INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 1, Issue 4, (2011) E-ISSN: 2222-6990

Investigation of the industrial clusters in Islamic Republic of Iran (Case Study of Yazd city using local production systems method & Industry Perception Model)

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DOI Link: http://dx.doi.org/10.6007/IJARBSS/v1-i1/100

Published Date: 22 October 2011

Abstract
All countries hope to achieve increasingly developments which grow fast. Nowadays many developed countries are using strategy of industrial clusters development because they influence the competitiveness of industrial clusters in the country as well as beyond national borders and show new ways of thinking about the place of dealing and earning. Industrial clusters influence competition through increasing of productivity based on settlement of companies and providing quick guidelines for development and innovation and encouraging of new business. Industrial cluster is one of new combined methods of various theories such as theory of economic geography, regional economics, national innovation system, transmitting knowledge theories, social capital theories and social networks .Recently this method in Iran attracted many attentions based on industries compatible with mentioned method which attempts to provide a better and competitive market place for the country, region and the world. In this study literature of industrial clusters is initially reviewed and then data analysis methods, used model and eventually results of this paper will be dealt with.
Keywords: industrial clusters, small & medium enterprises (SME), local production systems method (LQ), Industry Perception Model (IPM)

1. Introduction

All countries hope to achieve increasingly developments which grow fast. Nowadays many developed countries are using strategy of industrial clusters development because they influence the competitiveness of industrial clusters in the country as well as beyond national borders and show new ways of thinking about the place of dealing and earning. Industrial

clusters influence competition through increasing of productivity based on settlement of companies and providing quick guidelines for development and innovation and encouraging of new business. Industrial cluster is one of new combined methods of various theories such as

theory of economic geography, regional economics, national innovation system, transmitting knowledge theories, social capital theories and social networks .Recently this method in Iran attracted many attentions based on industries compatible with mentioned method which attempts to provide a better and competitive market place for the country, region and the world. As was mentioned above industrial clusters phenomena does not refer to a long period in the past and most developed models have some theoretical weakness and they are only theoretical patterns borrowed from other countries which are matched with internal situation of countries. Nowadays this approach attracted attention of many international organizations like the World Bank, International Monetary Fund, OECD, EU, ILO and other organizations. However, this approach has established its position as one of the economic development tools.

A new approach proposed nowadays in the discussions of regional and industrial development is that different regions depending on, natural, human and organizational advantages or available industrial should pay serious attention to the development of a limited number of industrial clusters and facilitate different dimensions for organization of clusters. In these situations they can be successful in international markets and hold more valuable sectors of related goods from their value chain and they can reform or reconstruct existing structures against world problems. Nature of the new cluster phenomenon is such that because of lack of explanation and the correct definition of these concepts there is no coherent classification. Some people consider it as a part of policy innovation that can be investigated in the form of national innovation system. Some people consider it as an economic phenomenon which is placed among the economic policy making factors because of its economical advantages . Some people put it in extended field of policy making and some people put it in industrial policy field. Different countries of the world understand various benefits and interests of industrial and use different strategies and policies in order to increase development of these industrial and also they use the results of their implementation in a better way. Considering the existence of industrial clusters of in Iran and by considering the successful implementation of industrial cluster strategies in other countries we clearly understand that there is a need for implementation of industrial clusters in order to achieve industrial development as soon as possible with more speed and less expenses

2. Literature Review

2.1Theoretical Basics

Industrial clusters or business clusters deal with small and medium enterprises; hence various studies have been directed specially by Italian authors in 1980's. Industrial upheavals of Italy were analyzed in terms of small and medium enterprises' perspectives. It is worthy to say that analyzing industrial clusters, as the present form, has been started by Michael Porter's Competitive Advantage of Nations (1990) and then completed gradually.

2.2 Cluster Definition:

Michael Porter, who is recognized as the founder of industrial cluster concept, defines the cluster: "Clusters are geographic concentration of interconnected businesses and associated institutions in a particular field".

United Nations Industrial Development Organization (UNIDO) defines industrial cluster as: "Geographic and economic concentration of manufacturing activities which produce and sell a domain of interrelated and complementary products, hence they have common problems and opportunities. The aforementioned concentration gives rise to economic advantages including the necessity of formation of specialized distribution system of raw materials and parts or

growth of experienced human resources in a specialized producing sections and promotion of specialized technical, managerial and financial services."

2.3 Cluster Objectives

According to statistical analysis of more than 500 clusters throughout the globe, different objectives have been mentioned for enterprises that intend to take part in an industrial clusters. They are spilt into six discrete classes as the following:

1. Networking all enterprises and conducting common studies;
2. Using politic instructions;
3. Forming inter-institutional commercial interactions;
4. Optimum using of proper education and training tools to meet enterprises' requirements;
5. Employing innovations and technologies of other enterprises;
6. Using interests due to more development of clusters.

In the case of realization of at least 4 objectives out of six ones in a certain cluster, a hopeful future would be predicted for that cluster. In the same direction, for developing industrial clusters various countries define one or more classes as their main objective to form cluster and other objectives will be considered as the secondary goals. Among other things, link and network formation are of the most important objectives of each collection. This objective is emerged automatically in some clusters while others entail appropriate policy makings.

2.4 Data Analysis Methods

Although numerous methods have been proposed to analyze and appraise size and importance of regional clusters, there is not any acceptable widespread technique to evaluate and measure them. Various countries and regions inclined to define clusters with different methods and a wide range criteria and research techniques.

Several models by economists have been designed to analyze behavioral and functional dimensions of (industrial-technological) clusters by which cauterization process, former and latter interrelations of enterprises within a certain cluster, upstream and downstream relations amongst clusters as well as overflow and clusters' overlapping would be studied. Bergman & Fester (1999) categorize clusters analysis methods based economic literature as the following:

A. Expert viewpoint
B. Location factor
C. Matching based on input-output table
D. Network-based analysis
E. General census

These methods have strength and weak points which would be used according to the usage case. They are all suffer from limited access to the local data, so they are trusted based on accessibility rate or data precision. Expert viewpoint method is used whenever there is not proper and enough information and also enough time and budget to collect them or the present information is unreliable. In this case, simple survey and/or repeatable survey of experts would be used.

The second method is able to represent import or export states of the cluster rather other clusters and/or local parts and other regions using national information and particularly local factors of employment and its interference in local statistics, and then analyzes inter-cluster interference state by using of obtained factors. Third method scrutinizes national and regional

input-output tables and their coefficients. Inter-cluster interference coefficient would be analyzed through upgrading and comparing with regional wages' level.

Network-based analysis is a method in which, because of lack of enough opportunity and cost, a main enterprise of a certain cluster is selected and then some decisions will be taken about state of the cluster through studying behavior of its enterprise. The fifth method is indeed the most expensive and most precise method to analyze clusters. It is able to bring about precise and reliable information for complete and precise analysis of clusters; hence it may be used as the basis of policy making.

3. Model

Although numerous methods have been proposed to analyze and appraise size and importance of regional clusters, there is not any acceptable widespread technique to evaluate and measure them. Various countries and regions inclined to define clusters with different methods and using a wide range criteria and research techniques.

Identification methods of industrial clusters are posed as qualitative, quantitative and combination ob them. Quantitative methods are spilt to two general parts. General local statistics and other partial information about current enterprises in a certain industry and other economic information as well as geographic properties such as employment are used in the first part methods. In the second part, information of input-out-put tables is used to identify industry clusters of various industries. Information due to opinion polls across enterprises is employed in qualitative methods to identify industry clusters. In this method, locality indicator is focused while industrialism element, industries classification and mutual relations amongst industries are underestimated.

3.1 Local Production Systems Method

There is a close relation amongst local production systems method and industrial zones' concept; it embarks to identify local production systems based upon current processes and specialties of a certain activity. In this method, local statistics and partial information of enterprises are used to identify industrial clusters. Presence of at least five enterprises with a same activity in the region is necessary. At least 100 workforces should be active in such economic activity. Enterprises concentration in each kilometer must at last two times more than national concentration average.. The main quantitative tool to estimate specialty rate of each cluster is LQ[1] which is calculated as the following:

Location Qutent [1]-

$$LQ = \frac{Eij / \sum_i Eij}{\sum_j Eij / \sum_i \sum_i Eij}$$

where:
Eij: employment rate in the industry (i) and in region (j)
$\sum_i Eij$: Whole employment in the region j.
$\sum_j Eij$: national employment in industry i, and
$\sum\sum Eij$: a symbol of national employment.

LQ compares an industry share in the certain region with its share in the nation. LQ >**1** values represent a relative specialty of the region in the certain industry. In most studies about identification of industrial clusters, when LQ >1.25 means there is an undeveloped cluster in the region.

4. Results and Discussion

As it was mentioned previously when LQ is more than 1.25 means there is an undeveloped cluster in the region and related industries are inclined to export and they are ranked in terms of their possible importance in export and wealth creation. This method is relied on some limiting assumptions about similarity of national and regional production paradigm such as homogeneity of technical structure of a province with nationwide technical structure, relative similarity and equality between proficiency and provincial and national workforce. In this paper LQ was measured using current statistic resources and their proper categorization. Considering their LQ values, > 1.25, the following eight industries have industrial cluster property in Yazd Sub-province:

As it is seen in the table1, textiles industry with LQ = 4.09 in Yazd has the highest value amongst industry-cluster based industries and it covers 39% of all companies and factories in industry cluster class of Yazd. In the second rank rubber and plastic products with LQ =2.4 is placed. The third rank is occupied by generators, transformers and unclassified electrical machines in somewhere else with LQ =1.8. Paper and paper made products, non-metallic mineral products, official, accounting and calculator machines, furniture and uncategorized artifacts in somewhere else, and substantial metals with LQ = 1.54, 1.48, 1.48, 1.32 and 1.31 are placed in 4^{th} to 8^{th} ranks respectively.

In spite of most conformity with industrial clusters definition, this method encounters with some limitations and shortcomings. First, it shows only concentration point of special industries in special regions and ignores their relations with each other or other industries, on the other word former and later relations are being underestimated here. If there is not any previous and clear information about current links among industries, denoting industry cluster to mentioned concentrated points will be failed undoubtedly. Another problem is that if standard classification systems are used, then it is possible that those activities which are not suited in on of classes of the mentioned system would be deleted.

Regarding shortages of the mentioned industrial cluster identification method, so using other potential methods for identifying industrial clusters is suggested.

3.2 Industry Perception Model

General perception:

Many scholars are of the conviction that industrial cluster means centralizing likely and competing businesses in one region which could create wealth through export and whose geographical centralization results in the development of the expertise, organizations, trust, and pride. Therefore, the following issues need to be taken into consideration:
Exportable: Cluster sells the goods or services to places located outside the region
Specialized: centralization of jobs in the cluster is higher than the average centralization at the national level.
The reasons behind using Industry Perception Model

1. Reduction of the volume of operation
2. Reduction of the volume of required information
3. Reduction of non-expert supervision
4. Conforming the model of determining the clusters to the economic conditions in the region under study and focusing on the industries that are in more conformity to the concepts and structure of industrial clusters.

Size and growth of the cluster

Cluster must have a meaningful size. If the cluster is new, it needs to have a higher growth rate in comparison to the level of the country. In regard to the aforementioned issues, a model is to be presented which is called Industry Perception Model. In this model the industries whose goods or services has the potential of being exported to locations outside the region and in which centralization of jobs is more than the average centralization at the national level will be identified. In this model, employment concentration index, which is used as an index with industry exportability as the axis, is calculated as follows:

$$LQ= \frac{Xir/Xr}{Xin/Xn}$$

Xir is the amount of employment in *i* industry in region *j*, *Xr* is the total employment in region *j*, *Xin* in the national employment in *I* industry, and *Xn* is the total national employment. The industries in which the *LQ* is higher than 1, are called the industries with potential of export and can be ranked according to their possible significance in export and creation of wealth and based on the value of their LQ. This model is based on a number of restrictive hypotheses in regard to the similarity between national and regional production models and similarity between national and regional consumption models. In more exact sense, it has been assumed that in each industry, the productivity of the regional work force is equivalent to the productivity of the national work force. If productivity of regional work force is higher, less number of workforces would be needed in order to produce a particular product in that region. In that case, LQ will estimate the potential for industrial exportation in each industrial branch lower than the real value. If the productivity of regional workforce is lower than the national level, then LQ will estimate the potential of industrial exportation higher than the real value.
The next step in the process of industry perception model is categorizing single clusters into basic clusters. There are not any hard and fast rules to be used here. However, the categorization of the clusters has been recommended to be based on the general understanding of the industry and the other information related to the region. The final step is evaluating and refining basic industrial clusters. Interviews with the executive departments of agencies rely on proofs about the power of being linked with the clusters and this information has been provided in a small booklet, though they need to be changed a bit in order to be used for the evaluation of basic clusters.

Steps for identifying industrial clusters in Industry Perception Model

In Industry Perception Model, the following steps are taken in order to identify industrial clusters:

1. The structural elements of each cluster are identified.
2. The proper factors for analysis of structural elements of industrial clusters are identified.
3. The proper statistical framework and reliable sources are determined
4. The employment concentration index is calculated.
5. Analysis of the calculated factors in the concentration index in order to omit the activities which do not possess the primary conditions of the cluster
6. Preparing and providing a questionnaire to gain information from the available units of the activities which meet the primary conditions of the cluster
7. Distribution and filling the questionnaires.
8. Analysis of the collected data
9. Determining the strengths and weaknesses of the structure of the industries that meet the primary conditions of industrial clusters

Introducing the structural components of industrial clusters

Theoretical foundations of industrial clusters and the factors pertaining to structural performance of clusters emphasize the factors that affect the formation and performance of clusters. In other words, the availability of one or a number of factors is not enough for making judgments about the quality of quantity of activities that have the potential for being clusters. Thus all factors need to be evaluated. The inter-relations between agencies and relationship between the cluster and its environment must be taken into consideration separately when the structure of industrial clusters is being determined.

A. **relations between member agencies of the cluster**

1. seller-purchaser relations
2. Competitive and cooperative relations
3. source-sharing relations
4. A raft of factors which contribute to competition power

B. clusters and relations

The structural components and the factors behind formation and performance of industrial cluster are as follows:

1. expert and professional workforce and pleasant work environment for the personnel
2. proper technology that has the ability of competition
3. cooperative spirit among small and medium size agencies which have the primary potentials for being put into clusters
4. the existence of a inter-agency networks, relation between agencies and customers, suppliers of raw materials and machineries for rapid and proper flow of the information that is required in the cluster
5. possibility of having enough access to technology and innovation between agencies
6. possibility of supplying the raw material as well as repair and maintaining the equipment, using the experience of other agencies
7. existence of research and consulting entities

8. the existence of a coordinating entity for regulating the relations between agencies
9. access to the market, marketing, commerce, distribution and selling
10. possibility of funding and providing investment aid
11. proper policies of the local government and the supportive entities
12. existence of proper physical structures (energy, roads, etc networks)
13. The independence of agencies from large industries and having a type of relation that the performance of small agencies is not influenced by the policies and plans of bigger agencies.

In other words, it can be said that the main axis for collecting data through questionnaires is as follows:

1. human force
2. network of supplying the raw materials
3. technology
4. network for accessing the market
5. financial supply and investment aid
6. coordinating entity

4. Results and Discussion

In the industry perception model, the industries whose goods or services have the possibility of being exported to locations outside the region AND their employment concentration is higher than the average national level are identified. In this model, employment concentration index, which is used as an index indicating the export-oriented industries, is used. The next step in the Industry Perception Model is categorizing single industries into basic clusters. The final step consists of evaluating and refining clusters. Interviews with the executive departments of agencies rely on proofs about the power of being linked with the clusters and this information has been provided in a small booklet, though they need to be changed a bit in order to be used for the evaluation of basic clusters. Based on the aforesaid issues, first, the employment concentration index is used and the industries whose concentration index was higher than 1.25 were identified. Next, a sampling was conducted on the related industries and then the designed questionnaires were distributed between the industries were filled in, and the data was extracted as follows:

4.1 Human force

One of the advantages of industrial clusters is external economic arising from using expert work force that has been provided through an increase in the local work division as well as expert suppliers. The reaction of sample units in Yazd city in regard to human force of clusters indicates that there is motivation for cooperation and using the professional abilities of human force of other units among different industries.

4.2 Network of supplying raw materials

One of the features of developed industrial clusters is fast and easy access to suppliers of raw materials as well as the sale market and this is due to concentration of related industries in one location, which results in reduction of production costs. In other words, there are strong pre/pro relations between the available units of the cluster as these units can satisfy their needs for raw materials, mediatory goods, or the like from other units of the industrial cluster and from the same region. According to the data collected from sample units in Yazd city, although a small percentage of the sample units displayed willingness for cooperation with

other units in regard to supply of raw materials, a large percentage of producers from which the units directly supplied their required raw materials were placed outside Yazd city and this can be regarded as one of the weaknesses of industrial clusters in Yazd city.

4.3 Technology

The data collected from the sample units studies in Yazd city indicate that although a large percentage of units display willingness for providing services that are related to machineries to other similar units, a high percentage of the aforementioned units have not used their machineries in order to complete the productions of other units. On the other hand, a significant percentage of the aforesaid units had announces that they had used their machineries for completing the productions of other units only inconsistently and in certain periods. As a result, it can be said that technology transfer, using common technology, using innovations and technology of other agencies is not strong among the sample unit's studies in Yazd city.

4.4 Network of accessing the market

Reviewing the answers provided by the sample units about network of accessing the market illustrate that the majority of goods manufactured by the units were supplied to units outside the city. This has a number of different reasons among them lack of supplementary industries, lack of sufficient market for the manufactured goods in the city-in other words surplus in products. In regard to cooperation for introducing new markets and the duration of cooperation for introducing the aforesaid markets, the answers are indicative of the weakness of industrial clusters in Yazd city. However, the strength of industrial clusters in Yazd is in terms of their relation with the network of accessing the market, in that there is very good cooperation among the units as far as introducing new markets is concerned.

4.5 Financial Issues

Investigating the opinions of sample units indicates that in spite of the fact that sample units evaluated the results of cooperation for resolving financial problems positive and although they formed a fund that being its member or investing in it will help resolve financial needs of the cooperating units, a large percentage of the units have not taken any measures in regard to solving financial problems endured by similar units yet.

4.6 Coordination

Reviewing the opinion and answers provided by sample units in Yazd city on the questions on coordination, that is membership in a guild society, willingness to form non-governmental organizations so enhance the shares in the market of Iran and other counties and resolving the problem encountered by them, it can be said that that membership and willingness of units for forming non-governmental organizations is high and this can be considered one of the strengths of clusters in Yazd city.

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Appendix

ISIC Group	Industries with cluster property in Yazd Sub-province	No. of factories and companies	Measured LQ
17	Textiles	458	4.09
25	Rubber and plastic products	271	2.4
31	Generators and transformers and unclassified electrical machines in somewhere else	43	1.8
21	Paper and paper made products	48	1.54
26	Non-metallic mineral products	273	1.48
30	Official, accounting and calculator machines	30	1.48

36	Furniture and uncategorized artifacts in somewhere else	16	1.32
27	Substantial metals	34	1.31
	Grand total	1173	

Table 1. Industries have industrial cluster property in Yazd Sub-province