

# Relationship State - University - Company: Triad for Knowledge Management and Development of Science and Technology in Colombia

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## Abstract

**Objectives:** This research describes the analysis of the management of knowledge and the Estado-Universidad-Company relationship (Triad), in Colombia as an essential element for the growth of science and technology. **Materials and Methods:** it is to analyze the management of knowledge through the experiential-introspective approach, with techniques and instruments of data collection, which were validated by experts, and then analyzed using descriptive statistics and as a product described a new scientific knowledge based on patterns of regularity; explained from the interdependencies between the different classes of actual events. **Findings:** It should be noted that municipal governments and enterprises do not have budgets, which increases the need for investment in I&D project, involving. The municipalities and companies do not design valid strategies focus train and implement for decision-making. The Innovation and Development expressed the view that the State a 27.4%, almost never uses its own equipment and tools. In addition, policies are subject to the needs of your environment. The above results indicate that there are differences between the responses of the population specifically when it comes to the State, company and university, despite the fact that the Government creates specific policies on science and technology and need tools to consolidate the processes of I+D+i. **Application:** it is conceived as a product of the scientific knowledge the design of abstract systems with a high degree of universality that analyze the Estado-Universidad-Company relationship, as the axis for the development of science and technology in municipal governments and companies from the need for investment in I&D project for the management of innovation are not handled the strategies for decision making.

**Keywords:** Development of Science and Technology, Knowledge Management, Relationship Status-University-Company

## 1. Introduction

The need for effective management in the innovation as well as, to evaluate the results of the work developed in the states, universities and companies, to involve the essential elements (search, use of methods, validation of the reality, among others), the research process; brings scientific answers based on the use of advanced technology to meet the innovative tools such as surveillance, targeting, training and implementation of the acquired knowledge. There is a strong need for states, Latin American universities and companies from Argentina, Colombia, Peru and

Venezuela to recognize signals from the environment to generate knowledge, as well as management of technology in the plans and projects involving not only this triad (state, university and business), but to the people who are enmarada in the social environment<sup>1,2</sup>. In addition, the action research has allowed for the student to be able to innovate and create positive attitudes of what you want to investigate, but for this, the creates ways of projecting the reality where the phenomenon to study shows its characteristics and/or qualities, based on effective work as well as in the development of the innovation of scientific knowledge<sup>1</sup>.

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The need for scientific research, development is due to the lack of knowledge to adapt technological equipment, what makes people to deviate from the process, to such extents that disregard the identification of needs<sup>3</sup>. It is necessary to emphasize that the parties develop programs that must be adjusted to science and technology, that is to say, the state through public policies displayed the importance of generating scientific knowledge based on the use of tools of innovation (telematics) to assist in the development planned for the emergence of the Society<sup>4</sup>. These policies are in accordance with the educational plans of the universities, the lines of research of where projects are formulated aimed to raise solution to social problems and the company plays a key role when allows the individual to involve all the needs of the same in the investigation<sup>5</sup>. It shows that the research is part of the development of a society where the same reflected in public policies, specifically when it comes to science and technology.

In Colombia this triad, provides opportunities for students the possibility of raising strategies to solve social problems. That is to say, it emphasizes the importance of the state in development of public policies on science and technology; for universities to maintain up-to-date research lines according to the needs of the enterprises, which are the engine of economic development, through the activities of science and technology in favor of accountability to society. In the field of science and technology has been the quality of life of societies, although the programs have not focused on solutions, because in the communities there are individuals with negative attitudes. That is to say, show resistance to change. Similarly, these policies have tending by The development of institutes, training and incentives to researchers, the productive sector to promote technology transfer, research activities, to raise research policies by areas and coordinate with the government industrial development<sup>6</sup>.

The state shows concern for converting those weaknesses into strengths through projects that cover the needs of society with the participation of universities and companies<sup>7</sup>. This relationship is due to the fact that the universities are responsible for preparing the future professional and, therefore, the implementation of public policies in the field of science and technology in the lines of research, addressing the realities of society. In such a way that companies are the entity that will finance the implementation of the research projects. These policies seek to increase the generation of knowledge, promote innovation and productive development, strengthening human capacities for

science, technology and innovation (ITC), consolidate infrastructure and information systems and promote the social appropriation of science, technology and innovation in Colombian society<sup>6</sup>. This is reflected in investment programs; they need for their development, and reflect that research and innovation are the main productivity and growth, in the digital era.

The competitiveness of a country is related to the development of innovation, which deepens in proposing solutions to the economic crisis, through the promotion of research in science and technology. The need for research to the triad (the state, university and company), as a pillar of the growth of science and technology, envisioning what innovative and creative, subject to the standards of scientific research, that is to say, that can be studied and verifiable. Where it is possible to subsequently create programs to involve the sectors that make up the triad through projects that aim to give a solution to the needs of society.

## 2. Materials and Methods

The proposed methodology took as an object of study the knowledge management by applying the experiential-introspective approach, with techniques and instruments of data collection, which were validated by experts, and then analyzed using descriptive statistics and as a product described a new scientific knowledge based on patterns of regularity; explained from the interdependencies between the different classes of actual events. Likewise, it is conceived as a product of the scientific knowledge the design of abstract systems with a high degree of universality that mimic the processes of generation and behavior of the reality to study that is to say, to analyze the triad (the state, university and company), as a fundamental pillar of the growth of science and technology<sup>7</sup>. The research is part of the descriptive mode that describes the components of the variables considered by researchers<sup>8</sup>. The information units are referred to people who have the knowledge about the characteristics or variables that you want to investigate. Therefore, they are considered as the primary source; in this sense it is the nine persons responsible in the municipalities, universities and private companies (Table 1).

As a tool for decision of the information was applied a structured interview which took into account the growth of science and technology (State, University and Company) and levels of management of innovation

**Table 1.** Description of the triad: number of person linked to the areas of science and technology in municipal governments, universities and private companies

Triad		Person of the Area of Science and Technology
Municipal governments (state)	Municipality of Riohacha	3
	Municipality of Albania	3
	Municipality of Maicao	3
Universities	University of La Guajira	3
	University of Atlántico	3
	University of Magdalena	3
Private companies	Cerrejón	3
	Chevron Corporation	3
	Promigas	3
<b>Total</b>		<b>27</b>

represented by investment in research and development<sup>7</sup>. In the interview was designed with eight questions and then was applied to the population under study with four alternative answers: Always (A), Almost Always (AA),

Almost Never (NA) and never (N). Once you have collected the information, we proceeded to the management and processing of the data through the descriptive statistics (percentage distribution and arithmetic mean) with IBM SPSS Software Version 22.0., the coding to Baremo (Table 2).

**Table 2.** Ranges and categorization according to the encoding of Baremo

Ranges	Category
$3,41 \leq x \leq 4,00$	Highly developed
$2,81 \leq x < 3,40$	Developed
$2,21 \leq x < 2,80$	Relatively developed
$1,61 \leq x < 2,20$	Little developed
$1,00 \leq x < 1,60$	Nothing developed

### 3. Results and Discussion

Table 3 describes the result of the analysis is the data of the different variables accessed through the interview to persons working with the elements of the triad (the state, university and company) in the areas of science and technology.

On the basis of Table 3 was obtained that the innovation and development the interviewees expressed the view that the State a 27.4%, almost never uses its own equipment and tools in addition to almost never have dedicated infrastructure (including laboratories specialized

**Table 3.** Description of the management and investment in I&M (State, University and Business)

Area of knowledge	Alternatives (%)											
	Always			Almost Always			Almost Never			Never		
	St.	Univ.	Com.	St.	Univ.	Com.	St.	Univ.	Com.	St.	Univ.	Com.
Investment in I&M	24,9	29,1	25,5	22,9	20,2	22,2	27,4	27,3	31,7	24,8	23,4	20,6
Innovation Management	22,3	29,3	29,4	29,3	28,4	20,4	29,7	23,2	31,3	18,7	19,1	18,9
Average	23,6	29,2	27,5	26,1	24,3	21,3	28,6	25,3	31,5	21,8	21,3	19,8
Arithmetic Mean	State			1,62	1,75	Average	1,69	Little Developed				
	University			1,47	1,78		1,63					
	Company			1,78	1,74		1,76					

St: State, Univ: University, Com: Company

documentation center land and buildings that host activities I+D), or account with staff (includes researchers, support staff and staff), as well as policies are subject to the needs of the environment, which almost never exist budget resources, while 24.9% 24.8%, and 22.9% almost always uses equipment and instruments, infrastructure, for the development of projects of I+D.

In contrast, in the universities, according to those interviewed in a 29, 1% always uses its own equipment and instruments also have dedicated infrastructure (including laboratories specialized documentation center land and buildings that host activities I+D), and always with staff (includes researchers, support staff and staff), as well as policies are subject to the needs of the university environment, always exist in the budget, while 27.3% think almost never, 23.4% and 20.2% almost always uses the elements strategic financial products of investment in I+D.

However, in companies with a 31.7% of the respondents pointed out that almost never uses its own equipment and instruments that almost never have dedicated infrastructure (including laboratories specialized documentation center land and buildings that host activities I+D), nor has staff (investigators, support staff and others), as well as the policies are subject to the needs of the environment, demonstrating that almost never exist budget resources, while the 25.5% 22.2%, 20.6% and almost always never used the financial resources to carry out research and development projects.

Considering the above results reflect that there are differences between the responses of the population specifically when it comes to the State, Company and University, where there is a lack of development of science and technology, despite the fact that the Government creates specific policies on Science and Technology, the companies are required to specify the Tools to consolidate the processes of I+D+i though at the universities comply with each of those policies, there is no adequate consolidation in the triad. In addition, increase technical and technological base for the generation of knowledge, encourage innovation and productive development, strengthening human capacities for science, technology and innovation (ITC), consolidate infrastructure and information systems and promote the social appropriation of science, technology and innovation in Colombian society, what evidence the interrelationship of the triad (the state, university and business. Based on the above, the process of materialization of the policy affects society whose

behavior depends, in turn, the nature and scope of the action at different levels of implementation<sup>6</sup>.

The state-society relationship is made concrete through successive positions of different social actors and state, compared to issues raised by the development of society. Some of these university institutions have been able to achieve the alternative of resources through international cooperation schemes, for those who are authorized within the scheme, allowing you to achieve maximum expression with an 18% of the amount required for their budgets. These results, specifically the universities, similar to the approach that the expenditure in I+D has a positive influence on productivity, with a rate of return that outperforms conventional investments<sup>6</sup>. The relationship between investment in I+D, scientific production, level of education and wealth is evident.

With regard to the management of innovation the interviewees expressed the view that the State a 29.7% notes that almost never detects external opportunities in the area of technology, as well as almost never analyzes the scientific-technological information in decision-making and implement the knowledge acquired after the search for information, which takes them away from policies of the investigation with regard to the innovation of the investigative action, while 29.3% almost always, 22.3% and 18.7% never always detects opportunities, analyzes the scientific-technological information, and implement the knowledge acquired.

Unlike the state universities according to the interviewees object of study in a 29.3%, points out that always detects external opportunities in the area of technology, as well as always analyzes the scientific-technological information in decision-making in addition to that implement the knowledge acquired after the search for information, which takes them away from policies of the investigation with regard to the innovation of the investigative action, while 28.4 28.4% 23.2% almost always, almost never, 19.1% did not find opportunities, analyzes the scientific-technological information, and implement the knowledge gained.

For its part, the companies a 31.3% almost never points out that always detects external opportunities in the area of technology, as well as always analyzes the scientific-technological information in decision-making in addition to that implement the knowledge acquired after the search for information, which takes them away from policies of the investigation with regard to the innovation of the investigative action, while 29.4%, 20.4% and 18.9% almost always never detects opportunities, analyzes the

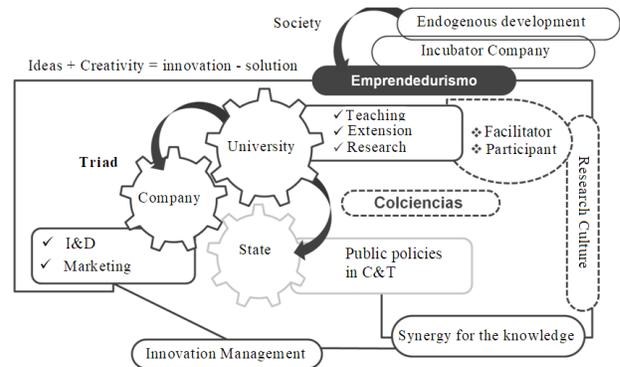
scientific-technological information, and implement the knowledge.

Taking into consideration the results above you can consider that there are differences between the responses of the population specifically when it comes to the State, company and university, where there is a lack of development the obtaining of knowledge, allowing focusing and adjustment to the needs, like the lack of decision-making, in contrast to the universities complies with the rules and policies in science and technology in decision-making. Based on the above, there is a need in the municipalities and companies implement the tools of innovation management as it seems reasonable to argue that you can make good use of most of the tools of innovation management more modern if a competent consultant works in close collaboration with the top management of the project, strongly committed and can compensate for the absence of commitment on the part of the address, nor the lack of general competence on the part of the inquirer<sup>1</sup>.

However, when it comes to analyzing the triad (the state, university and company) area of science and technology, it can be noted that the average of the responses in terms of investment in R&D and innovation management is located in the state, with 28.6 per cent in almost never, while in the University is 29.2% in the alternative provided in 31.5% companies almost never. This shows that there is differences between the responses so that you can point out that it is little developed with differences when they refer to the State, the university and the companies because they need to develop investments managed innovation set to public policies where you create institutes for the development of research, due to the fact that there are budgets for this, although teachers do not have full knowledge of the existence of the same<sup>6</sup>.

In the same way is little developed to increase the generation of knowledge, encourage innovation and productive development, strengthening human capacities for science, technology and innovation (STI), consolidate infrastructure and information systems and promote the social appropriation of science, technology and innovation in Colombian society, there is a clear interrelationship of the university-business-state (Figure 1)<sup>9</sup>.

To properly manage the knowledge, it is necessary to take into account the triad state, university and company, because they allow through public policies on science and technology (S&T), the creation of programs encouraged by Colciencias (Administrative Department of Science, Technology and Innovation. Promotes public policies to



**Figure 1.** Dynamic model of interaction to increase the Science and Technology (T+I).

promote ITCin Colombia, which makes at the universities require teachers to keep up-to-date and exploit to the maximum the creativity, strategic thinking to help raise awareness of change. From there, that the innovations generated will enable the university to enter the competitive world, specifically if you are involved with the research with a social sense, since it is through the search will get models adapted to the needs of each environment, leading to the development of local, regional, national and international levels<sup>10</sup>.

For its part, the State, develops programs that must be adjusted to science and technology, that is, through public policies displayed the importance of generating scientific knowledge, the same must be based on the use of telematics tools of innovation (mass media), which help in the prospective development of the country. These policies must be adjusted to the educational plans of the universities. That is to say, to the lines of research and action to effectively manage the projects that can provide a solution to the socio-cultural problems and where the company plays a fundamental role when allows the individual to involve all the needs of the same in research as well as the development of plausible solutions to the context and its requirements<sup>11</sup>.

As well as the universities would have the unification of the teaching, extension and research as an essential part for the fulfillment of the policies of the state, leading companies to get involved and cooperate through research (I+D), for the improvement and innovation, helping the productive apparatus of the region - Country. However, this triad (State, University and Company), for the development of the model in need of actors such as facilitators and participants who are the leading the inquiries of the local requirements in order to be able to raise R&D,

this will establish an effective technical memory (strategic element for storing knowledge<sup>12</sup>.

This Estado-Universidad-Company relationship, promotes the consolidation of the technology park which is a laudable purpose of the modern university with a view to endogenous development<sup>13</sup>, allowing the incubation of companies where research and implementation of public policies can be measured through indicators of innovation provided by the research, directly involving the society through the ideas (developments) generating value, allowing the best practices, lessons learned, generate benchmarking, there is a socialization of knowledge and innovation to marketing of the same<sup>9</sup>. All of this is specific to the production of knowledge, which is based on the generation, conversion and transfer as transversal axes for the Synergy of knowledge.

Based on the foregoing, innovation happens to be one of the fundamental processes of knowledge management, which makes the universities are immersed in the competitive world leading to the same to make efforts to update each of the training programs enabling them to adapt to the risks that are found in the entrepreneurship. It is for this reason that the aim of the triad, is to increase the availability of trained human capital for Science, Technology and Innovation in the department of La Guajira which contribute to the improvement of productivity and competitiveness, this will be achieved with the description of the terms of the innovation process, which allows you to demonstrate the importance that has the technology at the time of managing the knowledge of the people who want to stay within the system of research, development and innovation (I+D+i).

## 4. Conclusions

The results obtained in the investigation attempt to establish that the public policies and management of knowledge, to visualize the importance of the relationship between the State - University - Company. In the municipalities and companies it is necessary to emphasize in their budgets the need for investment in I+D project, where they can involve the universities. The integration of each of the parties allows the development of activities for the benefit of society, specifically in the area of science and technology, where you can develop programs of integration, i.e. use of the internet for the search, facilitating the inclusion of the new and creative society in general not only to a part of the environment. However,

that relationship or triad depend to a high degree of the budget allocated by the State and to a lesser extent manage to go to the request of loans through various programs and formats, for that reason the possibility of investment that is generated in connection with research and development and a high concentration in the payment of staff dedicated to this area, this is due to the increases that can be generated within this sector, however the commitments on the part of infrastructure as well as equipment and instruments are the areas of greatest demand to the placement of the investment and, to a lesser extent related to inputs and travel.

For its part, the municipal governments and businesses, do not have the resource of documentation centers which are geared to the collection, selection and processing as well as storage of information, to give guidance to the process of teaching, research and extension, stressing that the areas of exact and natural sciences, engineering and technology, and the social sciences are those in which there is the greatest amount of information protected. Despite the fact that in the universities is evidence that within these institutions there is a range of infrastructures that allow you to comply not only with the research activities but also with academic activities.

With regard to the management of the innovation it can be noted that the municipal governments and companies are not handled the strategies, i.e. lack of surveillance, targeting, training and implementation of information for decision-making in the margin to the integration of each of the institutions that make up the triad and that therefore the way to science and technology project. The biggest trend is away from the development of experimental development projects then applied research projects and, to a lesser extent, those related to basic research.

Also, do not identify the sources of information to make decisions is insufficient research, the selection of the potentials of information that are used in the generation of new knowledge, as well, show little training in the daily activity in the improvement of scientific knowledge, and are unaware of the politics of research with regard to the innovation of the investigative action. In other words, the triad (the Mayor-Universidad-Empresas) weaknesses to promote the generation of knowledge to facilitate change in the research, lack of strategic elements that will allow you to development of the up-to-date knowledge, also accept little changes of paradigms that allow the practice of research of an updated form and not coupled to the changing environments involving adaptation processes in research.

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