THE CONCEPT MAP AS A TOOL FOR DESINGING A COMPETITIVENESS AND INNOVATION SYSTEM FOR CAUCA - COLOMBIA

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Abstract. The projects called "Strategy of Innovation for the Competitiveness of strategic sectors for the Cauca Department in Colombia" and "Knowledge Management System for the Pacific Zone in Colombia", financed by Colciencias and SENA, explore the applicability of the concept maps in this territory as a mechanism to facilitate the knowledge capture regarding strategic topics for this region with the purpose of determining its supply and demand. During the development of these projects a method has been designed for allowing mapping or organizing the knowledge on small-scale agroalimentary chains, analyzing them as social networks made up by heterogeneous actors. This allows emphasizing the roles played by the different actors of a competitiveness system supported by Science, Technology and Innovation (SRCyT&Inn), in a predominantly rural, pluriethnic, biodiverse and multicultural region.

1   Introduction

The emergence of the global economy has had profound implications for the sustainability of small-scale rural producers in Colombia. The redefinition of Colombia's competitive position in order to face the globalization processes has focused on different sectors of the economy and left aside the great majority of small-scale rural producers, generating a combination of factors that affect the competitiveness of these producers, among which are the following: i) the reduction of Government support in technical assistance and research, ii) the direct competition with foreign products, many of which are subsidized, iii) the municipalization and regionalization of the responsibility necessary to support the rural sector. The latter implies having to face great responsibilities whilst having very small budgets. The combination of these factors has resulted in a deep crisis of the agrarian economy and has affected in particular those areas with a rural majority such as the Cauca Department.

This paper presents the results obtained during these research processes, focused on the design of an Innovation Regional System that promotes the Competitiveness.

2   Objective and Scope of the research

2.1   Main Objective

To create in a participative way the component innovation within the Competitiveness Strategy of Cauca department.

2.2   Specific Objectives

- To provide technical support to the Competitiveness Regional Commission for the designing and implementation of management processes of the innovation in the productive sectors.
- To contribute to the innovation capacity of the actors who participate in the Regional Competitiveness System, specially the Mipymes and new local authorities.
- To generate a project portfolio in order to promote regional Innovation.

2.3   Analysis Unit: Small Scale Productive chains as Social Networks of the SRCyT&Inn

A Regional Innovation System can be defined as a "set of networks of public, private and educational agents who interact in a specific territory taking advantage of a particular infrastructure, for the purposes of adapting, generating and/or spreading technological innovations" (Carlson, B. & Stankiewicz: 1991).

The Regional System of Science, Technology and Innovation (SRCyT&Inn) is, for the Department of Cauca, the mechanism of joined construction in which to articulate, dynamize and integrate the active forces of the department, allowing the system actors to understand the complexity of this society for generating the capacity of giving them their own solutions and promoting the creation of their own model of development.

The social networks that integrate the SRCyT&Inn join different actors together with the purpose of developing potential innovation, both in the communities of small scale producers to facilitate their insertion in the knowledge and information society, and the entrepreneurs' networks of companies with technological base. Both types of organizations have different conditions, but the same model can describe them for the sake of this research project.

3   Methodology

3.1   Description

The methodology designed considers one phase for research followed by one of social interaction, as it is inherent to the research action projects. This implies that the direction that should be taken after the interaction is determined by the actors rather than by the research project team.

The research team has to face three responsibilities: i) the population of the Department of Cauca should be encouraged to develop a sense of belonging and the need to use the Knowledge map, ii) the development of a method for the construction of Knowledge maps, and iii) the construction of a technological platform that can help to get an automated map.

3.2   Research Techniques

This encourages the users of different kinds of methodologies with common contact places through the execution of the research. Some of the techniques to be used are: workshops, interviews, surveys and narrative records among others.

The project works with the help of a mixed model, recapturing a hermeneutic and historical approach sustained in the understanding and interpretation through the consent rather than outrage, which required getting deeply involved with the analyzed communities. Data has been collected through interviews, narrative records and workshops.

4   Results

4.1   Competitiveness and Innovation System of Cauca

The members of the SRCyT&Inn research team have to accept that the government and the institutional agents cannot fulfill the demands of the social actors in the productive chains, and as a consequence so the social actors have produced non-formal second level organizations. The formal and non-formal organizations do not recognize each other, leading to a work disarticulation. Therefore, it is essential for the two types of organizations to dialogue and try to work together. Most of the actors participating in the SRCyT&Inn project (Policy makers, Centers for Technological Development and researchers, Interface Institutions) privilege the codified knowledge and find it particularly hard to understand, and hence value, the ancestral knowledge that the rural producers, entrepreneurs and others possess; so we think it is important to develop the institutional ability to acquire that non-codified knowledge.

In order to facilitate the conception of a SRCyT&Inn model, it is very useful to classify the actors in arbitrary categories. For this model, such categories are:

Policy Makers (State - Donors): Organizations with national, regional and local scope who are in charge of designing and implementing policy mechanisms and financing the support of enterprise development initiatives. "The government, through its organizations in the national, regional and local environment, is responsible of designing and implementing policy mechanisms to support the initiatives of rural managerial development" (Lundy and Gottret: 2004).

Interface Institutions (Agencies of Development): The governmental and non governmental organisms that are in charge of facilitating processes of enterprise development and to provide support services for diverse actors, so that these can adhere effectively to the chains, networks, etc, with opportunities to generate income and employment for the population.

Centers of Technological Development and Researchers (Research Institutions): These are institutions with the ability to lead and to facilitate research processes and contribute with co-innovation that generate and apply both on the processes innovations (or management), and in the technological innovations (or basic). Centers of R+D. "The research institutions with capacity to lead and facilitate research processes and co-innovation that generate and apply process innovations (or management) as much as technological innovations (or basic)".

Producers, Companies, Chains, Clusters: Actors of the community, organizations who develop production processes that include transformation of resources into goods (i.e. goods of transferable property) or services (activities, nontransferable). Actors of the community, organizations of the productive chain (Producers, Transformers and Traders).

The challenge for SRCyT&Inn is to introduce the use of the knowledge map mechanism in the dynamics of the social networks as a support for the management processes of knowledge. The creation of "Cauca Región de Conocimiento" (Cauca a Region of knowledge) is an initiative led by the SRCyT&Inn that will become the scenario to be used for the generated advances.

Considering that the actors involved in the SRCyT&Inn have valuable tacit and explicit knowledge, they have to face complex approaches because of the following factors:

- The difficulty to relate them to the knowledge of other actors, given their diversity.
- The impossibility to codify them in a complete and valid form.
- The coverage of a characterization of actors for a purpose of meso-competitive impact is too demanding and requires long term resources.
- The spreading and appropriation of knowledge are based on the confidence of the actors to share their knowledge freely.

In the Department of Cauca the project implies to work with the knowledge maps as a tool to facilitate their codification for minimizing their complexity and maximizing the access to them. The figure 1 shows the analyzed aspects of this project: on the one hand, it shows the components of the SRCyT&Inn, on the other hand, it emphasizes on the importance of the knowledge management system as a way to support the learning processes found within the social networks, a basis that fosters the innovation at microcompetitive level, which is the real environment in which the SRCyT&Inn is intended to work properly. The knowledge Management System: i) analyzes the Department of Cauca context as a region whose people know the need they have for searching alternative ways to neo-liberalism as a development strategy and an aid for their insertion in a globalized economy. The regional actors explore particularly the opportunities that the theories of Endogenous Development and the guidelines given by the Systemic Competitiveness offer, highlighting the importance of the networks, and the social actors as creators of a growth process that should work with equity and social inclusion; ii) it also suggests an adequate knowledge management model that supports the construction of an own development model linked to a knowledge management strategy that contribute to the knowledge dialogue among peasants that count on valuable ancestral knowledge and legacies, most of which are tacit, before actors of support local institutionality that work with codified knowledge, specially about markets and technologies. This knowledge flow is characterized by important obstacles and some potentialities that this type of projects helps to recognize; iii) it also requires a planned, cyclic, and feedbacked communication process, which shall be nonexclusive and responsible to facilitate the SRCyT&Inn actors to be backed by a cultural factor that may reinforce formal communication and minimize informal communication. It will similarly allow them to get more integration in order to share and acquire information and new knowledge that will help them to fulfill the objectives and processes of the networks and the consolidation of the system itself, and iv) describes communication, management of information, and knowledge management tools. One of these tools, subject of this study, is the knowledge maps that allow codifying the processes that take place within the networks. These codes get associated to factors such as associability, relation with the environment, competitive intelligence and technological management. This paper will focus on the latter.

During the execution of this project, the concept maps have become tools for knowledge capture; it may be possible that the depth of this approach is not very meaningful, but it offers important judgment elements. Having this purpose in mind, the project has taken the definition of concept map as a process that represents the structures of knowledge used during learning, in a bidirectional graphic that includes labeled concepts and concept links to associate, hierarchize or present them in a proposition form. (Novak 1984).

The advantages of a concept map are the following:

- The possibility of presenting knowledge in a precise way relating it with other knowledges and establishing concepts that can group up knowledge in case there is no possibility to show it with all its components.
- The easiness that the captured knowledge offers to communicate because of its graphic structure so that it can be included in Web or printed tools for those actors that do not have computer means to provide feedback on the process.
- It is useful to understand and integrate different aspects of knowledge found in a social network.
- It fosters collective spaces for discussion because it makes the participants to debate the hierarchy of knowledge they have acquired and its connection to others.
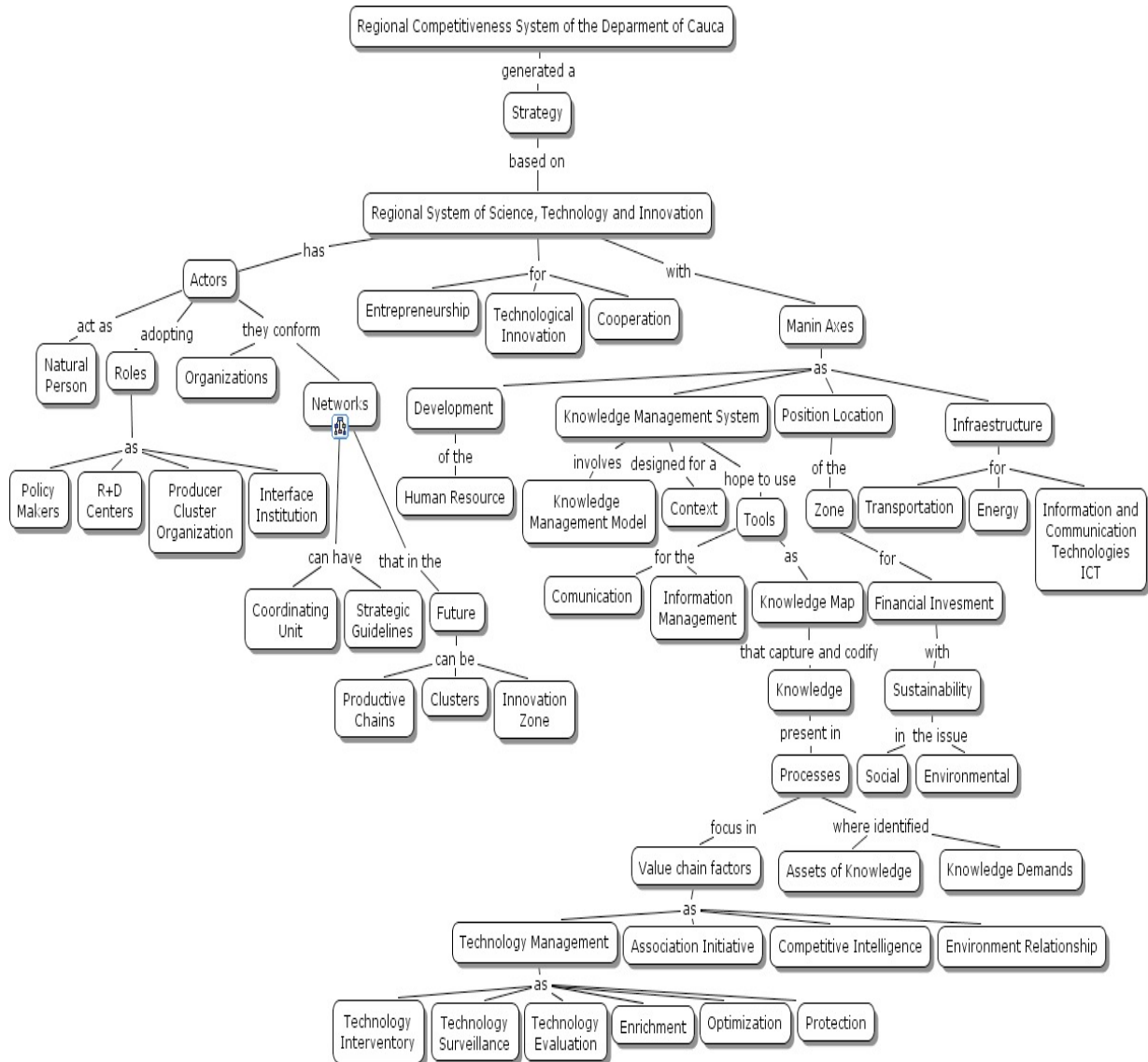
Source: Deycy Sánchez – Adolfo Plazas - Luz Stella Pemberthy

Figure 1. Concept map: Synthesis of the Research Project

4.2 Method for a Knowledge Map building

The purpose and the scope of these projects created the necessity of thinking about knowledge maps oriented toward the processes, since these "provide a representation of the strategic processes and the knowledge sources that the program of knowledge management should maintain to adequately support the business processes" (Sanchez 2004). It is also important to think about the production, knowledge management, associability, technological administration and competitive intelligence processes and about those related to the environment. By virtue of this requirement, a knowledge map construction method was proposed, which includes the following phases:

4.2.1 Work Context

This context is built up in the frame in which a knowledge map is being generated. In the case of a territorial field, the development model adopted must be mentioned, plus the particularities of the actors and their responsibility in the construction of the development model that has been chosen. In other fields, this is carried out by the governor, institutional, academic, and other actors, who in some occasions do not have the adequate information about the communities' problems. The generalization they make is not the best interpretation, as the communities' expectations may be different and even opposed to other communities located in the same area. This makes the process more expensive, although enriching.

4.2.2 Selecting the study object

With the view offered by the analysis mentioned previously, some important regional aspects that are considered relevant should be privileged. The best way to do this is to take into account the initiatives, projects and institutions that have already made the analysis regarding this issue; otherwise, the prioritization may be based on biased viewpoints that may distort both, the process and the final results. The regional vocation should be clear and the help needed should be located on those projects which may have a promising future.

Later, a social network or productive prioritized chain will be chosen; the documents that contain parts of the history, evolution, composition, and interesting thematic areas need to be studied. The information obtained will help to relate the real context with the chain or network chosen. When the "where" is selected, it is necessary to determine the "what," which are the important aspects or topics to be known through the map. This part of the work requires extended discussions for avoiding misinterpretations and the aforementioned work not to be distorted and future actions can be oriented properly.

4.2.3 Instrument Design

When all the elements to be studied are ready, specialists who know the selected unit for analysis are consulted. These actors are members of institutions who generally have confidence with the other members of the chain or network; for this reason they feel secure when suggesting strategies, instruments of working sketches, oriented towards the information needed. Furthermore, they are the ones who present the initiatives to the communities and back them so that the environment for working is adequate for an efficient teamwork. This is the way the instruments for working are developed, which in the case of the knowledge map is focused on the interviews and narrative records because they provide the characterized information since it is produced in the daily language of the actor that provides it.

4.2.4 Field work

The first visit is made with the design instruments. This visit determines if the instrument responds to the generated expectations or if it is necessary to adapt it. The research team takes the information that is possible to obtain and decides if it is necessary to program new visits with the purpose of obtaining the information missing. This information is generated by means of an interview or a narrative recording, so that it becomes a simple transcription of the actor words without any style adjustment. Each one, from his/her point of view, can give different interpretations, but at the end the actor will be the one to reaffirm the validity of the suggestions.

4.2.5 Analysis and Synthesis of the Information

A formal scheme to organize the obtained information is needed; the tables are particularly useful to this purpose. However the tables can not allow seeing a wide panorama, which makes the use of a concept map as a tool to get this aim. Initially only bits of a map are carried out with the obtained information, but later they become integrated as in a puzzle. It is necessary to discuss if this way of presenting the map really involves the concepts in a coherent way. Additionally, it also describes the knowledge and the meaning the concepts adopt in the context of the work for the target communities.

4.2.6 Knowledge Codification

The first abstraction level reached with the concept maps allows deepening little by little in each aspect. Moreover, it is possible to think about structural ways to organize the information with the purpose of including an application based on ontologies; this requires the construction of concept collections (described in classes) with their characteristics (attributes) to help to generalize the information and to extend the model to other similar organizations. The topic must be known deeply before proposing a model that makes knowledge codification easier. Nevertheless it is not possible to think that the whole knowledge can be included in it; however, it must be analyzed as if it were possible for avoiding the loss of rigorousness of the process.

4.2.7   Feedback

Once a proposal is ready, it must be presented to the community again. The possible way to socialize it is by using the concept maps. This tool helps to refine the model and to communicate the ideas in a specific and clear way promoting discussions among the actors. The appropriate size for these maps is that of a poster so that it becomes legible and easy to observe. It is really advisable to think about a way of avoiding to overload it with too much information; it is preferable to use several images and not to include all the information that has been found in just one single map.

The following conceptual map (Figure 2) explains those technologies inherent to the production of special coffee varieties and how the culture through the processes of knowledge management establishes particular practices for this productive process in Cauca.
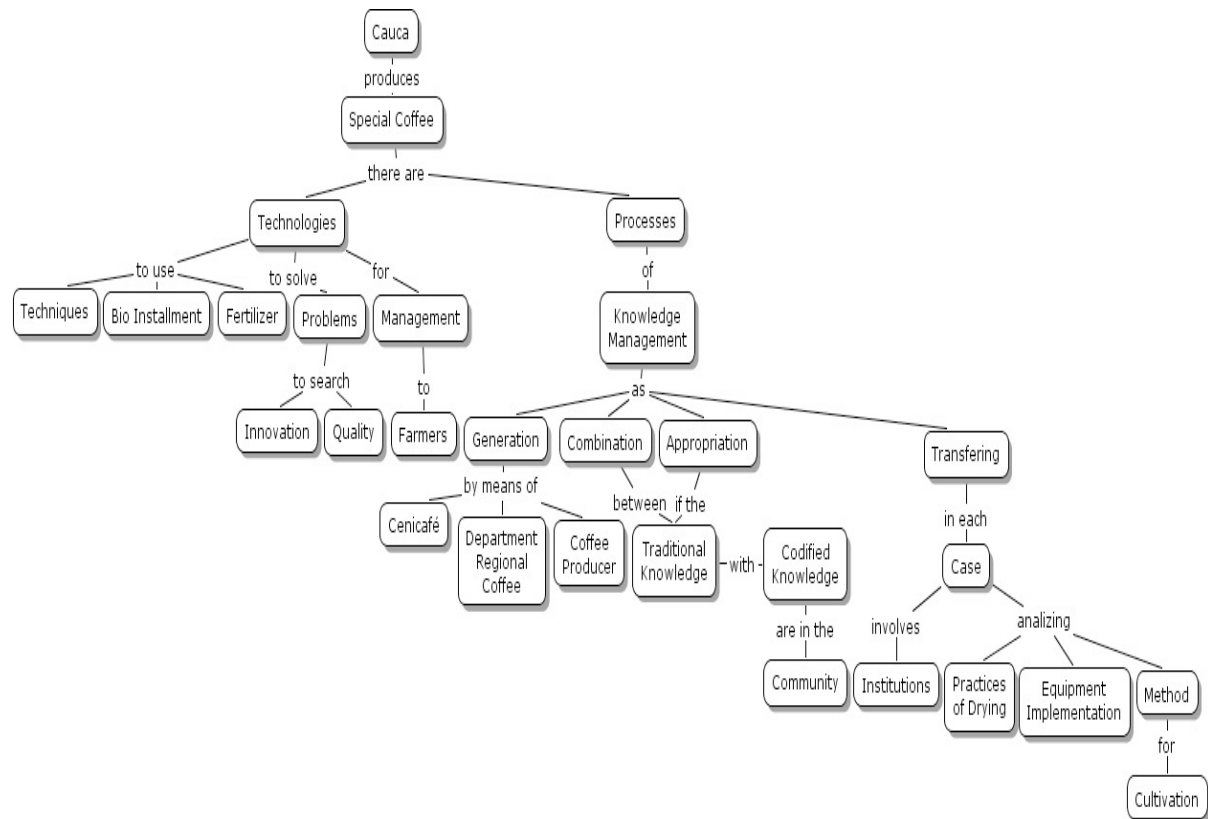
Source: Deycy Sánchez

Figure 2. Concept Map of Technologies for the production of special coffee varieties in Cauca

The previous map sets the starting point to establish a way for codifying and organizing the knowledge, one of the topics of interest to use is the technological management. Figure 3 shows the characteristics considered to codify knowledge associated to the technological inventory, technological monitoring, and technological evaluation, which are three of the six processes that allow analyzing this topic. In this regard, the projects determine that a technology in a productive chain or network must describe its name, its associated topic, an evolution step (embryonic, growth, maturity, saturation), a condition (inside or outside the network), a superior technology (that includes others), and an associate technology (depends on others). With this general description of a technology, the technological inventory and evaluation can be made. The process of technological evaluation permits to compare the technologies used in the productive chain or in a social network with respect to the ones found in the social environment (outside the network). To fulfill this, arbitrary criteria are adopted and the technologies are compared to each other. Nowadays the work is concentrated on the refinement of this representation model and on its knowledge codification.
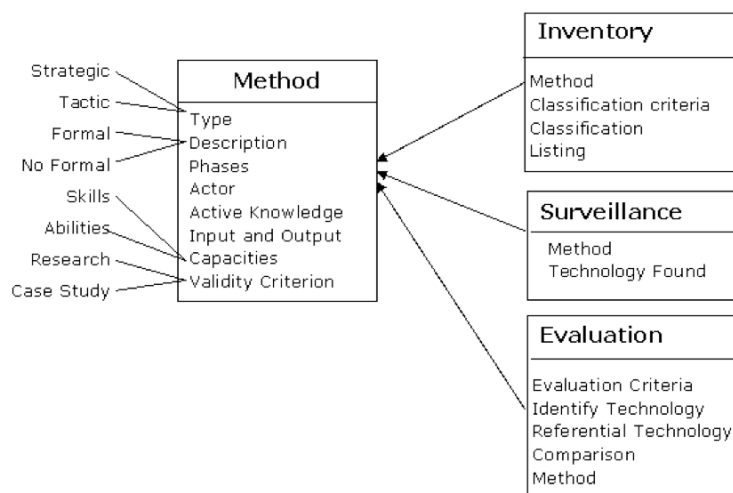
Source: Deycy Sánchez – Luz Stella Pemberthy

Figure 3. Aspects of the technological management approached in the knowledge codification

5   Conclusions

The conceptual maps have helped the project executor equipment in the process of internalization and reflection on different topics arising during the development of the initiative. It has also allowed the coherent integration of different knowledges and concepts with a pre-established intention. In addition, they have ensured and facilitated the communication of different approaches given the multidisciplinarity of the team.

The appropriation of the knowledge map as a tool for knowledge management requires management strategies within social networks that constitute the SRCyT&Inn. This appropriation is only possibly perceived in the long term; in the short and mid term it must be frequently nurtured and improved with the purpose of giving answers to the actors and to the local users' demands.

The conceptual maps, as tools for capturing and codifying knowledge are limited regarding their updating; this is because they must obey to static glances in a specific moment. If this reality changes it is necessary to start over all the process and adapt the whole concept map to a new situation, which makes its use expensive and complex.

For rural producers the concept maps are difficult to understand. Perhaps it is due to the educational level of some of them, so it does not allow them using this tool now. In the future we need a deep educational process to promote the learning of this concept maps.

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