has seen considerable change in process technologies, along with some changes in products and raw materials. Several major manufacturing activities have undergone considerable change in process technologies in the post 1991 period. There is considerable evidence of introduction and fast diffusion of new technologies at all production stages: CAD-CAM for designing, open end technique for spinning, shuttle-less loom for weaving, cone dyeing for yarn and introduction of soft flow dyeing for fabric dyeing. This is made possible by changing nature of production networks. Increase in inter-firm division of labour and emergence of a large number of specialized service providers using upgraded technologies has enhanced the overall pace of the change. Both the clusters provide significant evidence for the use of IT tools in management, and to a lesser extent, in marketing.

There is some difference in the level of diffusion of IT based technologies at the manufacturing level in two clusters. Unlike Moradabad, in Panipat use of CAD-CAM is very common. This has been made possible, among other things, due to presence of design centers. This suggests that there does exist some clustering advantage which has facilitated diffusion of ICT technologies in designing.

While there is virtually no use of electronic and micro electronic technologies in the core manufacturing activities in Moradabad, in Panipat several machines with electronic/micro-

462 There is not much diffusion of soft flow dyeing technique, which is introduced in the cluster very recently.

463 However, while 100% firms in all size groups use computers in Moradabad, there are many non users in Panipat. All the non users, who are either small or very small firms, are catering only to the domestic market. Since 100% of small and very small firms in Moradabad, which is catering almost exclusively to international market, are using computers, it can be inferred that use of computers is a competency which the firms must have for being able to participate in the international market.
electronic controls are in use.\textsuperscript{464} Though both in Moradabad and Panipat, there is evidence of some innovations and technological changes \textbf{not all the changes can be termed as technological up-gradation}. For example, some of the raw material changes in Moradabad, like change from brass to iron, can at best be seen as a part of survival strategy rather than an instrument of value up-gradation. Similarly, movement away from high value artistic products to low value utility items, involving cheaper raw materials and simple technologies, can not be termed as technological up-gradation. Likewise, revival of handlooms and production of simple hand-woven carpets/durries in big volumes for export market in Panipat can not be termed as technological up-gradation. These changes merely represent choosing differently from the existing pool of technological knowledge, in response to pulls from the market/policies, rather than a movement towards the technological frontiers, much less as pushing the technological frontiers forward.\textsuperscript{465}

On the whole Panipat textile cluster has much higher level of technological dynamism as compared to Moradabad metal art-ware cluster. Over the last decade and a half, firms in the Panipat cluster have managed to promote and foster several technological changes in ranging from introducing new production processes, diversifying into new products, introducing and absorbing new techniques and machinery coupled with several organizational mechanisms in assimilating new manufacturing processes. It is clear from section 5.1.4, the cluster has seen fast rate of growth in total output and exports in the post reform period; the annual exports from the cluster have gone up from being less than Rs. 200 crores in 1991-92 to more than Rs.1200 crores in 2001-02. It is equally clear that the initial boost to this growth was provided by the change in the macro economic policy paradigm. However, it would not have been possible for the cluster to respond to these incentives and experience such fast growth in output and exports, without the presence of some production and technological capabilities in the cluster. Presence of production capabilities, mainly in the form of virtually unlimited supply of skilled labour, along with a highly lean and mean production system has been the most important factors in this regard. Introduction of several organizational changes has also contributed towards the survival

\textsuperscript{464} However, the diffusion of these technologies in manufacturing is slow and is confined to fairly big firms. The reasons or this are that the IT based equipment is too expensive for small firms, and they lack the required capabilities to manage it. This shows that Firms have to have a threshold size and capabilities for being adopters of IT based technologies in manufacturing.

\textsuperscript{465} But, on the whole in Panipat there is some evidence of value addition through technological upgradation. The cluster which was earlier confined to items like furnishing fabrics and bed covers has entered the more value added, cut and stitch segment of home textiles. The short run survival and growth of the cluster is facilitated by the fact that at present 'Home Textiles' is the fastest growing segment of the global textile market.
and growth of the cluster in the face of increasing global competition. But while the existing capabilities of the cluster have ensured its short run survival and growth, the same can not be said about its long term growth and survival.

Both the case studies provide ample support to the hypothesis (H4) that only limited functional up-gradation can said to have been taken place in the clusters. Even though both the clusters can be termed as ‘full package’ clusters, performing all the manufacturing stages, none of them have made significant movement towards the upstream or down stream activities of the value chain like designing, distribution and retailing, which are the value intensive activities. By and large, firms producing for the international market in both the clusters continue to produce against designs provided/pre-approved by the foreign buyers. Though both the clusters have some design capabilities, they are far from attaining functional up-gradation through design autonomy. The products of both the clusters are sold in the international market under the brand names of the global lead firms organizing the value chain. It may be said that only limited up-gradation taking place in the clusters. Further, though a negligible number of firms in the cluster are attempting at sectoral/ sub-sectoral diversification, none of the two clusters are poised for up-gradation through sectoral diversification.466

As emphasized by Humphery (1995) and Bell and Albu (1999), one of the significant ways by which to understand the potential for technological dynamism of a cluster is to look at its trajectory of growth over a period of time rather than at the static picture at a point of time. From such a perspective, it can be said that Panipat cluster shows significantly higher technological dynamism than Moradabad and is continuing to progress and grow at a much faster pace compared to Moradabad467.

Technological change is not the only, or even the most important strategy adopted for survival and dynamism by the firms in the clusters. Both clusters provide evidence to support the hypothesis (H3) that clusters are likely to indicate significant role played by organizational and market related innovations. Firms in both the clusters have adopted several organizational innovations and market innovations in order to maintain global competitiveness in terms of cost, product quality, social accountability standards and delivery schedule.

466 Though some of the firms in Moradabad are diversifying in furniture and at least one of the sample firms has entered the garment sector, there is little evidence to suggest that the clusters are poised for value addition through sectoral diversification.

467 Though it is reasonable to infer that Panipat has had more dynamism as compared to several other textile clusters like Bhiwandi, there is however no basis for suggesting that the performance of Panipat has been best among textile clusters. The evidence suggests that some of the clusters like Ludhiana and Tirupur have performed very well.
In both the clusters, improvement in quality/reduction in rejection rate emerges as the main motivation for introducing organizational changes like vertical integration and more rigorous methods of quality control. But the two clusters differ with respect to the nature of changes taking place in their organizational structure. In Moradabad there is a clear trend towards greater vertical integration. Big exporters are integrating quality critical stages of manufacturing. This process is similar to what happened in Sialkot Surgical instruments Cluster, Pakistan (Nadvi 1996). The picture in Panipat is more complex. While the big players are integrating some stages of manufacturing in their units, some of the smaller producers aspiring to enter more challenging global market, are increasingly depending on specialized service providers in order to improve the quality of their products.

Second important difference is that while in Moradabad, organizational changes like vertical integration and enhanced supervision, are adopted as the primary, or even the only measure for improvement in quality of products, firms in Panipat are not primarily dependent on organizational changes for quality improvement. While for the small firms greater dependence on specialized service providers has made the use of better process technologies possible, in the larger firms technological up-gradation is introduced by vertically integrating one or more processes. Panipat resents a good example of complimentarily between technological and organizational innovation mentioned in literature (see Edquist 1992, Humphery 1992).

In both the clusters, there is significant change taking place with respect to market channels and also in the way marketing is organized. Export orientation of both the clusters has gone up significantly in the post reform period. But while Moradabad has started catering almost exclusively to the global market, a significant portion of the turnover in Panipat is still going to the domestic market channel.

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468 Technological changes, brought with or without the organizational changes, are the main source of improvement in quality. Use of better technologies in designing, spinning, weaving and dyeing, and use of superior raw materials are the main factors responsible for up-gradation through quality improvement. However, the adoption and diffusion of better process technologies is facilitated by the changes in the manner in which various stages of production are organized in the production chain within the cluster.

469 The share of exports through buying agents, who made their presence felt only since 1994, is on the increase. Direct exports are common in places like the Middle-east, South Africa, Morocco, and in a few European countries. Most of the export to the USA and Western Europe are taking place through the buying agents. The firms catering to the domestic market however continue to adopt arms length marketing techniques.
In both the clusters a large number of exporting firms have got inserted in the GVCs led by global retailing giants from USA and European countries like UK, Italy and Germany.\textsuperscript{470} In both the clusters there is complete absence of any market related joint action. Absence of collective marketing effort for procuring raw materials poses a major problem particularly to small workshops and household units in Moradabad, which have no access to good quality brass and other raw materials. More importantly, they have no direct access to market for their goods.\textsuperscript{471}

### 7.2.2 Clustering and Technological Up-gradation

Though both the clusters do experience passive external economies emerging from their big size and high degree of concentration of the same sector activity, relative importance of different type of external economies is different in two clusters (Table 7.1). The role of market economies emerges to be more significant in Panipat where 13(28.9) firms (as against 20.4%) in Moradabad firms perceive ready market for their output as an important clustering advantage. The biggest difference between two clusters in terms of market economies was the relative importance attached to the availability of machinery and equipment and good quality raw materials. While as many 16(35.5) of Panipat firms reported availability of specialized machinery and equipment to be an important advantage, only 1 (2.3) firm in Moradabad thought so. Similarly the number of firms considering availability of good raw material to be an important advantage was 20 (44.4) in Panipat, while their number was just 20(44.4) in Moradabad.\textsuperscript{472} Given the presence of much larger firms in backward links in Panipat, as compared to Moradabad, this is not surprising.

In both the clusters labour economies are perceived to be very important. Availability of skilled/cheap labour emerged as the biggest agglomeration economy for both the clusters and was rated to be much more important than any other external economy as shown in Table 7.1.

There is however little evidence of dynamic technological economies resulting from collective efficiency, as emphasized by Schmitz (1995a) and others. None of the two clusters

\textsuperscript{470} The important retail chains for which the firms in the two clusters are working as commercial sub-contractors include Wal-Mart, J.C. Penny, GAP, Pottery-Barn, Target, Ikea, Body Shop, Spiegel, Harrods, Macy's, Bloomingdale's and Federated Brook, Lenin and things, Tuesday Morning and Coin etc.

\textsuperscript{471} A self help group, set up with the help of ILO and EDI did visit Delhi to explore the possibility of direct marketing by artisans. But the initiative is at a very primitive stage.

\textsuperscript{472} In both the clusters 'any other advantage' included presence of inland container depot, proximity to Delhi trust/networking etc. to be one of the advantages, and presence of brass/textile milieu which inspired them.
throws evidence for high level of trust and social capital, which form the basis of collective efficiency.\textsuperscript{473}

<table>
<thead>
<tr>
<th>Clustering Advantage : Availability of</th>
<th>Number of Firms (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moradabad (n = 44)</td>
</tr>
<tr>
<td>Big Market for output</td>
<td>9(20.4)</td>
</tr>
<tr>
<td>Skilled labour</td>
<td>38(86.3)</td>
</tr>
<tr>
<td>Cheap labor</td>
<td>0(0.0)</td>
</tr>
<tr>
<td>Good Quality Raw material</td>
<td>5(11.4)</td>
</tr>
<tr>
<td>Technical/General Services</td>
<td>5(11.4)</td>
</tr>
<tr>
<td>Products/Technological/Market knowledge</td>
<td>7(15.9)</td>
</tr>
<tr>
<td>Machinery and Equipment</td>
<td>1(2.3)</td>
</tr>
<tr>
<td>Any other</td>
<td>8(18.2)</td>
</tr>
<tr>
<td>None</td>
<td>1(2.3)</td>
</tr>
</tbody>
</table>

Note: Figures in parenthesis represent percentage of firms

Geographical concentration of same sector firms does provide small firms in the cluster with some opportunities for technological up-gradation which would not be available to them if they were located outside the cluster. Evidence from both the clusters, and particularly from Panipat, suggests that the benefits of the scale intensive technologies can be passed on to the small firms in the cluster through specialized service providers or through capacity subcontracting. For example, cone dyeing technology is which is not scale neutral, is used extensively in Panipat, even though most of the cluster firms are too small to have their individual facilities.

However, clustering has not resulted in strong knowledge externalities, in the form of knowledge spillovers, which is emphasized in the works of Paul Krugman (1991), Porter (1998) and others. In neither of the two case studies knowledge spillovers emerge as important source of innovation. The firm level surveys show that only 7(16\%) firms in Moradabad and 5(11\%)

\textsuperscript{473} Trust relations in both the clusters are fragmented along caste/community lines. Insertion of cluster firms in GCC has eroded trust relations in these clusters and has created a milieu imbued with secrecy and mistrust among different actors in the cluster. As a result there is virtually no collective efficiency resulting from bilateral co-operation based on social ties. There is little private joint action to promote technological up-gradation of the cluster.
firms in Panipat consider availability of knowledge as an important advantage of being located in a cluster. However, human resource-base (i.e. skilled labour) is the major advantage of being in the clusters. This is revealed at Moradabad and to a lesser extent at Panipat (See Table 7.1). What can be inferred from the point of view of clustering and technological up-gradation is that while clustering does play an important role in terms of availability of skilled labour, machinery and materials etc. it does not have a major impact on technological up-gradation of the cluster as a whole in our two case studies.

7.2.3 Demand Pull VS Supply Push

Both the clusters provide clear and strong evidence to support the hypothesis (H5) that demand pull is more important than the supply push or technology push in initiating the process of technological change. The role of demand pull factors far exceeds that of supply push factors in both the clusters. The comparative view of firm level survey of the two clusters suggests that technological changes in Panipat firms are even more demand driven than the Moradabad firms.

Since both the clusters in this study are export oriented clusters, demand pull exerted from external sources is important in stimulating innovation in both the clusters. But the manner in which market pull exerts itself in Panipat is considerably different from the way it does in Moradabad. The main reason for this is the difference in market channels catered by two clusters and the difference in the governance of value chains to which the cluster firms belong to.474

The sub-hypothesis (H5a) that new competition, in terms of quality and delivery schedules, is likely to play a more decisive role than the traditional price competition in prompting innovation and technological change does not find support in any of the case studies. One possible explanation for this is that these clusters are operating mainly in the lower end of the global markets, which are highly price sensitive.

The insights from meso level exploration shows that not all the technological dynamism in the Panipat cluster is export led. Like in Hosiery cluster of Ludhiana (see Tewari 1999) some of the most technological dynamic units in the cluster started exporting only after having acquired significant technological capabilities by serving in the premium segment of the

474 While Moradabad is almost exclusively catering to the international market, about 40% of goods produced in Panipat go on to feed the domestic market. Secondly, while almost all the firms in Moradabad are operating through various value chains, most of the Panipat firms catering exclusively to the domestic market are operating through arms length market relations.
domestic market for several decades. These firms continue to serve the premium segment of the
domestic market even after entering the export market. Unlike majority of exporters, these firms
have made considerable value addition through significant technological up-gradation and are
not catering to the bottom end of the global market. One of these firms provides significant
exception to the hypothesis of demand led technological change, which deserves mention. This
medium size firm catering too the domestic as well as global markets, which emerge as the most
dynamic of the sample firms and arguably the most dynamic firm in the cluster, denied presence
of demand, pull. It cited supply push was the only reason for introducing technological change.
Not surprisingly, the firm has very high level of technological capabilities.

7.2.4 Technological Capabilities and Knowledge Systems

By and large, the cluster level capabilities as well as firm level capabilities are low in
both the clusters. Though a majority of the firms in both the clusters do possess minor change
capabilities for managing continuously improvement, adaptation and incremental innovation of
products, processes and organisational arrangements, they lack capabilities for managing
significant or major technological changes. They also lack the capabilities needed for functional
up-gradation through design autonomy and retailing. There is also lack of linkage capabilities\(^\text{475}\), which may provide the cluster firms the competence to be a part of knowledge
and technology networks within the cluster or to network with the science and technology
institutions located elsewhere in the country. Firm level technological capabilities are far lower
in Moradabad as compared to Panipat.

Presence of a weak knowledge system and poor resources for technological learning is a
common feature of both the clusters. The characteristics of the knowledge using and knowledge
creating elements of the knowledge system in the two clusters resemble the general
characteristics that Bell and Albu (1999) attributed to developing country clusters producing
traditional consumer goods, using matured technologies. Knowledge using systems of the two
clusters are, by and large, unstructured and passive, and their knowledge generation systems are
undirected and closed. Much of the diffusion of knowledge in these clusters is through informal
sources.

It is observed that there is a problem in the way in which formal knowledge institutions
play their part. Lack of an educational institution imparting sector specific education is a major

\(^{475}\) Linkage capabilities include capabilities to transform technology related information and skills from relevant
outside agents. For detail see Lall (1992).
deficiency or constraint in the educational/technological infrastructure in both the clusters. An institution which can create skills specific to the local industry, and promote industry - academia interaction can benefit the local industry in a big way. Lack of an appropriate institutional set-up and ineffective operation of the existing institutions can said to have seriously curtailed the potential for creation of technological capabilities in both the clusters.\textsuperscript{476} The in-built rigidity in their structures on the one hand, and receding financial support from the government due to the new policy paradigm, has meant that their relevance is decreasing at a time when the need for specialized institutions is increasing. The networking links between these institutions and the cluster firms are low and seem to be on the decline.\textsuperscript{477}

In all, the two case studies in general substantiate the hypothesis (H7) that knowledge institutions in Moradabad and Panipat are unlikely to contribute significantly to the cluster level technological capabilities. As will be highlighted later, much of the technological capabilities in these clusters emanate from the production system rather than the knowledge system.

\textit{Weak Role of Horizontal Links; Limited Private Joint Action}

Both Moradabad and Panipat display lack of characteristics such as high social capital, resulting in co-operation among competing firms, and private joint action, and high visibility of local government, normally associated with a typical industrial district traveling on high road of flexible specialization. Instead of high level of trust, both the clusters display fragmented trust relations in social networks and secrecy in economic dealings. Both the case studies provide evidence of a social milieu imbued in secrecy and mistrust. Evidence of secrecy about the identity of the buyer and the product/product design, the concern about keeping the identity of the buyer and the design of the product a secret was much stronger in Moradabad than in Panipat.

As expected none of the clusters provide evidence for an innovative milieu created by high level of trust and social capital. In none of the clusters private joint action; either bilateral

\textsuperscript{476} Though both the clusters do have some presence of technological services provided by the central government, their role is marginalized because of their inability to keep pace with the requirements of the fast growing challenges of globalization, which requires them to be more flexible than ever before, even as they remained bogged down by several archaic laws. More over, they have to cope up with drying up of funds and mandate to be self sufficient in financial terms. By and large, they have failed to evolve in synchronization with the changing requirements of the clusters.

\textsuperscript{477} This is particularly evident in the case of MHSC in Moradabad, and to a lesser extent, in the case of NITRA center and WSC in Panipat.
or multilateral, contributes significantly in the creation of cluster level technological capabilities.

Clusters show a weak relation between the presence of horizontal links and innovative activity (H8). There is a fair amount of confusion and lack of co-ordination between private and public joint action,

Though none of the two clusters trade associations play significant role in the process of technological up-gradation, the role of the trade associations seems less dismal in Moradabad as compared to Panipat.478

Further, none of the two clusters have active associations of workers. Trade unions are virtually absent in both the clusters. Though the president of PBDA, the association of artisans in Moradabad, has been active in lobbying with the government for facilities like technical training, good quality raw material, subsidy for upgraded equipment and a gas pipeline, due to non participation of majority of the artisans in the cluster it is unable to make any den in the problems faced by workers.

*Strong Role of Vertical Links: Evidence from Panipat*

Evidence from both the clusters supports hypothesis (H8a) that the two clusters in our case studies are likely to indicate the presence of intra-cluster vertical links with a positive bearing on the innovative activity of clusters. Much stronger role of vertical links, based on economic ties as compared to horizontal links forged by social networks in the creation and diffusion of technological knowledge emerges clearly from both the clusters. This is particularly true in the case of Panipat, which has evidence of considerable incremental change resulting from vertical ties present in the production system of the cluster. Deep inter firm division of labour, an important characteristic which Panipat shares with European industrial districts, has contributed considerably towards its dynamism. Inter firm division of labour has helped in the

478 BAWEMA, the representative body of exporters in Moradabad, has been active in networking with ILO, EPCH etc. and is involved in organizing seminars and workshops. It is represented on various government committees and agencies like MHSC, and is networked with DIC. Unlike Moradabad, which has one strong association representing all the manufacturers and exporters in the cluster, Panipat so bogged down by multiplicity of trade associations? The fragmented and non-inclusive nature of trade association creates a stumbling block in the creation of holistic perspective about the industry and its requirements, even as it reduces the power of the associations to lobby with the government.
adoption of scale intensive new technologies which are undertaken by specialized stage producers, and has helped in fast diffusion of micro-electronic tools like CAD-CAM.\textsuperscript{479}

A good part of dynamism of the cluster in Panipat can be attributed to a high density of inter-firm links, which lends huge flexibility to Panipat's production system. In fact a considerable part of the technological capabilities of the cluster in Panipat industry is located in its production system. Presence of large number of activities in backward and forward links in Panipat presents the cluster with considerable opportunity of up-gradation. Not only has the presence of machine good sector in Panipat made incremental innovation through the interaction between the users and manufacturers of machinery a common feature, it has also presented the cluster with development of Jugaru technologies. Though Jugaru technology/machines, created as a result of close buyer user links in the cluster, may be much inferior to the state of art machines, they play an important role in the survival of the cluster. Jugaru technology has the double purpose of making small units viable by keeping the start up cost low and allowing the firms flexibility to cope up with the fast changing market demand.\textsuperscript{480} High possibility of getting new machines made quickly and at a low cost makes product innovation, requiring adoption of new machines swift and cost effective. It also reduces the impact of path dependency, by making replacement cost low. Thickness of intra-cluster vertical links in the value chain also helps in faster diffusion of new technological knowledge.

Thirdly, presence of good quality service providers at every stage of production in Panipat has made it possible for small firms to upgrade the quality of their products with the help of modern technology used by the specialized service centers.\textsuperscript{481} Though there do exist service centers for specialized activities like electro plating, in Moradabad they often operate at the lower end of the technological spectrum and are unable to pull up the quality of products or lend any technological dynamism to the cluster.

In general, technological capabilities of Moradabad are constrained due to lack of activities in the backward links, such as machine good sector and manufacturers of good quality

\textsuperscript{479} Difference in the density of forward and backward intra cluster links emerges as one of the most significant reasons for differences in the levels of technological dynamism in two clusters as well as the difference in their dynamics of change.

\textsuperscript{480} Kibria (1998), presents a fascinating account of the role of jugad of the mistris of Pakistan in development of engines and machine tools at a much lower prices than similar imported equipment.

\textsuperscript{481} Presence of good quality service providers in large number ensures both access and competitive prices, which are affordable by small firms.
brass. Secondly, gap in the production chain, such as absence of a state of the art die making machine are a limiting factor.

In Moradabad most significant vertical link facilitating creation and diffusion of technological knowledge is located in sub-contracting relations between the exporters and artisans/jobbers. In Panipat, on the other hand, marketing links between suppliers of dyes and chemicals and their users, rather than production links emerge as the most important source of innovation/change resulting from the learning by interacting mode.

On the whole, though the level of technological capabilities in both the clusters is low, technological capabilities of Panipat are higher than those of Moradabad. This is mainly in account of deeper inter-firm division of labour and larger number of backward and forward linkages. Presence of production capabilities, mainly in the form of virtually unlimited supply of skilled labour, along with a highly lean and mean production system has been the most important factors contributing towards its dynamism.

**Significant Role of Traditional Skills: Evidence from Moradabad**

Availability of labour emerges as the most important advantage perceived by the entrepreneurs in both the clusters (Table 7.1). However importance of skilled labour is much more pronounced in Moradabad than in Panipat. The industry in Moradabad is critically dependent on the traditional skill base of the local artisans. The rare skills of the artisan, such as namoonewalas and dhalaiiwalas, which are preserved through the process of intergenerational transfer of tacit knowledge, are quite indispensable in the production process. More significantly, artisans also contribute significantly to the innovation process of the cluster; interaction between the artisans and the exporters emerges as the most important source of technological learning in Moradabad (Table 4.16). It is therefore not surprising that as many as 38 of the sample firms in Moradabad consider availability of skilled labour to be the biggest strength of the cluster, while their number in Panipat is only 22. Ten of the sample firms in Moradabad reported skilled labour to be the only clustering advantage.\(^{482}\) It may be noted that significance of skilled labour in a large measure is rooted in the history of these two clusters.

**Workers as Entrepreneurs: Evidence from Moradabad**

One aspect in which Moradabad seems closer to an ID model vis-à-vis Panipat is evidence of some **vertical mobility of workers** in the former. Among the sample firms several entrepreneurs have previously worked as wage labourers/jobbers for other firms. More
significantly some of the most innovative firms in the cluster are owned by workers turned entrepreneurs/owners. In contrast to Moradabad, Panipat has no evidence of vertical mobility among the members of the working class. The absence of vertical mobility of workers with traditional skills, like weavers, in Panipat, can be explained in terms of a significant difference in terms of labour process between Moradabad and Panipat. Due to presence of a very large number of HH units owned by the artisans, there is possibility of the artisans moving vertically from being jobbers to suppliers and eventually becoming exporters. In Panipat, which does not have any units owned by artisans, this route for vertical mobility does not exist. Secondly, lack of rootedness of Panipat workers inhibits the process of emergence of entrepreneurs from the labour class. Unlike Moradabad, workers, Panipat workers are not embedded in the local culture and they have no strong social identity as a group. Most of the workers in Panipat are migrants, with casual/contract jobs. Since their jobs get terminated in a few months time, most of them do not have any permanent base in the cluster. They maintain links with their home states, UP and Bihar, and continue to be socially embedded in those states. This deprives Panipat of the advantage that Moradabad has in terms of the contribution of workers as entrepreneurs in the innovation process.

**Role of Attitude of the Entrepreneurs: Evidence from Panipat**

One important factor contributing towards survival and growth of the Panipat cluster, which emerges quite clearly in several interviews, is the juggaru attitude of the entrepreneurs. The juggaru attitude of the entrepreneurs and the capability to circumvent laws, though helpful in the short run expansion of production capabilities, is detrimental for the creation of long term technological capabilities. It puts a premium on enhancing profitability through unfair means and adversely affects the incentive to upgrade. For example, very few units in Panipat avail of

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483 In-spite of considerable rural unemployment youth of Haryana don't like to work as wage labourers, especially when they are educated.

484 There are however a large number of entrepreneurs in Panipat who have previously worked in supervisory or managerial cadres in other firms. In fact three of the sample firm entrepreneurs who were ex-employees of the most innovative sample firm in our study. They reported having gained invaluable experience as employees of that unit.

485 According to Mr. K. K. Aggarwal, Chairman of Alps Industries Ltd. a well reputed home- textiles unit located in Ghaziabad, UP, apart from agglomeration economies, which Panipat enjoys, due to concentration of thousands of textile units, the biggest advantage of the cluster is ability of its entrepreneurs to deal with bureaucracy and the legal provisions. According to him so adapt are entrepreneurs in Panipat in ‘fixing’ that they have succeeded in fixing even the inspectors of the foreign buyers. This has led to non fulfillment of conditions imposed by the foreign buyers and thus retarded the speed of adoption of clean technologies and fulfillment of social accountability norms and labour standards, demanded by the big global buyers.
TUFS because for availing an interest subsidy of 5% under TUFS they will have to pay a tax of 12%, which they otherwise evade.

**Firm Size and Technological Capabilities**

One important finding that emerges from both the case studies is that very small firms have low levels of technological capabilities and are unable to introduce any significant technological changes. Evidence from both the clusters confirms the assumption that, firms have to have a certain threshold size in order to acquire critical level of intra-firm technological capabilities, which in turn, will allow it to leverage the advantages of technological spillover, which a cluster may have to offer. On the other hand, the evidence from both the clusters suggests that the largest firms are not necessarily the most technologically dynamic firms. While in Moradabad a medium size firm, with an annual turn-over of Rs.20 crores, had the highest level of technological capabilities among the sample firms, in Panipat a medium size firm, with an annual turn over of Rs.40 crores, had the highest level of technological capabilities and was, technologically, the most dynamic firm among the sample firms.\(^{486}\) The optimal size of a firm, from the point of view of technological dynamism may however vary from sector to sector.

Though it is problematic to infer a casual relation between the firm size and the level of innovative activity, the importance of a critical minimum size of the firm in acquiring threshold level of technological capabilities is amply demonstrated in both the clusters Evidence from both the clusters suggests that the level of technological capabilities and the extent of technological change managed by small and very small firms are lower than those in the medium and big size group of firms. The possibility of small and very small firms to introduce significant/major changes is constrained, due to their limited financial resources as well as their limited intra-firm technological capabilities. Thus the hypothesis (H6) that Clusters are likely to indicate a positive relation between the firm size and the technological capabilities having a bearing on the innovative activity of the firms, finds support in both the case studies.

**7.2.5 External Links and Technological Upgradation**

Evidence from Moradabad, and to a smaller extent from Panipat, confirms that a developing country cluster can get increasingly integrated in the global production system, without any significant technological upgradation. Though demand pull exerted by demand of

\(^{486}\) The turn over of the largest sample firms in two clusters was Rs. 67 crores and Rs. 125 crores, respectively.
foreign buyers is indicated as a powerful stimulus for technological upgradation of both the clusters, it has not led to significant technological upgradation.\textsuperscript{487} Secondly the case study of Moradabad goes on to prove that even a hundred percent export oriented cluster in a developing country can continue to have low technological intensity and hence dynamism. In Moradabad, in spite of very higher export orientation, the industry continues to experience technological obsolescence, while in Panipat, the cluster which continues to cater to the domestic market, there has been has some technological up-gradation.\textsuperscript{488}

Evidence from Panipat suggests that high technological capabilities are the cause rather than the effect of entry in the global market. Evidence of considerably lower than average level of technological capabilities of the firms in the domestic category in Panipat\textsuperscript{489} suggests that entering the export market requires certain threshold level of technological capabilities. This evidence is not surprising given the fact that out of the few Indian clusters which are claimed to be dynamic,\textsuperscript{490} only in Tirupur dynamism of the cluster is triggered off by the participation in the more challenging export market. In other two clusters; Bangalore and Ludhiana, which continue to produce mainly for the domestic market,\textsuperscript{491} the pre-existence of high level of innovative capabilities seems to be the cause for their entering challenging segments of global markets.

Though the insertion of cluster firms in GVCs has resulted in greater consistency and higher quality of products, and increase their speed of response to customer orders, it has not helped them much to up-grade process technologies. Like many developing country clusters, these two clusters continue to be competitive at the lower end of the global market. Both, Moradabad and Panipat, continues to experience reduction in the unit value realization of their products, even as they continue to increase their cost effectiveness either by increasing their technical/organizational efficiency, or by squeezing labour cost or both.

\textsuperscript{487} This is in line with the evidence from clusters like Sialkot Surgical Instruments Cluster, Pakistan, (Nadvi 1999) Sinon Valley Footwear Cluster, Brazil (Schmitz 1995), and several other clusters in developing countries. \textsuperscript{488} In Panipat two sample firms which have best technological performance are catering to the upper end of the domestic market along with export market. One of them has entered the export market only in 2004. Both these firms have entered the export market after having catered to the upper end of the domestic market. \textsuperscript{489} See Table 5.14 \textsuperscript{490} Three Indian clusters, often referred to as Indian IDs in the making; Bangalore Electrical Goods cluster, Tirupur knitwear cluster and Ludhiana Hosiery cluster seem to be the exceptions. For detail see Holmstrom (1999), Swaminathan, and Jeyaranjan, (1999), Nadvi (1995) \textsuperscript{491} In Ludhiana more than 70% product are produced for the domestic market. See Tewari (1999), UNIDO 2001b
There is little evidence to hypothesis (H9) that technological up-gradation as resulting from learning by exporting. There is no evidence of foreign buyers passing on upgraded process technologies to the cluster firms. One reason why the insertion of cluster firms in some of the biggest GVCs has not contributed much in terms of new technological learning is that these clusters are operating in the quasi hierarchical, buyer driven commodity chains, which are governed by global retail giants, rather than manufacturing giants.

Some of the perceived advantages of globalization, like acquiring state of art technology via the FDI route, have not materialized in the two clusters as none of them have received any FDI.

7.2.6 Role of Government Agencies and Technological Upgradation

The two case studies hold support to the hypothesis (H10) that the existing role of the government agencies in promotion of innovation and technological change in the clusters is weak. This is consistent with the findings of other studies, including the study of more than 3000 Karnataka SSI units by Bala Subrahmaniya (2003), which shows negligible dependence of the innovative firms on government agencies.

Unlike in many other states, there is little in the state industrial policy of either in, UP or Haryana which is specifically aimed at the technological upgradation of SSI units, particularly in the industrial cluster segment. While UP government does offer some incentives for exporters, such as giving some subsidy for foreign travel for exhibitions printing of promotional material etc., Haryana government does not have such promotional policies. An earlier scheme giving power subsidy to the SSI units for their first five years has now been scrapped. Not surprisingly the DICs (District Industrial Centers) of the two industrial districts have little to show by way of their contribution in this respect. The centers, though originally designed to play pivotal role in the development of the industry located in their district, have been reduced to offices for registration for SSI units and issuing them no objection certificates on behalf of various government departments. The DIC in Moradabad is marginally involved in the function of networking with trade association on the one hand and with organizations like ILO, (which was implementing a cluster development programme in Moradabad at that time). It

492 The optimistic views of authors like Hobday (1995) and Gerrefi(1999), who suggest that the producers who gain access to GVC have good prospects of upgrading as a consequence of ‘learning by exporting’ find little support in the case studies. This is in contrast to the experience in some other developing country clusters, such as Sialkot cluster of surgical instruments, in which foreign buyers are reported to provide significant technological support in order to resolve the FDA crisis (See Nadvi 1999).

493 DC(SSI)2001
is involved in organizing some training and awareness programmes for the workers with the collaboration of ILO and BAWEMA. The role of Panipat DIC in the development work of the industry is even less impressive than that of the Moradabad DIC.\footnote{According to the office of DIC, Panipat, the only scheme in which the center is involved now is Pradhan Mantri Rozgar Yojna (PMRY) Earlier there used to be several Central government schemes which were being implemented by DIC. But now, most of them have been discontinued because of the inability/unwillingness of the state government to give the matching subsidy for them.}

### 7.2.7 Organizational and market Innovations

Both the clusters provide support in favour of H5, hypothesizing significant organizational and market based innovation by cluster firms. In a large number of cases organizational changes in Panipat are inextricably linked with technological changes. Unlike Moradabad, where the pressure to improve quality has resulted in vertical integration of the quality critical stages of manufacturing at the export houses, in Panipat, there is no simple, unidirectional trend. Both the tendencies; tendency towards greater integration, as well as tendency for sub-contracting more activities can be simultaneously found in the cluster. Most of the changes in the sub-contracting pattern are prompted by the need to improve quality with the help of new process technologies.

### 7.2.8 Innovation, Technological Change and Development

As noted earlier, the notion of development is not linked to economic growth, but at a general level concerns with the issues of well being of workers like employment and environment. Though the clusters have seen substantial increase in output and exports in the post reform period, their growth can not be equated with development. Both the clusters, and particularly Moradabad art-ware cluster, are a far cry from an ideal type Italianate ID (industrial district) concept, in which innovation based growth promotes balanced and sustainable regional development.\footnote{Sengenberger and Pyke1992}

**Growth but Little Development: Evidence from Moradabad**

In Moradabad the high rates of growth in the value of output and exports, which was initiated by the change in the macro policy framework, is fueled mainly by availability of cheap and highly skilled work force and is facilitated by incremental changes in products and raw materials, along with some organizational and market changes. Growth in value of exports has come mainly from growth in volumes rather than value addition. In fact the unit value
realization for the products of the cluster has been going down in dollar terms in last few years. 495 The rate of growth of output and exports has already come down since late 1990s.

Lack of technological capabilities in the cluster indicates that chances of maintaining long term competitiveness on the basis of innovation and technological dynamism are remote. Secondly, the organizational setup of the cluster, which has trappings of pre-capitalist, rather than post Fordist era, militates against technological upgradation. The label of ‘Chawl Capitalism’, used by Bagchi (1998:22) describes the cluster well. Like most of the traditional ICs in India, the cluster is dominated by informal sector. Several stages of production in these clusters are being undertaken in the non-wage economy. Piece-rate payment system continues to be dominant mode of payment to artisans. Dominant actors in these clusters are a few trader entrepreneurs whose innovative urge is undermined due to their primary interest in trading rather than in manufacturing activities.

The main reason why growth of output in Moradabad can’t be seen as equitable growth is that the distributions of the benefits of growth are highly skewed. The benefits of organizational changes and whatever little technological change that has taken place in the cluster in the post reform period are confined, by and large to the exporters. They have further perpetuated acute inequality and hierarchical structure of the cluster. This in turn has eroded trust relations among various actors in the cluster. The new arrangement of sub contracting quality intensive stages to on-campus sub-contractors means that a very large number of artisan entrepreneurs have been forced to work as paid workers on the premises of the exporters. This has consolidated the control of exporters on the production process without increasing their risk in that proportion. While over seventy percent activities continue to be undertaken by second and third tier firms, they have virtually no surplus to invest in technological upgradation. Nor do they have access to institutional credit at reasonable rate of interest.

The inequitable distribution of gains of economic growth is one of the major factors responsible for plunging the cluster in a vicious circle of low technology, low productivity, low quality and low value realization. In spite of the concentration of economic surplus with them, very few of the exporters are involved in significant innovative activity. The small section of the exporters, who has cornered almost all the surplus generated during the export boom have

495 Most of the firms reported that the dollar price for an average item from Moradabad has gone down sharply in last 5 years, though the rupee price is maintained at the old level due to devaluation in value of rupee. According to one of the exporters the unit value of its items has gone down considerably even in rupee terms.
invested most of their surplus in building palatial offices and show rooms. Sharp increase in inequalities of income and wealth in favour of exporters has put a ceiling on investment that is required for technological change.

The case study provides no evidence for the hypothesis that the technological changes and innovation (including organizational innovation) taking place in the two clusters are likely to have an important bearing in improving the total volume of employment and wage rate (H11) and sub- hypothesis that technological changes and innovation (including organizational innovation) taking place in the two clusters are likely to have an important bearing in improving the environmental conditions of the labor (H11a) on the notions of development. The market led technological changes that have taken place in the cluster in the post reform period have impacted negatively on both; the quality and quantity of employment. Visits to several export houses, workshops and to areas where a large number of small household units are concentrated, made it amply clear that the quality of life of majority of workers was very poor. One of the most discerning conclusions that emerge from the evidence of the case study is that in spite of the fast growth of output and exports in recent years, the industry in Moradabad has failed to provide opportunities of decent work to majority of the members of the working class. More seriously, the growth process is turning a sizable section of the working population into, what can be termed as, ‘technological refugees’. A large number of highly skilled workers are loosing work due to the product/raw material changes taking place in the cluster. Since the new jobs created as a result of expansion in output are mostly for unskilled labour, they are going to the migrant workers, who are more pliant and are ready to work for lower wages. As a result, a sizable part of the section of the skilled workers are facing specter of long term unemployment and destitution. Most of the underemployment and displacement is the result of the market driven product/raw material changes taking place in Moradabad, which threaten deskilling and lose of tacit knowledge.

Negligible and decreasing participation of women in the industry in Moradabad and Panipat is another important aspect of unbalanced growth of the cluster. Considering that WPR (work participation rate) of women in UP have increased significantly since 1991496, this is an unexpected outcome. The experience of both the clusters, Moradabad and Panipat, differs from that of other regions in the developing world where export led growth is accompanied by

496 As per 2001 census WPR for women has gone up from 12.32 to 16.82 in UP and from 10.76 to 27.31 in Haryana during the inter-census period.
feminization of the labour force. But this is in line with the overall trends in India, where, unlike other countries increase in export intensity of the economy is not accompanied by greater feminization of labour force. 497

Metal art ware Industry in Moradabad continues to have significant, though decreasing presence of child labour. However, there was no evidence of child labour in the textile industry in Panipat.

Growth in output and exports is accompanied by the worsening of problem of pollution. Not only have the social accountability norms of foreign buyers failed to enforce use of clean technologies in the industry, the change in the demand profile has caused fast diffusion of polluting processes like electroplating. Increasing congestion in the bastis, due to increased activity and growing population of the cluster, has made the problem of pollution worse. Greater export orientation is accompanied by more pollution due to greater volumes of output, as well as due to greater adoption of environmentally unfriendly technologies. Not only is the continued use of obsolete machines in activities like polishing causing greater level of pollution, as the output levels go up, greater diffusions of more polluting finishes, such as electro-plating, is making the pollution problem worse. Pressure from foreign buyers has not resulted in any significant adoption of clean technologies in either of the two clusters. Nor have the social accountability norms set by their foreign buyers resulted in significant improvement in the working conditions. Growth process has become increasingly unsustainable in terms of environmental sustainability.

Evidence of pathetic and deteriorating conditions of labour along with heightened demand led economic dynamism in Moradabad is in line with the evidence from some other industrial clusters in India, like Flooring Tile Cluster in Morbi, Gujarat. (Das 2005)

On the whole Moradabad art-ware cluster is a far cry from an ideal type Italianate ID, which is expected to promote balanced and sustainable regional economic development. On the contrary, it is a particularly apt example of low road flexible specialization in which growth in output is accompanied by acute exploitation of labour. Not only is the growth of the cluster unbalanced because it is accompanied by sharp increase in the inequalities in the distribution of benefits of growth, it is unsustainable, both in terms of economic and environmental parameters.

497 See Mitra, (2006) and Sharma, A. (2006:2082) for participation of women in manufacturing sector in India. Mitra, (ibid) on the basis of analysis of NSS data for the period 1983 to 1999-02 observes that there is no evidence of feminization of labour in the manufacturing sector during this period and feminization is not a relevant process for India.
**Growth with Limited Development: Evidence from Panipat**

The overall picture is somewhat better in Panipat as compared to Moradabad, where high rate of growth in output and exports in the post reform period is accompanied by considerable technological upgradation. Panipat, due to its higher technological capabilities, and due to a different organizational set up stands a better chance of retaining its long term competitiveness. Though even in Panipat there is fair amount of decentralization of production, unlike Moradabad it has virtually no HH units. Secondly, since the exporting units in Panipat are undertaking more manufacturing activities than their counterparts in Moradabad, the pattern of utilization of economic surplus is much more pro upgradation in Panipat as compared to Moradabad. Considerable part of the surplus created as a result of export boom is being invested. Some of the entrepreneurs are investing heavily in state of art machinery and building for starting new units which are acting as specialized stage manufacturers/service providers for them as well as for other units in the cluster. This is facilitating small units, and particularly the suppliers to exporters and jobbers to enter export market.

However though the textile cluster of Panipat, which has more technological dynamism as compared to Moradabad, it cannot be yet considered to have attained the threshold of an international technological standard and practices. There persists considerable gap between the global best practices and those adopted in Panipat. In fact the cluster is not even close to the national technological frontier. The global competitiveness of the cluster continues to be low. The cluster continues to operate mostly at the lower end of the global market, with shrinking unit value realization of its exports in dollar terms. While the existing capabilities of the cluster have ensured its short run survival and growth, they are not enough for the technological upgradation of the cluster which would have guaranteed its long term growth. Though the cluster has a vibrant production system and easy availability of funds, inadequacy of technological infrastructure and lack of will to spend on innovation⁴⁹⁸ are likely to be major stumbling blocks in its long term competitiveness.

The distribution of gains from growth is much less skewed in Panipat as compared to Moradabad. On the whole, the condition of labour is better in Panipat as compared to Moradabad.  

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⁴⁹⁸ According to several observers, in spite of there being no dearth of funds due to availability of own funds as well as institutional finance offered by TUF / SIDBI and commercial banks, Panipat is unlikely to see increase in expenditure on development of new technologies because the entrepreneurs in Panipat are averse to taking risk which goes with new technologies.
Moradabad. Not only is the wage rate higher in Panipat, the level of destitution resulting from technological changes is much lower. Even though the district wise figures of unemployment are not known, on the basis of indirect evidence, as well as observations made during the field work visits, it could be inferred that extent of the problem of unemployment/underemployment is less severe in Moradabad as compared to Panipat. Secondly, since most of the workers in Panipat are migrants, the visibility of social impact of lose of jobs is much less, as compared to Moradabad, where settlers are hit hard.

The average monthly earnings of workers; wage labourers as well as self employed jobbers are higher in Panipat as compared to Moradabad. This is on two account of two factors; higher wage rate as well as greater number of days for which employment is available in Panipat. Though there is certain amount of seasonality in employment scenario even in Panipat, its severity is much less. In fact many entrepreneurs in Panipat claimed that there is shortage of workers and they were quite willing to provide work for their workers round the year if they did not go to their home towns in the harvest season.

Apart from quantitative aspects, on an average, the quality of employment is better in Panipat, as compared to Moradabad. This is on two accounts; lower level of work place pollution and fewer perks available to labour. Though several processes in textile industry are both hazardous and polluting and the use of anti pollution devices like ETP is as dismal in Panipat, the level of pollution generated by the industry is not as high as in Moradabad. In Panipat diffusion of new technologies in processes like fabric and yarn dyeing has meant that pollution levels generated by the industry have not increased proportionately to increase in output. Though the compliance of pollution laws is poor in both the clusters, there is some evidence of closure of dyeing activity in the units which were using highly polluting primitive dyeing technologies. This has happened due to two reasons; enforcement of anti pollution laws by HPCB and due to availability of specialized units using better dyeing and processing technologies, which makes it possible to perform these activities at lower cost and with lower pollution levels. Pressure from foreign buyers has resulted in use of azo free dyes, which are more environment friendly than the direct dyes.

Growth in different segments of the industry is uneven and is accompanied by growing inequalities between different. While exporters have been the beneficiaries of the fast growth of the industry in Panipat, the condition of the units catering exclusively to the domestic market has deteriorated in the post reform period.
Secondly, relatively better condition of labour vis-à-vis Moradabad does not mean growth in Panipat has been equitable. The workers in Panipat have not benefited much from the fast growth of output and technological change in Panipat. Like Moradabad, Panipat continues to depend considerably on its cheap labour and numerical flexibility. The real wage rate and the quality of life of workers in the cluster have not improved much. Most of the jobs are generated in the informal segment of the industry, where labour is treated as highly expendable resource. As in Moradabad, in Panipat the ratio of casual workers has been going up, and the collective bargaining power of workers has gone down. There is no evidence of creation of multi-skilled work force with permanent jobs, more incentives and greater role in decision making. Again, like Moradabad, in Panipat the share of women in employment has been going down.

On the whole, high rate of growth in output and exports in the cluster can be equated with and a sustainable and equitable development. The Panipat case study provides limited evidence for the hypothesis (H11) and sub-hypothesis (H11a) on the notions of development.

7.3 POLICY INSIGHTS EMERGING FROM TWO CASE STUDIES

This section presents a summary of some of the important policy related insights emerging from two case studies.

1. The two case studies show that there is nothing inbuilt in the market friendly liberalization policies which ensure technological or functional upgradation in the industrial clusters. As the evidence from Moradabad shows, growth dynamism initiated by some policy induced changes may in fact be responsible for deterioration in the condition of the most vulnerable section of the society. Therefore there is need for greater and a more structured government support for these clusters, if they are to be prevented from joining the ‘race for the bottom’ in this era of globalization and to be converted in centers of equitable and sustainable development.

2. The evidence from both the case studies indicates that the reach of the existing technological support programmes of the government has been limited, and that there is need for major revamping in the delivery system. Three policy insights emerging from the case studies in this regard are:
• 'Real services' rather than fiscal support are needed to promote innovation and technological upgradation in the clusters.
• Support should be collective/cluster based instead of being targeted at individual units.
• The support institutions/policies need to have more decentralized structures if they have to be effective.
• Any strategy for promoting innovation based sustainable development in the region unless the have Special focus on small firms and on workers. In clusters like Moradabad, where most of manufacturing activity in the cluster is carried out by small artisanal units, there is urgent need for the support systems to be targeted at them. Unless the technological as well as the credit needs of the small units are met possibility of technological upgradation in these clusters will remain remote.

3. Creation of education and training facilities for helping workers in acquiring new skills on the one hand and strengthening their collective bargaining power by facilitating trade union movement in the region can go a long way in encouraging firms in the clusters to adopt growth strategies based in innovation and technological change.

4. There is a need for a comprehensive and holistic cluster development policy, with a two layer structure comprising of National Cluster Development Agency (NCDA), as the umbrella organization and Local Cluster Development Agencies

5. Local Cluster Development Agency (LCDA) for each (big) cluster is needed to meeting the customized needs of individual cluster through decentralized public action, even as it makes it possible to reap the benefits of presence of a very large number of same sector clusters in the country. 499

6. Specific functions to be performed by LCDA, as emerging from two case studies are

   (i) Provision of Good Physical Infrastructure: Since lack of good infrastructure, particularly, lack of uninterrupted power supply emerges as one of the foremost impediments in the process of technological upgradation, provision of good infrastructure is a task which the LCDA must accomplish. This includes provision of sector specific infrastructure required by the cluster.

499 The proposed LCDAs are suggested for all big clusters, which constitute the subject matter of this project.
some of the tasks that TIA has to perform in order to promote upgradation of the cluster.

8. The need for an innovation policy framework which promotes synergetic complimentarily between the national, sectoral and regional systems of innovation emerges very clearly from two case studies. In a two layer framework while the LCDA can focus on strengthening of the RIS, the NCDA can devise policies and create agencies aimed at optimally using the existing regional, national and sectoral institutions for the purpose of stimulating innovation based growth in different industrial clusters.

7.4 SOME SUGGESTIONS FOR FUTURE RESEARCH

The theoretical framework developed in this thesis and its application to the exploration of case studies ha been quite fruitful in substantiating or assessing various hypotheses. However it has not been possible to deal, in depth, with various other aspects, which were suspended from exploration on account of the limitations imposed by the scope of this thesis. Some of the suggested lines on which future research in this area can be undertaken are as follows:

(i) Further studies on clusters with a focus on innovation and technological change of the magnitude as that pursued in this thesis is called for. Given the ‘road map’ and the theoretical guide posts in the theoretical framework in this thesis, further studies could be directed towards a more in-depth empirical research of firm level studies, entertaining larger sample than the one pursued in this thesis. Larger sample of firms, with appropriate questionnaire will be suitable for econometric analysis at the firm level.

(ii) Sub-optimal level of the impact of cluster level technological capabilities and the residual impact of knowledge institution is a serious concern from the policy perspective and the cluster development programmes of the government. Further studies, which focus on the impact of knowledge institutions and cluster level technological capabilities, are called for to validate, or to critically examine the findings made in this study.

502 The idea that continental, national and sub-national innovation systems can play complimentary roles was promoted by Freeman (2002).

503 Given the size of big clusters in India, the cluster can be treated as geographical unit for the Regional Innovation System.
(iii) Since clusters represent spatial concentration of same sector firms in a given region, regional dimensions of development are very important for understanding dynamics of change. While in the ID literature, there is considerable emphasis on local government and local institutions, case studies on clusters in developing countries, including India, are not very eloquent on the regional dimensions. Future case studies on Indian clusters must pay much greater attention to regional dimensions of development than is accorded to them at present. Insights from literature on Regional Innovations System (RIS), which is extensively used in the context of industrial clusters in developed countries, can be highly relevant in furthering the discourse on innovation and technological upgradation of clusters in India.

(iv) Important as Regional Innovations System (RIS) model is, the recently developed variant of innovation systems, Sectoral Systems of Innovation (Malebra 2000, 2005), seems no less relevant. This is not surprising, given the fact that a cluster is a dual entity, encompassing sectoral and spatial concentration of firms. Further research on industrial clusters in India can draw on insights from Sectoral Systems of Innovation which focuses on sectoral players, like buyers and suppliers in a particular sector, educational and other sector specific institutions and on sectoral policies. For the studied on industrial clusters in which the regional economy is heavily dependent on single industrial sector, the Sectoral System of Innovation approach, with an overlap of geographically focused RIS may provide us with best set of tools to analyze innovation in a clustering context.

(v) Clearly related to the above discussed points is the issue of exploring clusters for a systematic policy perspective for industrial clusters. ID literature clearly brings out the critical role of innovation policy in the success of industrial clusters in developed countries like Germany. As noted in chapter 6, though there is no innovation policy in India at present, further studies are needed for exploring the relevance of a suitable innovation policy and developing a comprehensive policy framework, which will be relevant for a country like India. The need for further studies for exploring an innovation policy framework which promotes synergetic complimentarily between the national, sectoral and regional systems of innovation emerges very clearly from two case studies.

(vi) From the point of view of scholars carrying out research from an inter-disciplinary perspective, clusters of the kind selected in the study (i.e. traditional, big clusters) also provide a very significant sociological and socio-anthropological ground for study. Such
a study could focus more on technological change and innovations from the point of view of artisans and their cultural history and socio-economic context within which they are located.

(vii) Given a large number of same sector industrial clusters in India,(appendix1) there is need for exploration of a policy framework which will facilitate building of capabilities through synergetic networking between knowledge and other institutions located in 'same sector' clusters. It is suggested that future research pays attention to the 'Location Quotient' (LQ) as well as the 'Sectoral Concentration Quotient' (SCQ) of clusters in order to divide them in meaningful categories from the point of view of policy oriented research. The concept of SCQ, which is being introduced in this work, is a measure of the degree of dominance of the cluster in a particular sector. SCQ of a cluster can be defined as the ratio of the value of the output produced in that particular cluster to the value of total output of the sector/sub sector produced in the national economy. The value of SCQ would lie between zero and one. In the extreme case where the activity of a particular sector/sub-sector is concentrated only in one cluster, the SCQ of that cluster would be one. Clusters like Glass Bangles cluster of Firozabad, Locks cluster of Aligarh, and Brassware cluster of Moradabad are some examples of clusters with high SCQ.

Future policy orientated studies can explore the possibilities of developing these clusters with high SQS as 'lead cluster' which can be endowed with specialized facilities for creation and diffusion of sector specific knowledge, which can benefit all the clusters in the same sectoral group. For clusters like Panipat, which may have high location quotient, but a low sectoral concentration quotient, the research can focus on the exploration of policies for development of linkage capabilities, which will allow these clusters to benefit from existing sectoral resources available elsewhere in the country.

504 The concept of Sectoral Concentration Quotient (SCQ) is different from that of Location Quotient (LQ) which is commonly used in clusters literature. Location quotient, which is defined the ratio of the percentage of percentage of work force engaged in a particular industrial sector in a geographical location to the percentage of work force engaged in that sector at the national level, is used for measuring the extent of dominance of a single activity in a given geographical territory. SQC, on the other hand measures the degree of dominance of a geographical location in a particular industrial sector. For detail on concept of LQ see Bergman, and Feser (1999).
(ii) *Creation of Appropriate Knowledge Institutions* is essential for creation/diffusion of new technological knowledge and training workers in new skills. This assumes greater importance in the emerging knowledge economy. Lack of basic education among workers, along with lack of cluster level training facilities, is one of the biggest stumbling blocks in the

(iii) **Plugging Value Chain Gaps**

One important function of the cluster development policy should be to facilitate the creation of integrated and synergetic value chain, covering maximum number of the activities in the value chain. Among other things, such an effort can facilitate knowledge spillovers through learning by interacting.\(^500\)

7. **Technology Intermediation Agency**

There is need for creation of a technology intermediary agency (TIA) with in the framework of LCDA, in the clusters.

- The central task of TIA is to should be to act as a *technological gatekeeper* of the clusters and facilitate all the steps in an innovation cycle, starting from the identification of new technologies and the best sources for acquiring them, adaptation of technologies to make them suitable for local conditions, and finally facilitating their diffusion. Diffusion of new technologies *provision of real services* like training in new technologies, provision of specialized equipment in the form of common facility and adequate testing facilities.\(^501\)

- *Creation and promotion of innovative networks* with in the cluster and interacting with innovative networks outside the cluster, on behalf of the cluster agents would be an important function of a cluster based technological intermediation agency.

- *Development of markets* through activities like collection of market intelligence, creation of high value niche market, development of market consortiums, developing and promoting a brand name for the cluster, and setting up of retailing chain are

\(^{500}\)For example a state of art die making facility will not only increase the efficiency of the Moradabad cluster by plugging an important gap in the production chain, but can also boost design based innovation, due to closer interaction between traditional designers and the modern die making unit.

\(^{501}\)In some sectors/sub-sectors creation of new technological knowledge indigenously may be as important in order to maintain long run competitiveness.