# AN OVERVIEW OF INDUSTRY, URBANIZATION AND DISASTER RISK NEXUS IN PUNJAB

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**ABSTRACT:** The paper focuses on the contemporary industrial location theories and examines their applicability in the Province of Punjab, Pakistan. The paper explores the spatial bond within industry, urbanization and disaster risks—germinating from the insertion of economics, geography, planning, ecology, and security concerns into the industrial location theory. The paper correlates the industrial concentration pattern with that of urbanization patterns and the prevailing disaster risks in the province. The study makes use of Centrality Functional Index (CFI) and Rank Mobility Index (RMI) along with spatial visualization techniques using GIS—making use of isolines/density buffers and choropleth maps. The study explores a high degree of correlation within industrial locations and the agglomeration of urbanization, investments, and disaster risks. The study suggests a planned distribution of industry for a balanced and disaster sensitive urbanization policy and socioeconomic development in the province.

**Key words:** Industrial Location, Urbanization, Balanced Industrial Development, Disaster Risk Management

## INTRODUCTION

At the very outset, the industrial location theories were developed with the motive of profit maximization approach by economists—who tried to integrate industrial locations with the 'theory of firms', later on, due to multiple links and operations of industry, the planners and geographers also joined in the debate on industrial location (Glasson, 1992).

During last quarter of the 20th century, the environmentalists and ecologists—with their popular yet, ethical and aesthetical principle of sustainable development added another important element to industrial location theory, even though they concentrated on the macro impacts of industrial development and the consequent resource depletion, and not much the location of industrial development. Lastly, the human safety and security issues—in the backdrop of 9/11 and associated terrorist strikes and to a number of past industrial disasters like Bhopal, Chernobyl and the like, added the fourth dimension to industrial location theory (Figure-1).

**Figure-1: Expert Fields that Contributed to Industrial Location Theories**
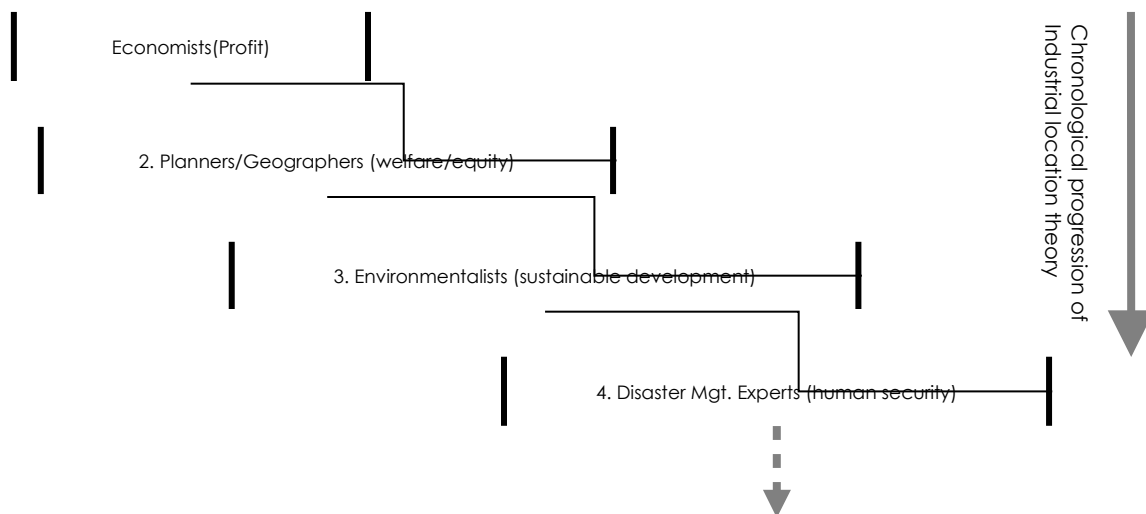


Source: Authors own construct 2011

Within the orchestra of economic geographers some of the prominent figures are Adam Smith, Ricardo, Von Thunen, Mill and Weber, and the umbrella theories of industrial locations were; the least cost approach; the market based approach; and the profit maximization approach. The Figure-2 illustrates the optimum location of an industry in different cost-price situations, where at location 'A' the cost is lowest and at location 'B' the revenues are highest, so the optimum location is within locations A & B, probably at location 'O'.

In line with the umbrella economic industrial location theories a number of industrial clustering and growth models have been developed and applied in different countries of the world. The first within those is the Hoovers typology who classifies the industrial agglomeration into; scale economies, localization economies, urbanization economies; and global economies (Hoover, 1948). McCann identifies some other notable industrial clustering models applied in different parts of the World (McCann, 2001), namely:

- Growth Pole Model
- The Business Incubator Model
- The Product Cycle Model
- The Porter Model
- The New Industrial Area Model

**Figure-2: The Optimum Industrial Location Based on Cost and Revenue Curves**
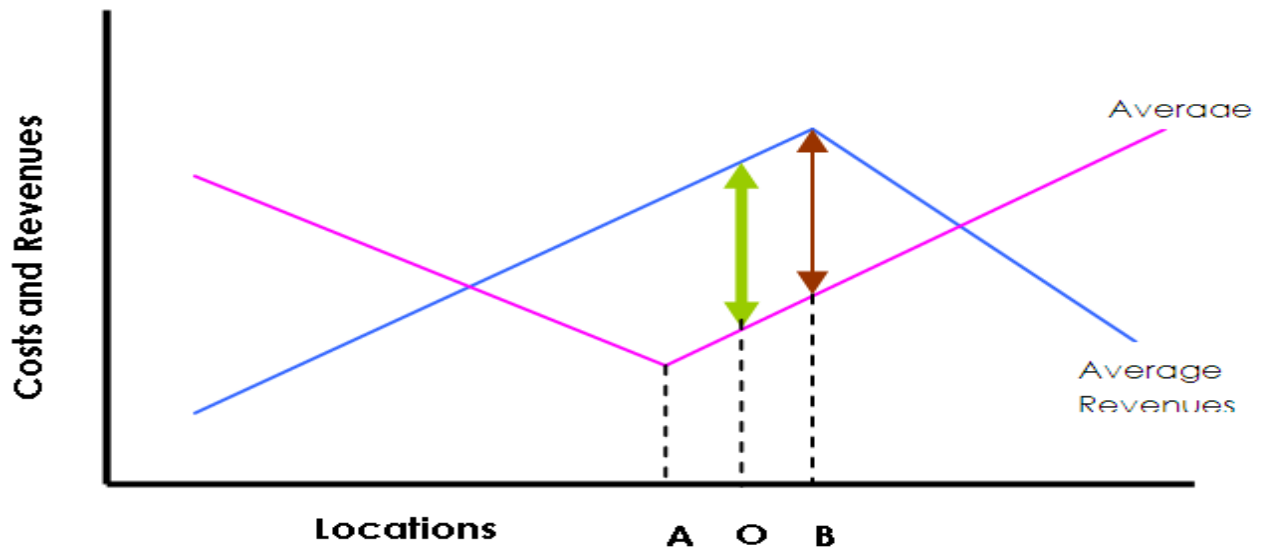


In recent years, sustainable development concerns have been in the lime light, but environmental concerns remained focused on remedial measures. Although, many writers have commented on the role of environment in planning such as Chapman and Walker (1991), McHarg (1992), and Selman (2000), but the first environment sensitive industrial location study was made in the year 2001 in Punjab (Piracha, 2001).

Lately, especially after the 9/11 attacks and the corresponding war against terrorism, human security concerns became the priority issues in industrial development policy. The security concerns also had their realization in the backdrop of natural and man-made industrial disasters; such as 8/10 earthquake in Pakistan and the Bhopal and Chernobyl incidences, to name few. Moreover, with a shift in disaster management paradigm from reactive to proactive mode raised the importance of land use planning in location of industrial establishments (Gupta and Nair, 2009). The National Disaster Management Authority (NDMA) with the active support of UNDP-Pakistan is also pursuing hard towards mainstreaming disaster risk reduction element into development process, to which industrial development and location is also a major component (NDRMFP, 2007).

The paper explores the spatial link within industry, urbanization and prevailing disaster risks in the Punjab Province. It analyzes the industrial establishments in terms of number and type of industrial establishments, number of employees within these industrial units, the overall industrial investments, and the specialization of industrial units within districts of Punjab.

To perform the above mentioned tasks the paper makes use of a very simple and useful technique known as Centrality Functional Index (CFI). The CFI analysis uses the census based industrial data from the Directory of Industrial Establishments Punjab, 2002. The CFI technique is also applied in identifying the potential disaster risks existing in the province. The statistical results generated with the help of CFI analysis along with the urbanization trends in the province are visualized

through GIS technology to identify the spatial linkages /bonds within concentration of industrial development, urbanization and disaster risks in the province.

The combined results of both statistical and geographical analyses explore the existence of strong nexus within industry, urbanization, and disaster risks in the province. The study demands for a balanced industrial development to alleviate the disaster risks and to have balanced socioeconomic development and urbanization in the province.

**Study Methodology:** The paper analyses the spatial concentration of industry, urbanization and disaster risks in the province and explores the degree of relationship within them (Figure-3).

**Figure-3: The Research Methodology**
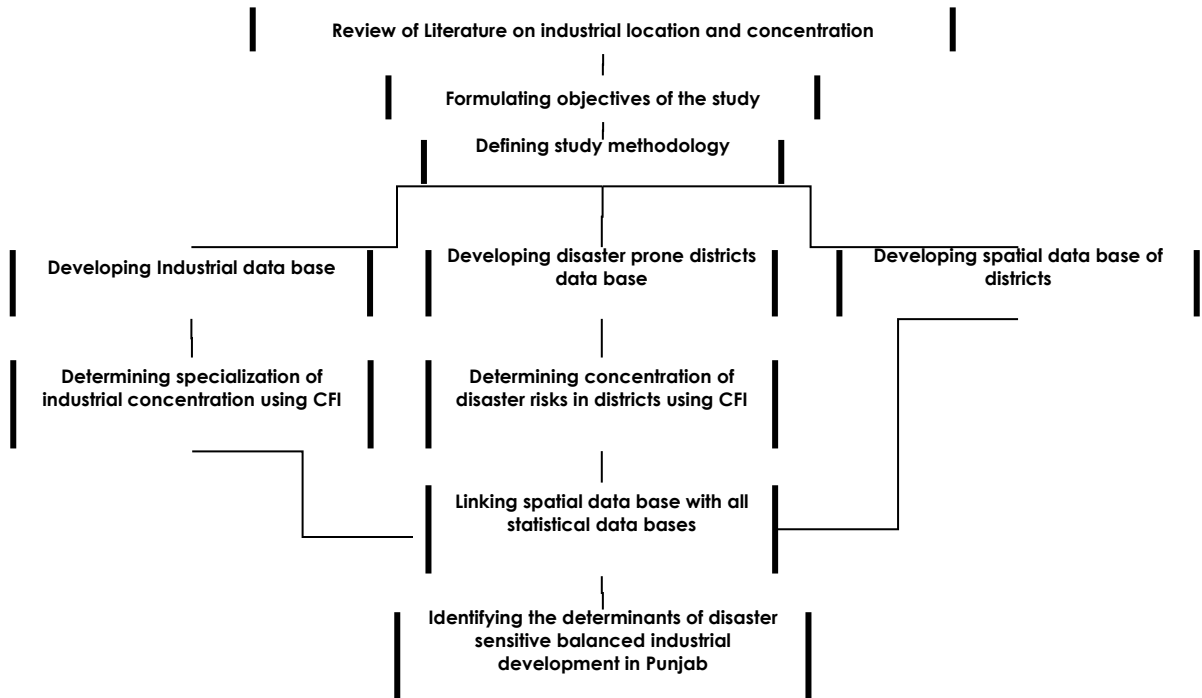


Source: Authors Own Construct 2011

The study objectives are mainly derived from literature on industrial location. Responding to the objectives formulated, firstly; the study developed a data base of industry in the province, using the Directory of Industrial Establishments Punjab 2002. The industrial data was then processed using (CFI) to assess the centralization of industry in Punjab. The CFI is a multipurpose and useful technique to assess the centralization of any phenomenon in a geographical space (Janssen, 1996). Secondly; the district based disaster risks were assessed using the Disaster Risk Management Plan Punjab, 2008 (DRMPP, 2008). The risks identified were also processed using CFI technique to assess the concentration of disaster risks in the province. Thirdly; the urban population densities are analyzed using 1998 census data and its trend projections up to 2008. The fourth parallel activity was to develop a spatial data base of districts in Punjab. The maps collected were later on digitized and geo referenced using the GIS Arc View 3.2. Finally, by linking spatial data base with the industrial data base, disaster risks data base, and urban population data base, the study analyzes the industrial distribution pattern in relation with the disaster risks and population distribution in the province.

The analytical results were also visualized through isolines/density buffers and choropleth maps using GIS.

**The Centrality Functional Index for Industries:** The Centrality Functional Index (CFI) for industries is performed using four facets, namely; CFI on the basis of number of industrial units, employment concentration, financial investment, and nature and type of industrial units. The results of CFI analyses for top 20 districts are summarized in Table-1: The CFI results in terms of number of industrial units, Faisalabad holds the top most position and Gujranwala and Lahore hold the 2nd and 3rd position respectively. The CFI in terms of employment generation, again Faisalabad holds the top most position, while Lahore and Kasur districts hold the 2nd and 3rd highest positions respectively. The CFI analysis in terms of gross financial investments, Muzaffargarh district ranks first, while Kasur and Faisalabad districts hold the 2nd and 3rd positions respectively. Lastly, the CFI analysis on the basis of nature and type of industries (i.e. specialization of industries) indicates Lahore district on the top most position, While Gujranwala, Shiekhupura, Faisalabad, and Sialkot districts hold the 2nd ,3rd , 4th , and 5th positions respectively (Figure-4).

**Table-1 Centrality Functional Index of Industry in Punjab**

| Districts | Industrial Units | Employment | Investment(Million) | Centrality Index (Industry) |
|---|---|---|---|---|
| Lahore | ***5777 | **83664 | 19452.10 | *5602 |
| Gujranwala | **7289 | 44546 | 6506.07 | **4797 |
| Shiekhupura | 2812 | 67980 | 31627.39 | ***3767 |
| Faisalabad | *10166 | *129183 | ***38959.17 | 2604 |
| Sialkot | 3072 | 31424 | 5264.73 | 2014 |
| Kasur | 3746 | ***69064 | **50757.32 | 1284 |
| Rawalpindi | 2005 | 21211 | 12231.80 | 1120 |
| Multan | 3330 | 33931 | 5984.99 | 1016 |
| Sargodha | 1621 | 19146 | 5082.07 | 880 |
| Sahiwal | 568 | 8521 | 1412.88 | 761 |
| Gujrat | 1167 | 17466 | 4022.06 | 672 |
| Okara | 877 | 5234 | 2084.70 | 491 |
| D.G.Khan | 631 | 11865 | 9057.75 | 397 |
| R.Y.Khan | 1004 | 16769 | 17904.26 | 383 |
| Jhelum | 485 | 6249 | 3203.47 | 358 |
| Muzaffargarh | 1176 | 28686 | *83187.36 | 348 |
| Khanewal | 1127 | 9232 | 2395.38 | 336 |
| Vehari | 1132 | 13740 | 2145.05 | 271 |
| Bahawalpur | 1013 | 16315 | 5317.63 | 270 |
| Jhang | 2423 | 23067 | 7027.64 | 213 |

Source: CFI for Industries, calculated from the Provincial Census of Industries, 2002
**Note:** *the top most position **the 2nd highest position ***the 3rd highest position

**Figure-4 CFI of industries in Districts of Punjal**
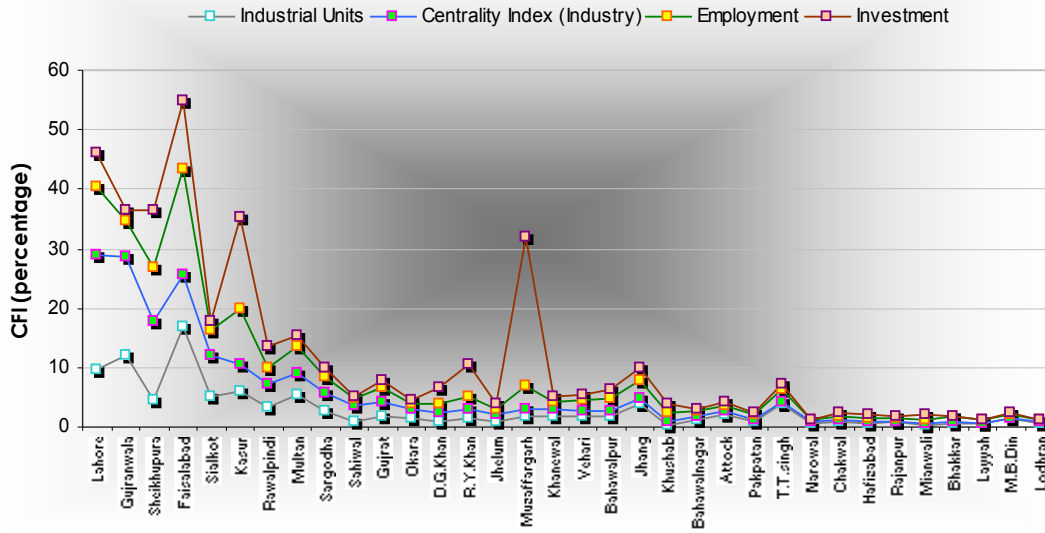


Source:  CFI for Industries, based on provincial industrial census, 2002
**The CFI for industries is also visualized through choropleth maps using GIS to have an idea about the spatial patterns of industrial activities in the province (Figures-5 to 8).**

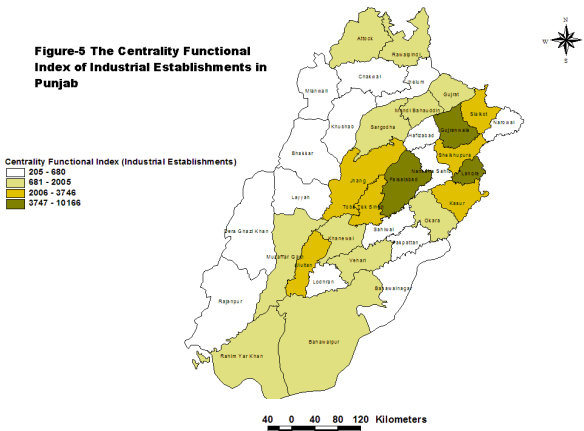**Figure-5 The CFI for Industrial Establishments**
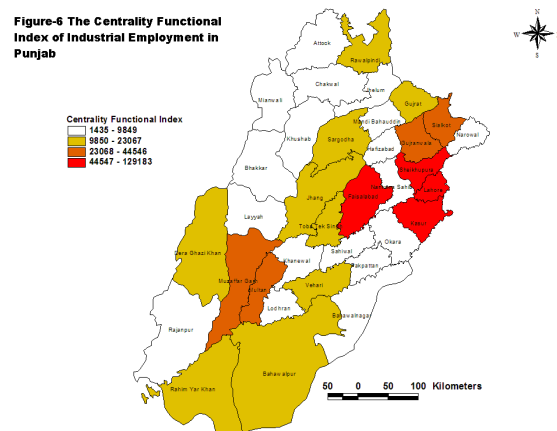


**Figure-6 The CFI for employment generated**
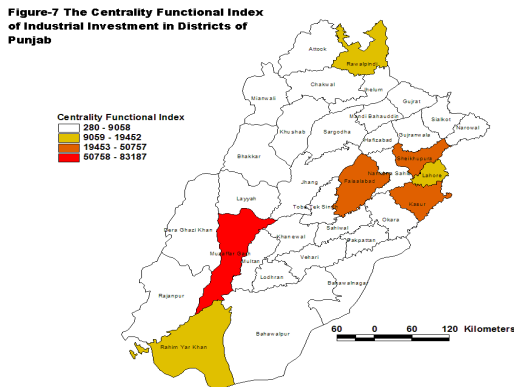
**Figure-7 The CFI for Financial Investment**



Figure-7 The Centrality Functional Index of Industrial Investment in Districts of Punjab

**Figure-8 The CFI for Industrial Specialization**



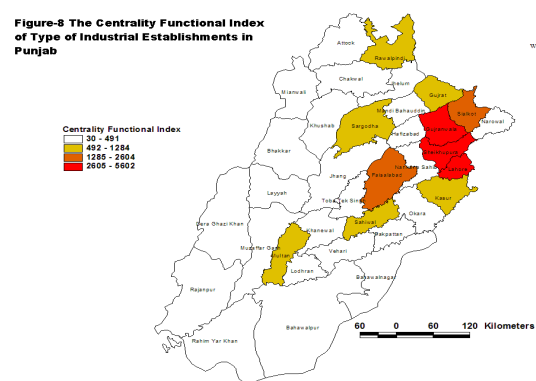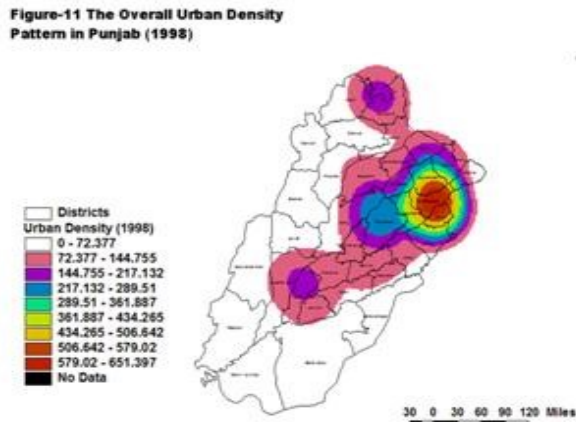Figure-8 The Centrality Functional Index of Type of Industrial Establishments in Punjab

Source: Authors own construct based on provincial industrial census data, 2002

**Figure-9 Urban density patterns in Punjab**



Figure-11 The Overall Urban Density Pattern in Punjab (1998)

not considerate about environment/disaster risks and the imparity issues.

**Figure-10 CFI of Disaster Risks in Punjab**



Figure-12 The Overall Disaster Risks Conditions in Districts of Punjab (2008)
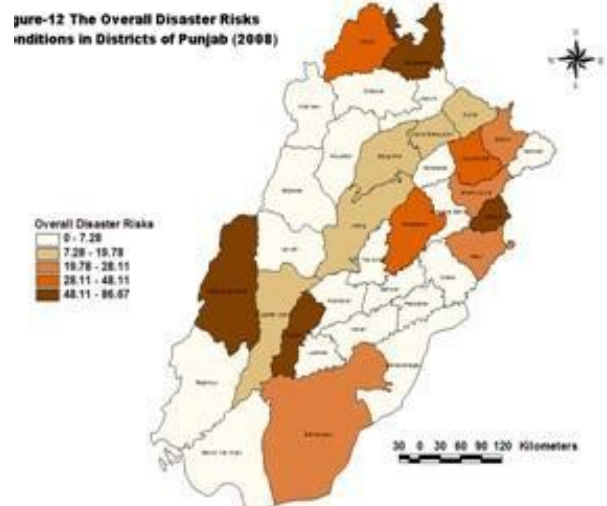
The GIS based CFI analysis indicates a high degree of correlation between urbanization and the industrial activities. The relationship is in line with the concentration of functions and facilities in the north eastern region of the province specifically the Lahore and Faisalabad regions. The CFI analysis based on industries also shows the concentration of industry within the same region—acting as the major factor for the concentration of urbanization and socioeconomic functions in the few selected districts of the province (Figure-9).

Looking at the industrial location decisions of Punjab Industrial Estates Development and Management Company (PIE) reveals that the company considers industry as a passive object depending upon the economic, physical and human resources and the market. Fore instance, out of seven ongoing/proposed projects, four are within Lahore urban region, one in Multan, one in Rahim Yar Khan, and only one in Sargodha region (PIE, 2011), which means the provincial government, is

The analysis shows a strong relationship between the financial investment and higher level of urbanization. Fore instance, Muzaffargarh and Rahim Yar Khan Districts which ranked high with respect to financial investment into industrial sector, also hold positive RMI values and ranked within top 20 cities out of 246 urban centers in Punjab (PCO, 2001). Which means that whenever public sector/external investment is made in the marginalized or depressed regions, the urbanization and corresponding socioeconomic development is ought to take place (appendix-1).

The CFI analysis also detects the phenomenon of agglomeration economies as Lahore, Shiekhupura, Kasur, Gujranwala, Sialkot, and Faisalabad are attracting industrial activities at the expense of other districts, and in the absence of urbanization and population and resource distribution strategy in the province, the ongoing

phenomenon of urbanization economies—the merging together of urban centers on the basis of mutually reinforcing economic and industrial activities—is ought to happen, which validates the Hoover's concept of 'urbanization economies' (Hoover, 1948).

The preceding figure indicates a concentrated urban density pattern towards north eastern part of the province including Lahore, Shiekhupura, Gujranwala, Kasur, Sialkot, Gujrat and Faisalabad districts (Figure-9). So, the CFI analysis in comparison with Urbanization patterns, Rank Mobility Index, and urban density analysis reinforces the importance of balanced urbanization, population distribution, and regional development strategy for the province and also provides justification for the inclusion of disaster risk reduction concept into industrial development process in the province.

**The Centrality Functional Index for Disaster Risks in Punjab:** The CFI for prevailing disaster risks in the province are based on the Disaster Risk Management Plan Punjab (DRMPP), 2008 and the provincial development statistics reports. The risks identified further determined the specialization of individual disaster risks using CFI methodology. Finally, by adding up centrality index values of individual disaster risks at districts the cumulative disaster risks were identified (Appendix-2). The disaster risks data base thus developed was analyzed through GIS technology to visualize the spatial pattern of disaster risks in Punjab and to identify the correlation between industrial concentration and disaster sensitive districts and regions. The GIS based chloropleth maps are developed for each and every disaster risk and for the cumulative disaster risks conditions at district level. The analysis indicates that Rawalpindi, Lahore, Dera Ghazi Khan, and Multan are the most sensitive districts in terms of prevailing disaster risks with a value range between 86.67 and 48.11. The second category of most sensitive disaster prone districts includes Faisalabad, Gujranwala and Attock with a value range between 48.11 and 28.11. The third category of disaster sensitive districts includes Shiekhupura, Kasur, Sialkot and Bahawalpur with a value range between 28.11 and 19.78. While, the 4th and 5th category of disaster sensitive districts include all those districts which are least industrialized, least urbanized, and generally least developed compared to rest of the districts (Figure-10).

# RESULTS AND DISCUSSION

The overall findings of the study on the basis of preceding theoretical review and the empirical results can be summarized as under:

❑ There is no proper Industrial location policy in the province and industrial development is taking place on firm specific econometric principles without considering the socioeconomic equity, environmental and disaster risk considerations for industrial development.

❑ In the absence of industrial location policy at the regional and provincial level, most of the industrial establishments are following the agglomeration trends mainly the localization and urbanization economies trends.

❑ High degree of correlation exists between highly urbanized regions like Lahore, Faisalabad, Gujranwala and the specialization of concentration of industries.

❑ The areas contiguous to Lahore urban region such as Kasur, Sheikupura, and Gujaranwala are attracting most of the industrial development due to close proximity to Lahore and relatively low land and labor costs. Therefore, there is a tendency of merging of urban settlements and the concentration of industries in the Lahore Urban region.

❑ There is an observed high degree of relationship within disaster prone districts and the highly urbanized and industrialized districts in the province, which may have serious repercussions in terms of man made and natural disasters.

❑ In terms of CFI based cumulative disaster risks assessment, Rawalpindi, Lahore, Multan and Dera Ghazi Khan are the most sensitive districts, while, Faisalabad, Gujranwala, Attock, Shiekhupura, Kasur, Sialkot and Bahawalpur are also highly sensitive districts. Coincidently, all these districts are the most urbanized districts and most of them are agglomerating into mega urban regions.

**Policy Recommendations**

❑ There is a need for multifaceted industrial location policy in the province which can address the socioeconomic and disaster risk management issues along with the econometric determinants for industrial development.

❑ The balanced industrial development is also one of the most important mechanisms to face the urban challenge and to address the structural changes in the demographic patterns. Therefore, it is a high time to use industrial development as a tool for population distribution, urban development, and balanced urban settlements system in the province

❑ It is further suggested to divert public sector investments towards marginalized areas, especially in the sectors of power and energy, roads and information and communication

technologies (ICTs). A shift of industrial development towards marginalized regions along with other public sector investments is expected to promote not only the industrial development but will also augment safer urban development practice and a balanced urban settlements system in the province. The following figure summarizes the major determinants of the proposed industrial development and location policy in the Punjab Province (Figure-11).

**Figure-11: The determinants of proposed industrial development and Location Policy in Punjab Province**
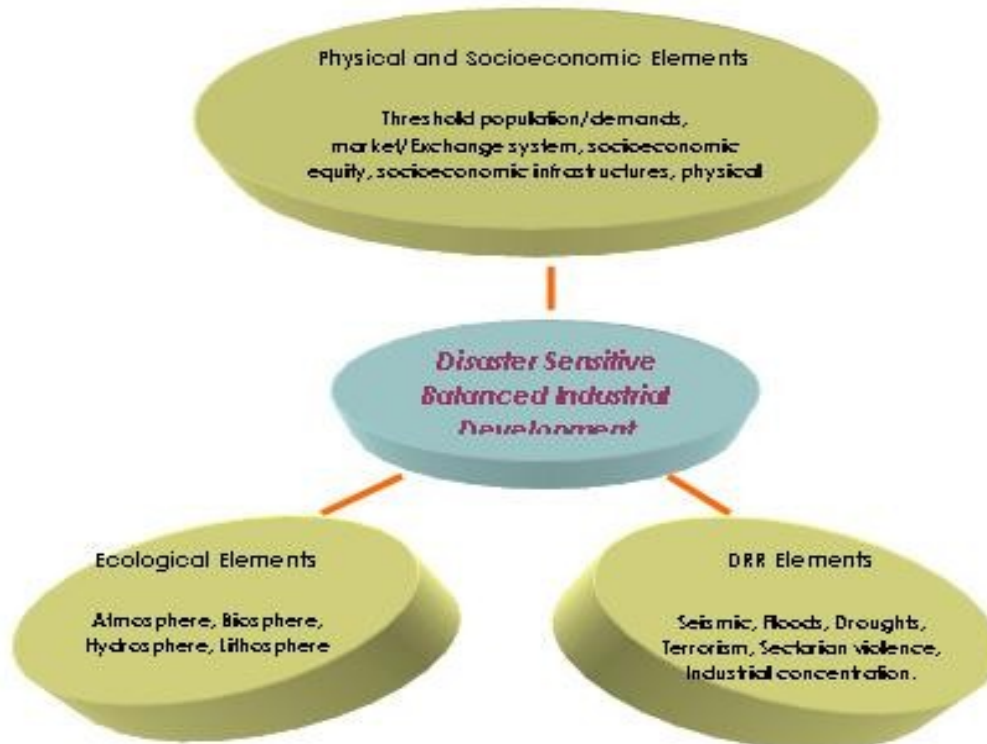


## REFERENCES

Chapman K. and D. F. Walker, Industrial Locations: Principles and Policies, Blackwell, London (1991) quoted in Piracha, A. L. An Environment-Based Approach for Guiding Decisions on Industrial Location: Analysis and Application in Punjab Province, Pakistan, Ph.D. Dissertation, SERD, Asian Institute of Technology, Bangkok (2001)

DRMPP, Provincial Disaster Management Authority. Disaster Risk Management Plan Punjab, Government of the Punjab, Lahore (2008)

Glasson, J. An Introduction to Regional Planning, UCL Press, London (1992)

Government of the Punjab, Directory of Industrial Establishments Punjab 2002, Volume-II, Directorate of Industries Punjab, Poonch House, Lahore (2002)

Gupta, A. K. and S. S. Nair, Policies and Strategic Provisions for DRR in India, A Lecture in Disaster Risk Reduction Workshop at NIDM, New Delhi (2009),

Hoover, E. M. The Location of Economic Activity, McGraw Hill, New York (1948) quoted in McCann, P. Urban and Regional Economics, Oxford University Press, Oxford (2001)

Janssen, B. Planning as a Dialogue, Spring Center, Faculty of Spatial Planning, University of Dortmund, Dortmund (1996)

Losch, A. Die Raumlische Ordung der Wirtschaft (1940), translated by Woglom, W. H. The Economics of Location, Yale (1954), quoted in Glasson, John. An Introduction to Regional Planning, UCL Press, London (1978)

McCann, P. Urban and Regional Economics, Oxford University Press, Oxford (2001)

McHarg, I. L. Designing with Nature, John Willey and Sons, New York (1992) quoted in Piracha, A. L. An Environment-Based Approach for Guiding Decisions on Industrial Location: Analysis and Application in Punjab Province, Pakistan, Ph.D.

Dissertation, SERD, Asian Institute of Technology, Bangkok (2001)

NDRMFP, National Disaster Management Authority, National Disaster Risk Management Framework Pakistan, Government of Pakistan, Islamabad (2007)

PCO, Provincial Census Report of Punjab 1998, Population Census Organization, Statistics Division, Government of Pakistan, Islamabad (2001)

PIE, Industrial Estates of PIE, Punjab Industrial Estates Development and Management Company, Govt. of the Punjab (2011),

Piracha, A. L. An Environment-Based Approach for Guiding Decisions on Industrial Location: Analysis and Application in Punjab Province, Pakistan, Ph.D. Dissertation, SERD, Asian Institute of Technology, Bangkok (2001)

Selman, P. Environmental Planning, Sage Publications, London (2000) quoted in Piracha, A. L. An Environment-Based Approach for Guiding Decisions on Industrial Location: Analysis and Application in Punjab Province, Pakistan, Ph.D. Dissertation, SERD, Asian Institute of Technology, Bangkok (2001)

Weber, A. Uber den Standort der Industrien (1909), translated by Friederich, C. J. Alfred Weber's Theory of the Location of Industries, Chicago, (1929), quoted in Glasson, John. An Introduction to Regional Planning, UCL Press, London (1978)

**Appendix-1: Table Showing Rank Mobility Index of Top 20 Cities in Punjab**

| Sr. # | City Name | Population (1981) | RMI Index (1998-1981) |
|---|---|---|---|
| 1 | Kamra Cantt. | 5858 | 0.366 |
| 2 | Multan Cantt. | 35754 | 0.326 |
| 3 | Muridke | 35419 | 0.326 |
| 4 | Lodhran | 21791 | 0.312 |
| 5 | Muzaffar Garh | 53192 | 0.217 |
| 6 | Jalalpur Jattan | 29590 | 0.168 |
| 7 | Depal pur | 25237 | 0.154 |
| 8 | Sadiqabad | 63935 | 0.148 |
| 9 | Rajanpur | 18789 | 0.144 |
| 10 | Gujranwala City | 600993 | 0.143 |
| 11 | Bahawalpur City | 152009 | 0.13 |
| 12 | Jauharabad | 18742 | 0.126 |
| 13 | Shiekhupura | 141168 | 0.111 |
| 14 | Mandi Bahauddin | 44796 | 0.108 |
| 15 | Kamoke | 71097 | 0.106 |
| 16 | Okara Cantt. | 26028 | 0.104 |
| 17 | Kot Addu | 37479 | 0.1 |
| 18 | Kabirwala | 22141 | 0.097 |
| 19 | Liaqatpur | 15271 | 0.097 |
| 20 | Rahim Yar Khan | 119036 | 0.091 |

Source: Authors Own Construct based on 1981 and 1998 Census

**Appendix-2: Table Showing CFI for Disaster Risks in Districts of Punjab**

| Districts | Internal Floods | River Floods | Fire Hazards | Terrorism/ violence | Earthquake | Drought | Pollution | Total Hazards |
|---|---|---|---|---|---|---|---|---|
| Rawalpindi | 20.00 | 0.00 | 8.33 | 12.50 | 33.33 | 0.00 | 12.50 | 86.67 |
| D.G.Khan | 0.00 | 3.57 | 8.33 | 12.50 | 33.33 | 3.70 | 0.00 | 61.44 |
| Multan | 20.00 | 3.57 | 8.33 | 12.50 | 0.00 | 3.70 | 12.50 | 60.61 |
| Lahore | 20.00 | 3.57 | 8.33 | 12.50 | 0.00 | 0.00 | 12.50 | 56.90 |
| Faisalabad | 20.00 | 3.57 | 8.33 | 0.00 | 0.00 | 3.70 | 12.50 | 48.11 |
| Gujranwala | 20.00 | 3.57 | 8.33 | 0.00 | 0.00 | 0.00 | 12.50 | 44.40 |
| Attock | 0.00 | 0.00 | 0.00 | 0.00 | 33.33 | 3.70 | 0.00 | 37.04 |
| Sheikhupura | 0.00 | 3.57 | 8.33 | 0.00 | 0.00 | 3.70 | 12.50 | 28.11 |
| Kasur | 0.00 | 3.57 | 8.33 | 0.00 | 0.00 | 3.70 | 12.50 | 28.11 |
| Bahawalpur | 0.00 | 3.57 | 8.33 | 12.50 | 0.00 | 3.70 | 0.00 | 28.11 |
| Sialkot | 0.00 | 3.57 | 8.33 | 0.00 | 0.00 | 0.00 | 12.50 | 24.40 |
| Jhang | 0.00 | 3.57 | 0.00 | 12.50 | 0.00 | 3.70 | 0.00 | 19.78 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| M.B.Din | 0.00 | 3.57 | 0.00 | 12.50 | 0.00 | 3.70 | 0.00 | 19.78 |
| Sargodha | 0.00 | 0.00 | 0.00 | 12.50 | 0.00 | 3.70 | 0.00 | 16.20 |
| Muzaffargarh | 0.00 | 3.57 | 8.33 | 0.00 | 0.00 | 3.70 | 0.00 | 15.61 |
| Gujrat | 0.00 | 3.57 | 8.33 | 0.00 | 0.00 | 0.00 | 0.00 | 11.90 |
| Sahiwal | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Okara | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| R.Y.Khan | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Khanewal | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Vehari | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Bahawalnagar | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Pakpatan | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| T.T.singh | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Narowal | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Rajanpur | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Bhakkar | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Layyah | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Lodhran | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 7.28 |
| Khushab | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 3.70 |
| Chakwal | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 3.70 |
| Hafizabad | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.70 | 0.00 | 3.70 |
| Jhelum | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.57 |
| Mianwali | 0.00 | 3.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.57 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | |

Source: Authors own construct using data from Punjab Disaster Risk Management Plan, 2008