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Intellectual Capital Assessment Models in Clusters: A Literature Review

Driss Tsouli [α] & Bouchra Elabbadi [σ]

Abstract- The purpose of this paper is to review the literature on intellectual capital in clusters in order to identify and compare the main models to measure at the cluster level.A systemic literature review was carried out using the most important bibliographic database Scopus and the most important journal on intellectual capital: journal of intellectual capital. The search covered the period from 2004 to 2016.

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I. Introduction

In the new economics of competition, the economic map of the world is dominated by what it called clusters.Clusters are geographic concentrations of interconnected companies and institutions in a particular field [14]. Clusters impact competitiveness inside countries as well as outside of national borders. Clusters are an international fact that arises inJapan, the USA, Germany, Netherlands, Finland,Sweden,and other countries. That's mean there is a possible relation between development and clusters.Therefore,clusters lead to a new way of thinking about location,challenging much of the conventional wisdom about how companies should be configured,how institutions such as universities can contribute to competitive success, and how governments can promote economic development and prosperity [14].

On the other hand, intellectual capital has become the most important resource for value creation and competitive advantage. Intellectual capital research has mostly concentrated on companies [2], and beside modest research at regions or nations level.

The first studies related to IC assessment on clusters have done by J.L. Hervas and J.I. Dalmau in order to construct an Intellectual Capital Cluster Index (ICCI). Later, some practitioners and scholarswere interested in IC in clusters. A literature review was conducted to identify the works related to IC at the clusterslevel and obtain an overview of intangibles. The specific objectives of this paper are: to identify the main advances in IC in clusters studies; to identify the main models developed to measure IC at the clusters level; and to characterize and compare the models. The research questions are: What advances have been made in the last decade in knowledge about IC at the clusters level? How is IC measured at the clusters level? What kind of indicators, variables, and components are being used? What are the main differences among models? What can be learned for future policies? The paper is structured as follows. The second section summarizes the conceptual framework and the underlying theories for IC analysis. Section 3 presents the methodology applied. Section 4 presents the models analyzed and initial findings and compares the main characteristics of the models. Section 5 offers some conclusions.

II. Clusters and Intelectual Capital Foundations

The point of departure of clusters intangibles has been the Marshall's project, under different names as social complexity [10], non-traded interdependencies[17] [16], or community of people. Consequently, nothing is new except the IC definition and the formal model to assess and value all these intangibles.

All these intangibles have been integrated in three basic elements identified in clusters [3].first, the specialization in one or in a few stage of production process which leads to a higher productivity.Second, the milieu [7], which can be devised on two aspects: culture (knowledge, competences,attitudes, high regard for risk and profit) andinfrastructure (land availability, communications, social services, services to the firms, "local banking") .third, the network which is formed by linkage (forward and backward) which provides a competitive advantage (customer relationship,corporate image, connections).

From another perspective, Porter s work [12] [14] on clusters led to know the forces like : special infrastructures available in the territory (skilled labour pool, universities, R&D centers, etc.); related and supporting industries, complementing core industry processes; demanding conditions, because a strong, trend-setting local market in quantity and quality helps local firms to anticipate global trends; and firm strategy, structure and rivalry, which forces local firms to move beyond basic country advantages to search for competitive advantages. All the expressed forces provided extraordinary conditions which support firm competitiveness and value creation in the territory and they constituted an intellectual capital source.

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Consequently, the linkage between firms, firms and institutions such a public R&D centers, universities, drive to arise the intellectual capital inside clusters.

For this reason, some scholars tried to build the models for assessing IC in clusters for every cluster elements which act as an IC sources for the value creation.

- *Linked Industries*

Porter s work[12] [13] [14] considered the connected industries more specifically the auxiliary industry provide a more efficient basis to supply inputs into the value creation system. Therefore, the auxiliary industry is a knowledge mechanism which contributes to the cluster IC stock providing to the rest of the value chain innovations, interactions and also information flows to the rest of the system's components.

- *Institutions and Infrastructure*

Porter [12] pointed that the importance of institutions is not only their existence, but the connectivity and the interaction with other cluster parts to contribute to upgrade the cluster's knowledge stock. For example University programs usually include specific and special courses linked to the located industries, constituting a source of skilled and trained labour, as well as vocational centres. Public R&D institutes, jointly with universities' cooperation, carry out cluster-specific research to expand the knowledge and technology useful and required in the area, frequently taking the form of formal contracts between located firms and the institutes themselves with the aim to enlarge firm's technological capabilities.

- *Human Resources*

The most important implication in a cluster is refers to the presence of a community of people. Porter [12] also mentioned in his model the importance of specialized human resources on cluster industries. People must be educated in specific cluster university courses and they could be trained in clusters requirement by specifyingcenter programs offered by regional authorities.Another important point is the social capital aspects (trust, common language, objectives and assumptions, local vocabulary and mutual understandings, among others) which are associated with high-quality information flows and tacit knowledge held by workers and managers available in the area [18].

Firm Strategy

For Porter, 1990, Clusters firms should not only take advantage from the territorial resources but create successful configurations of its own value chains. Firmstrategy builds competitiveness and thus creates value. That means, not only territorial resources are crucial but also the firms' actions. Without upgrading firms' strategies territorial resources cannot be interrelated in self-firms value chains. Similarly, [8] also recognize the fact that "the orientation and sophistication of the strategies undertaken by firms in the clusters ultimately determine the cluster's wealth creation capacity".

- *Linkages*

Knowledge creation and transmission mechanisms imply to strengthen linkages between the different agents located in the cluster such as clients, suppliers and other related industries through informal and formal collaborations and relationships [3] [6] . SimilarlyPorter's concept of fit explains the way in which activities are connected each other in the value chain rather than working isolated [11].

- *Economic Performance*

Economic performance represents the profitability and success achieved by the cluster as a whole, mixing financial such as returns or productivity and non-financial performance indicators specially connected to customer and market matters.

III. Research Method

The study presents a comprehensive review of the articles addressing the IC–clusters assessment models published from 2004 to 2015, the population to be studied included articles that were:

- Empirical, because practice is the origin of IC research[9].
- Published in peer-reviewed journals, which guarantees a high level of quality.
- Published from 2004 to 2015, as the seminal paper in this field of research was published in 2004 by AinoPöyhönenAnssiSmedlund.
- Written in English, since English is the official language of knowledge

The selection of papers was conducted using the primary academic databases of Scopus an initial search of the Scopus, (title, abstract and keywords field) was conducted using the keywords "intellectual capital" and "clusters". The results obtained (63 in Scopus) were then refined by analysing their titles. This step yielded a total of 6 articles. And the final decision was about the inclusion of these 6 articles.

IV. ICC: Main Models

The literature presents several models to measure IC at the cluster level using different methods to identify intangibles. In general, two approaches were identified (Table I).the first originated in the study of intangibles

Ofclusters and is promoted mainly by academics. The second, developed by international organizations and business schools, aims to study

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competitiveness, innovative capacity, and development not only at cluster level but at the whole regional level.

Table I Shows the models selected from the literature review for this study.

Table I: Models of measuring intangibles at the cluster level

Models	Authors	Organization
Models developed by researchers (academic models)		
theoretical model of the dynamics of intellectual capital creation in regional clusters and inter-organizational networks	AinoPoyhonen and AnssiSmedlund	University of Technology, Finland
The Intellectual Capital Cluster Index (ICCI)	J.L. Hervas and J.I. Dalmau	Polytechnic University of Valencia, Spain
Models developed by international organizations		
Knowledge Assessment Methodology (KAM)	World Bank (WB) [20]	
Global Innovation Index (GII)	INSEAD[4]	
Global Competitiveness Index (GCI)	World Economic Forum (WEF) [19]	
World Competitiveness Index (WCI)	International Institute for Management Development (IMD) [5]	

The first group includes the models derived from the taxonomy presented by Hervas-Oliver (2004), such as, networks, Institutions, infrastructure, Human resources, Firm strategy and Economic performance. Which seek to identify ICC, using indicators of intangibles that support regional growth. These models include Organizationalcapital,Human Capital, Social Capital, and the local and international relationships.

International organization models simply combine the vision of intangibles with the traditional economic growth approach. The results of these models are far from ICC principles.

Tables II and III show the main characteristics of each evaluation system. While academic models determine IC as an independent factor using indicators of intangibles, the international organization models use indicators of intangible and tangible assets to determine competiveness, innovation capacity, or development of countries without identifying total IC.

Table II: Academic models: main characteristics

Models	the dynamics of intellectual capital creation in regional clusters and inter-organizational networks	The Intellectual Capital Cluster Index (ICCI)
Authors	AinoPoyhonen and AnssiSmedlund	J.L. Hervas and J.I. Dalmau
Assessment objective	Knowledge creation	value creation
Main aggregated indicators	Knowledge and competence Relationships Information flow Management and leadership method	networks, Institutions and infrastructure, Human resources, Firm strategy Economic performance
IC components	Relational capital, human capital,organizational capital	Relational capital, human capital, social capital organizational capital
Assets	Intangible	Tangible and intangible
Methodology	Regional networks are presented as the networks of production, development and innovation in the region	An ICC index is determined. The indicators are added according to the relative importance of each one

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Table III: International organization models: main characteristics

Organization	World Bank (WB)	INSEAD	World Economic Forum (WEF)	International Institute for Management Development (IMD)
Assessment objective	Knowledge	Innovation	Competitiveness	Competitiveness
Main aggregated indicators	Knowledge Economy Index (KEI) and Knowledge Index (KI)	Innovation Input: Institutions, HC and research, Infrastructure, market sophistication and business sophistication. innovation output: scientific outputs and creative outputs	Institutions, Infrastructure, Macroeconomic environment, health and basic education, higher education and training, goods market efficiency, labor market efficiency, financial market development, technological readiness, market size, business sophistication and Innovation	Economic performance, government and business efficiency
IC components	Not explicit, but are deduced: HC, RC, SC, Renewal Capital, Market Capital, and Process Capital	Explicitly only HC. Also are deduced: RC, SC, Renewal Capital, Market Capital, and Process Capital	Not explicit, but are deduced: HC, RC, SC, Renewal Capital, Market Capital and Process Capital	Not explicit, but are deduced: HC, RC, SC, Renewal Capital, Market Capital, and Process Capital
Assets	Intangibles and Tangibles together	Intangibles and Tangibles together	Intangibles and tangibles together	Intangibles and Tangibles together
Methodology	KEI and KI are calculated by averaging indicators. Each indicator is standardized (scale 1-10)	GII and two sub-indices are determined: Innovation Input and Innovation Output. The first sub-index included: institutions, human capital and research, infrastructure, market sophistication, and business sophistication. The innovation output index included: scientific outputs and creative outputs. Sub-pillar scores are calculated as the weighted average of individual indicators; pillar scores are calculated as the simple average of the sub-pillar scores	The data are obtained from international databases and survey A total of twelve components (pillars) are determined using 112 indicators. The pillars are clustered in Basic Requirements (institutions, infrastructure, macroeconomic stability, and health and primary education), Efficiency enhancers (higher education and training, goods market efficiency, labor market efficiency, financial market sophistication, technological readiness, and market size), and Innovation and sophistication factors (business sophistication and innovation	331 indicators are used to determine 20 variables, which are grouped into 4 competitiveness factors. Each factor reports an index

V. Conclusions

Intellectual capital traditionally focused on micro-level and less on macro-level needs to be extended to the clusters. Sustainable and effective cluster economic growth occurs when all located agents (industries, institutions, and other actors) work formal or informally in the same direction and with shared

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goals.Although several models are available to measure intangibles at the cluster level, international organization models are the most widely used because policy makers are not yet familiar with the concept of IC and they are not aware of the importance of intangibles in competitiveness.

The main differences between the two approaches are the objectives and the conceptual framework .The academic models seek to determine ICC directly, , while the international organization models focus directly on capacity for growth or development without identifying IC or IC components or cluster characteristics.

The indicators used for the academic models are principally non-financial, In contrast, the international organization models have a high proportion of financial indicators. This combination of financial and non-financial indicators in all the models has also been pointed out by different scholars, who argued that an adequate evaluation system of intangibles includes both types of indicators.

This study has some limitations due to the wide dispersion of information related to IC and clusters. Therefore, there is probably more information on IC at the cluster level, although the literature reviewed is the most often cited and recognized by leading authors.

Another limitation is the number of articles studied only 6, there are extensive opportunities for future research given the novelty of IC studies at the cluster level.

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