Innovation Productivity and Competitiveness: A Case Study of Pakistan’s Textile Industry

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Abstract
Globalization, competitiveness and innovation have gained importance in the management agendas in both business and government. There is no clear consensus on how individual firms and regional and national governments should go about becoming more innovative and more globally competitive. This paper tries to explore critical issues related to innovation, creativity and sustainable competitiveness. The purpose of this paper is to develop a model, linking organisational attributes to creativity and innovation. Drawing upon existing and empirical evidence the paper develops and presents a case study of Pakistan’s Textile industry to support the conceptual model and proposes research propositions based on relationships suggested by the model. Porter (1998) emphasizes that the competitiveness of the industry depends upon the ability of its firms to produce efficiently and to innovate. This research paper tries to capture the mechanisms that foster high levels of productivity and innovation and lays out the implications for competitive strategy and economic policy. Today’s economic map of the world is characterized by what Porter calls clusters: critical masses in one place of linked industries and institutions- from suppliers to universities to government agencies- that enjoy unusual competitive success in a particular field. This paper suggests a conceptual framework of organisational characteristics influencing the process and formation of clusters. It tests various hypothesis in respect to the relationships between organizational attributes and the local clustering of the establishments in the textile industry of Pakistan. This paper hopes to make a useful contribution to the government policy makers in formulating macro policies towards prominent clusters and assisting firms as well as public institutions in making relevant investments towards the infrastructure.

Keywords: Clusters; Pakistan; competitive advantage, industrial linkages.

1. Review of Literature
This article is fundamentally concerned with Porter’s theory of competitiveness defined in his book “Competitive Advantage of Nations” (1998). The simple logic behind his theory is that nation’s competitiveness depends on the competitiveness of the industries and the companies forming its industrial clusters. Industrial agglomerations and clusters have been the focus of scientific research as long as modern national economics have existed. Over a century ago Alfred Marshall developed his idea of industrial districts. Other related concepts that have
now become significant to the cluster approach are Ronald Coase’s theories of the firms, first published in the 1930’s “(as quoted in Viitam o), and Joseph Schumpeter’s views of the dynamics of competition also presented at that time. Jacobs and De Man (1996) and Rosenfeld (1997) present an in depth discussions of different definitions of industry clusters. Jacob and De Man (1996) argue that ‘there is no one correct definition of the cluster concept….. different dimensions are of interest.’ They include key dimensions like geographical or spatial clustering of economic activity, horizontal and vertical relationships between industry sectors, use of common technology, the presence of a central actor (i.e., a large firm, research center etc.), and the quality of firm network, or firm cooperation (Jacobs and De Man 1996).

The varying definitions and dimensions of industry clusters has led to differing arguments regarding the methods and techniques used in its empirical research. The main distinction can be made between hard (i.e. quantitative) and soft (i.e., qualitative) methods that have been used in varying combinations. In the studies based on quantitative approach, industrial statistics and various statistical techniques are used for mapping clusters. The qualitative approach used in industry case studies relies more on information provided by company interviews etc.

There is a general consensus in the literature that in order to truly identify industry clusters it is necessary to conduct a qualitative analysis in addition to quantitative analysis. Surveys and interviews of key industry representatives will expand an understanding of the buyer-supplier relationships, as well as further identifying commonalities between industries (i.e. workforce or infrastructure needs, or technologies used) (Doeringer and Terkla 1995, Jacobs and De Man 1996, Sterberg 1991, Le Veen 1998).

The current article analyzes the competitiveness of Pakistan’s textile/apparel industry using a qualitative approach. The industry information was collected from 39 establishments through company interviews and surveys. The emphasis of analysis of this study is therefore more on intuitive reasoning.

2. Developing Indicators for Competitiveness

Porter (1998) emphasizes that the competitiveness of the industry depends upon the ability of its firms to produce efficiently and to discover new and better ways to compete. Number of factors influence the productivity and capacity of the establishments to upgrade overtime. These include organizational characteristics such as the structure of the establishments, nature of products/production processes, technology, R&D etc. Productivity of firms can be manifested in product changes, process changes, and new conceptions of scope.

This paper develops variables to analyze the factors influencing the productivity of the firms in textile/apparel industries of Pakistan. The organizational characteristics of the establishments in textile/apparel industries have been analyzed from two aspects

1) Products and production process
2) Level of technology and R&D

How these variables are used to analyze whether the organizational characteristics of the establishments are conducive to cluster development leading to sustainable competitive advantage is discussed in later sections.
Variables Representing Various Organizational Attributes

<table>
<thead>
<tr>
<th>Products and Production process</th>
<th>Technology &amp; R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Products</td>
<td>1. Technology</td>
</tr>
<tr>
<td>2. Production process</td>
<td>2. R&amp;D activities</td>
</tr>
<tr>
<td>3. Changes in Products</td>
<td></td>
</tr>
<tr>
<td>1. No of products</td>
<td>6. Use of scientific equipment</td>
</tr>
<tr>
<td>2. Types of products</td>
<td>7. No. of times machinery upgraded</td>
</tr>
<tr>
<td>3. Type of production process</td>
<td>8. % of R&amp;D workers</td>
</tr>
<tr>
<td>4. No of new products/businesses entered</td>
<td>9. Contact with foreign organizations for R&amp;D</td>
</tr>
<tr>
<td>5. % of imported equipment</td>
<td></td>
</tr>
</tbody>
</table>

4. Major Prepositions

4.1 Products and Production Processes:
The production process is closely related to the nature of products being produced by the establishments and their organizational strategies. The impact of products and production processes can be analyzed from following aspects

Products:
Establishments producing a range of products are believed to have less local linkages. This is because multi products are regarded to represent the organization’s ability to expand their market space. Establishments producing intermediate goods are regarded to have higher local linkages because the nature of their products represents greater need for external contacts than establishments producing finished goods.

Production Processes:
a) Firstly the small and labor intensive units producing unstandardized goods are likely to have higher local linkages because their unit cost of transaction in terms of communication and transport is likely to be higher as compared to establishments using standardized process and requiring inputs in bulk quantities.
b) Secondly the establishments producing standardized products and using a stable production process may be stimulated to vertically integrate and attain internal economies of scale. On the other hand establishments producing unstandardized differentiated products are likely to depend more on external local linkages (see Marshall 1979). Williamson (1975) regarded the mechanism that leads firms to engage in strategies of integration as the desire to minimize transaction costs. The existence of these costs was seen as being essentially the result of inadequacies of information resulting from such factors as the lack of candor of the
participants in exchanges between un-integrated activities. Moss (1981) has criticized this view and argues that it is the technological factors determining the two productive activities which will in turn determine the transaction costs of the participants, and not the informational costs.

4.2 Technology and R&D

The level of technology used by the establishments in their production process is believed to have a negative impact on the level of local linkages. The establishments using high level of technology are likely to have less local linkages mainly because the local market lags behind in technology and is not in a position to meet their advanced requirements. In case of the textile industry of Pakistan the establishments using higher level of technology were engaged in the production of intermediate goods and were using standardized mass production process.

5. Data and Methodology

The study is based on primary data collected from 39 establishments through a structured questionnaire. Collecting primary data has been the best source of information, largely because secondary data supporting company research in Pakistan is far from sufficient. Initially the survey was conducted through a normal mail channel. However due to lack of response interviews with various sample firms had to be conducted. The support of local chamber of commerce and some government officials also greatly contributed to the overall response rate.

5.1 Statistical Tests

Chi-square independence test has been used to analyze the association between the selected variables and the nature of the establishments. For example the association between the establishments having higher percentage of imported equipment and the type of products produced by them is analyzed. If the distribution of the establishments having higher percentage of imported equipment are identical in the ‘nature’ category (i.e are identical for finished goods and intermediate goods establishments) then ‘percentage of imported machinery’ and the nature of the establishments are statistically independent.

In the above stated example we want to use the sample data to decide whether there is association between the establishments having imported machinery and the type (nature) of the products being produced by them. In other words we want to perform the hypothesis tests

\[ \text{Ha: Imported machinery and the type (nature) of the products being produced by the establishments are statistically dependent (i.e there is association between the type of products being produced by the establishments and their percentage of imported machinery).} \]

The test statistic employed is

\[ \text{Chi-square} = \sum (O - E)^2 / E \]

‘O’ represents observed frequency and ‘E’ represents expected frequency.
Likelihood Ratio (LR) Test

The SPSS program is used for the computation of chi-square test statistic. This program automatically provides with the LR value. LR value is used where more than 20% of the expected frequencies are less than 5. Asymptotically LR test follows the Chi-square distribution.

P-value

The P-value can be interpreted as the observed significance level of a hypothesis test. The P-value of a hypothesis test is equal to the smallest significance level at which the null hypothesis can be rejected, that is, the smallest significance level for which the observed sample data results in rejecting Ho (Weiss, 1995, p.527). If the P-value is less than or do not reject the null hypothesis.

6. Findings and Discussions

6.1 Products and Production Processes

Products

The survey findings show two distinct features of the Textile/Apparel industry in Pakistan.

1) Diversification among the surveyed establishments significantly depended on the nature of their products. The establishments producing finished goods had diversified into the production of a range of products whereas the firms producing intermediate goods had mostly constrained themselves to one product. This was in accordance with the type of production processes being used by these establishments. Since the establishments producing intermediate goods were using standardized mass production process they had mostly constrained themselves to one product only (statistical appendix, table 3 & 4).

2) Another distinct feature that has come forward through the survey findings is the absence of backward and forward integration among the surveyed establishments. Even the establishments producing intermediate products and using standardized mass production process had not integrated backwards into the production of any of the major inputs. Moss (1981) has argued that the transaction costs are dependent on the technological factors determining the two productive activities. The establishments are only likely to engage in strategies of integration if technological factors of the two productive activities are such that economies of scale can be gained by internalizing the activities. Multi products can be regarded as the ability of the establishments to expand their market space. However the findings indicate that the particular structure of the establishments in the study area was such that only small sized establishments using an unstandardized production process were mainly engaged in producing a range of products (statistical appendix, table 3). This confirms the findings of Scott (1983) who has argued that the small and labor intensive firms producing unstandardized goods tend to have short distance or local linkages while large capital intensive firms producing standardized goods have less local linkages. He emphasizes that the unit cost of transactions in terms of their transport and communication costs tend to be higher when the products are small in quantity and unstandardized than when the products are large in quantity and standardized.
6.3 Technology and R&D

Technology
The following points summarize the findings

i) The overall usage of imported machinery is high in the industry in general. This is mainly because locally produced machines are confined to few hand tools or very simple machinery (statistical appendix, table 6).

ii) The proportion of imported machinery used is significantly higher in the establishments engaged in the production of intermediate products like cotton yarn/synthetic fibers etc as compared to those engaged in producing simple finished goods. This is in accordance with the fact that the establishments using a standardized mass production process have a higher proportion of imported machinery (statistical appendix, table 6).

The level of technology is believed to negatively influence the local linkages because it is believed that that local market may not be capable of meeting advanced input requirements associated with higher technology. The establishments like Apollo textile mills that were using a higher proportion of imported machinery also tended to import a higher percentage of their raw materials.

R&D activities are negligible in the industry. Even the establishments producing intermediate goods using a high proportion of imported machinery have very limited R&D activities. These firms have based their competitive advantage on low grade standardized products for the domestic as well as foreign markets. R&D activities essential for upgrading of products are not just taking place among these firms (statistical appendix, table 7 & 8).

7. Concluding Remarks

The paper has tested various hypothesis in respect to the relationships between the organizational attributes and the local clustering of the establishments in the textile/apparel industry of Pakistan. The selection of the organizational attributes has been based on the discussed theoretical framework. The hypothesis was grouped into different categories of the organizational attributes. The objective was to analyze the impact of these attributes on the cluster development of this industry. Chi-square test was used to analyze whether there was any association between the nature of the establishments and the organizational characteristics.

The survey results show that the prevailing goals of the owners / senior managers do not appear to lend themselves well to the upgrading of the industry. For example the establishment of independent R&D unit is crucially important for technological mastery. R&D activities within the firms strongly manifest the preferences of the owners towards organizing influence on innovation and product/process development. The survey results show that the R&D activities in the interviewed establishments were almost non-existent.

The survey shows that the overall usage of imported machinery was very high in the industry. This was particularly true in case of the establishments producing intermediate goods. However the extremely small percentage of engineers and managerial staff employed by these establishments indicates the lack of ability of these establishments to assimilate and develop upon the imported technology (Statistical appendix, table 1). This is also evident from the lack of innovative activities and limited product diversification by the establishments producing intermediate goods.

In short the above findings indicate that the industry has so far not been able to reap the benefits associated with local clustering.
### Statistical Appendix

#### Table 1 Proportion of Engineers and Managerial Staff

<table>
<thead>
<tr>
<th>Nature of Products</th>
<th>$\geq 10%$ Engineers/managers</th>
<th>$&gt;10%$ Engineers/managers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>15</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>12</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>11</td>
<td>38</td>
</tr>
</tbody>
</table>

1 cell (25%) have expected count less than 5. The minimum expected count is 4.92.
Likelihood Ratio: 0.003  d.f: 1  p value: 0.955

#### Table 2 Group Ties

<table>
<thead>
<tr>
<th>Types of Products</th>
<th>Group Ties</th>
<th>No Group Ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>6 (9.165)</td>
<td>15 (11.817)</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>11 (7.856)</td>
<td>7 (10.162)</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>22</td>
</tr>
</tbody>
</table>

0 cells (0%) have expected count less than 5. The minimum expected count is 7.85. The values in parenthesis are expected frequencies of each cell.

Chi-square value: 4.174  d.f:1  p value:0.041

**Solution**

Formula (see section 6.5.0 chapter 6)

$$\chi^2 = \sum \frac{(o_i - e_i)^2}{e_i}$$

$$= \frac{(6-9.165)^2}{9.165} + \frac{(11-7.856)^2}{7.856} + \frac{(15-11.817)^2}{11.817} + \frac{(7-10.162)^2}{10.162} = 4.174$$

#### Table 3 Number of Products

<table>
<thead>
<tr>
<th>Types of Products</th>
<th>One</th>
<th>Two</th>
<th>Three or more</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>4</td>
<td>10</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>12</td>
<td>9</td>
<td>39</td>
</tr>
</tbody>
</table>

2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.15.
Likelihood ratio: 14.417  d.f:2  p value: 0.001

#### Table 4 Production Process

<table>
<thead>
<tr>
<th>Types of Products</th>
<th>Standardised Process</th>
<th>Jobbing/batches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>12</td>
</tr>
</tbody>
</table>

0 cells (0%) have expected count less than 5. The minimum expected count is 5.54.
Chi-square value: 9.976  d.f: 1  p-value: 0.002

#### Table 5 Number of Scientific Equipment Used

<table>
<thead>
<tr>
<th>Nature of Products</th>
<th>$\leq 1$</th>
<th>$&gt;1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>22</td>
</tr>
</tbody>
</table>

0 cells (0%) have expected count less than 5. The minimum expected count is 7.85.
Chi-square value: 0.010  d.f: 1  p value: 0.921
Table 6  Types of Products & Proportion of Imported Machinery
(Number of Firms)

<table>
<thead>
<tr>
<th>Types of Products</th>
<th>&lt;=50%</th>
<th>&gt;50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>27</td>
</tr>
</tbody>
</table>

0 cells (0%) have expected count less than 5. The minimum expected count is 5.54.
Chi-square value: 6.064  d.f:1  p value: 0.014

Table 7  Contact with External Organisation for R&D

<table>
<thead>
<tr>
<th>Nature of Products</th>
<th>1 Firm</th>
<th>2 Firms</th>
<th>3 Firms</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 8  R&D Employees

<table>
<thead>
<tr>
<th>Nature of Products</th>
<th>None</th>
<th>&lt;=10%</th>
<th>&gt;10%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Goods</td>
<td>14</td>
<td>3</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>4</td>
<td>4</td>
<td>29</td>
</tr>
</tbody>
</table>
References

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