



HOW TO ACHIEVE COMPETITIVENESS IN HIGHER UNIVERSITIES?: AN INTELLECTUAL CAPITAL AND CORE COMPETENCES VIEW

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Abstract. *It is possible to examine intellectual capital (IC), which is comprised of a variety of intangible resources, as a useful and distinctive component for knowledge management in higher education. This study aims to examine how intangible intellectual capital (IC) interacts to generate competitive advantages and core competencies. The methodology design involved multivariate statistical analysis using System Dynamics (SD) and Structural Equation Modeling (SEM). Regarding the research's uniqueness and significance, no prior studies that examined the connection between IC, core competencies, and competitive advantage in higher education have been found. The findings demonstrate that it is possible to identify the intangible resources of intellectual capital in core based on the traits and level of development of IC at each university.*

Keywords: *intellectual capital, competitive advantage, core competences, mixed method, university.*

1. Introduction

The development of missionary activities in universities requires the use of a set of tangible or intangible resources that can influence in their competitive advantage. Knowledge is one of the most important intangible resources because it reflects the organization's IC by capturing, organizing and exploiting the collective knowledge of the whole organization [1]. IC includes other intangible knowledge resources such as co-working, skills, expertise, trust, software, quality, strategic alliances, know-how, processes and brand [2], [3], [4]. These resources are divided into three categories: Human Capital (HC), Structural Capital (SC), and Relational Capital (RC) [5], [6], [7],[8], [9], [10].

The intangible resources of the IC are a source of differentiation for the organizations, also, this kind of resources contribute to the generation of sustainable competitive advantages [11]. In the case of universities, competitive advantage can be local, national, or international. This advantage comes from creating value through the management of resources and skills [12]. Competitive advantage is achieved by recombining resources into core competences. These competences are specific to each university and it include research, technology management, financial support for human resources and interdepartmental initiatives, rewarding and retaining staff, and institutional image and branding [13]. The previous components shape IC in universities and allow for the differentiation of intangible resources and activities, the management of which through IC creates value [4]. IC

management also improves the performance of universities in the mission areas of teaching, research, and extension [3].

Identifying the intangible resources of IC, rather than the articulation that can exist between them, is the key for universities [7], [9]. For example, some research has analyzed how IC categories create core competences in different sectors of the economy, such as SMEs [14], technology development companies [6] and government agencies [15]. However, this process has not been studied in universities.

Therefore, the purpose of the research is to study how the intangible resources of IC become core competences and create competitive advantages in Colombian public universities. In addition, the study would like to know if there is a relationship between the core competences of the universities. System Dynamics (SD) and Structural Equation Modelling (SEM) were used as a method. This made it possible to summarize and associate the variables and identify the intangible IC resources that were most representative of the universities.

The study is divided as follows. First, the theoretical background will be presented. This will help to understand the concepts on which the investigation is based. This is followed by a presentation of the methodology, which is a description of the following elements: structural equation modelling (SEM) and System Dynamics (SD). Results to understand how IC categories relate to core competencies in HEI are then presented. Finally, conclusions and proposed future research work will be presented.

1 Theoretical background

Human Capital at universities

Human capital (HC) includes elements such as shared responsibility with the consumer, consumers' professional and technical knowledge, experience, education and training. [16]. It includes the body of explicit and tacit knowledge acquired by the academic community through formal and informal education. It also includes the experience and skills of students, teachers, and researchers. These resources are necessary for the development of the mission activities of teaching, research and extension. [17].

HC is the main component of IC. It is the driver for strengthening structural and relational capital. It reveals the university's ability to create value by connecting the experience, learning, skills, training and creativity of its people [10]. HC includes the sum of tacit and explicit knowledge of university staff (teachers, researchers, managers, administrators) acquired through formal and non-formal education processes [18].

Structural Capital in universities

Structural Capital (SC) includes the explicit knowledge associated with the internal processes for creating, communicating, and managing the university's scientific and technical knowledge. These resources include bibliographies, databases, research projects, intellectual property, routines, culture, values and infrastructure [17]. SC also makes it possible for knowledge to be retained in universities when members of the academic community move to other locations.

SC includes explicit knowledge associated with the internal processes of the higher education institution [4]. SC shows the institutional infrastructure in terms of actions that support the work of staff and it takes into account resources such as culture, routines, values, databases and intellectual property [10]. Other intangible resources that stand out in the SC of HEIs are information systems and research production [15], internal procedures, quality, bibliographical and documentary resources, files, technical developments, patents, licenses and software [19].



Relational Capital in universities

Relational capital (RC) favors the dissemination of knowledge created by professors, researchers, and students. This dissemination is generated through internal and external interactions with different stakeholders. RC includes intangible resources such as reputation, brand and strategic alliances in the long term [17].

RC includes the knowledge and learning competences that are product not only from the relationship between a university's members and its stakeholders, but also from other sources of relationships such as loyalty, brand and reputation [10]. RC involves the group of economic, political, and institutional associations developed between the university and non-academic stakeholders such as businesses, non-governmental organizations, local government, and society in general, including some intangible resources such as attractiveness and trust [4], image positioning, training activities in industry, collaboration with international research centers, networking with faculty, international student exchange, and international recognition of HEIs [7], [9].

Intellectual capital in non-academic organization

The relationship between IC and financial performance has been the subject of research in the banking sector. This relationship includes indicators such as ROA, ROE, ROCE, EPS and Tobin's Q [53]. Also, there is another category of capital in the banking sector called the capital employed (CE), which is a measure of an organization's productivity per unit of monetary investment in employees [54]. Research has also been done on the role of IC in the construction sector. The mediating variable between CI and organizational performance in this sector is knowledge management [55]. Knowledge management is a company's ability to create, socialize, protect and transfer knowledge among each of the stakeholders who need it.

In the Information Technology (IT) sector, human capital and structural capital support product and service innovation activities, and improve the position of the organizations in the market [56]. Also, the agrobusiness recognize the IC as a key factor that generates better knowledge exchange practices, enhance management skills and prepare themselves with more confident and rational financial resources [57].

Core competences at universities

Core competences allow stakeholder necessities to be met through the organization's capabilities regarding available skills and resources. The generation of products and services found on core competences defines the value intention of the organization in each target market and corporate strategy [5], [20]. In universities it is important to define which resources need to be articulated to generate the core competences and to ensure that they survive and thrive in the market [21]. These resources include organizational knowledge, assessment, research outputs, identity, technology management, funding, human resources, rewards, staff retaining, interdepartmental initiatives, image and institutional brand [13].

These resources can be expressed around the following core competences: setting up and managing research projects, disseminating knowledge and business support services, patents and entrepreneurship [22]. In public universities, core competences are not demarcated internally, but by the views of stakeholders. Only when a resource is recognized, respected and valued by external stakeholders can it be said that the public university has gained a competitive advantage within core competences [23].

2 Method

A probabilistic design using Simple Random Sampling (SRS) for finite populations was used according to the purpose of this research. A confidence level of 95% and a margin of error of 10% were chosen. One sample and a total of 85 valid responses were obtained. The choice of a Colombian public university is attributable to the requirement to validate transparency in the use of the government funds allocated to them. It also grows the visibility of the academic and scientific productivity generated by the faculty. Then, it was discovered that IC intangible resources can be reassemble into core activities that become core competences. The core competences in higher education developed from the interaction of IC resources are research, knowledge transfer, human resources, interdepartmental initiatives, academic and educational system, image and financial support [4], [13], [24].

To analyze the articulation between diverse core competences in universities, a multivariate analysis using structural equation modelling (SEM) were developed. These models are based on the identification of a measurement model and a structural model. The hypotheses of the relationship between the variables are summarized in Figure 1., considering the aspects previously discussed.

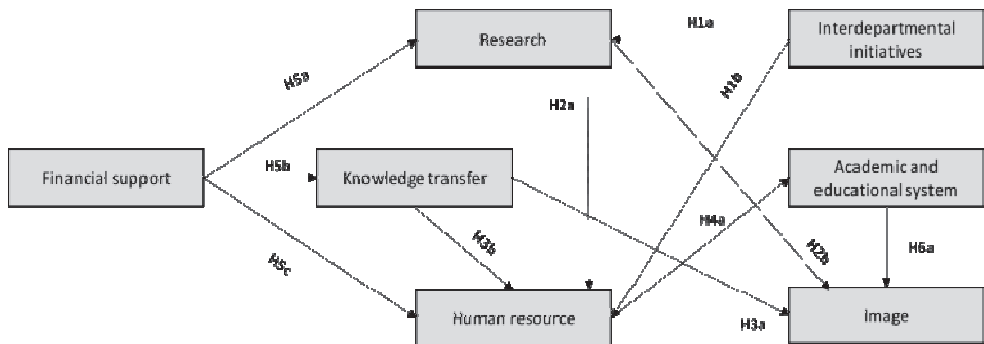


Fig. 1. Intellectual capital model hypothesis and core competences in HEIs

However, SEM is inadequate for exploring the causal relationships and complexity of the phenomenon of interest [25]. Nevertheless, they form the basis of the second method used in this paper. This method consists of modelling and simulation with System Dynamics (SD). These models allow us to identify the variables that are statistically significant for the problems studied. In addition, SD provides results that reflect the contribution of each variable to the phenomenon under study, as well as the causal relationships established between them [26].

Based on the above, a schematic model called a „Causal Diagram“ was developed. This model helps to understand the structure of the system. These diagrams make it possible to specify the variables, the model elements and the cause and effect relationships between them [27], [28]. Relationships between variables of interest can be represented by reinforcing (Ri) or balancing (Bi) feedback loops [29]. PowerSim Studio 10 software was used to model the causal relationships between the research variables. The input data for the variables correspond to a synthesis of indicators for measuring the IC in HEI proposed by [58], [59], [60], [61], [62], [63].



3 Results

Structural model

Linearity was analyzed by calculating Pearson's bivariate correlation coefficient between research, knowledge transfer, human resources, interdepartmental initiatives, academic and educational system, and image. Significant correlation coefficients were obtained at a confidence level of 0.01. The correlation coefficients fluctuated from

0.314 to 0.664. Considering the suggests presented by [30], there is no multicollinearity, specified that none of the correlations is greater than 0.9. Table 1., shows a summary of the outputs of the eleven research hypotheses. The acceptance or rejection of each hypothesis is related to its p-value.

The fit indices of the CFA model are also within the expected ranges, as follows: RMSEA (0,079); CFI (0,917); NFI (0,902); IFI (0,921); PCFI (0,843); PNFI (0,840).

Intangible activities, which later become core competences of public universities, are created through the relationships established between intangible IC resources. SC and HC are the most representative observable variables. For example, the quality of the teaching is the variable with the highest factorial load. It contributes 65.9% of the shared variability to the core competence „Academic and educational system“. This core competence articulates intangible resources through intangible activities that promote the quality of teaching, the adoption of new teaching models, and the transformation of traditional learning models into a student-based learning model [46], [47].

Table 1. Hypothesis testing

Hypothesis	Theoretical background	Results	P-Value
H1a	[31], [32], [33]	Accepted	0,001
H1b	[34], [35]	Rejected	0,603
H2a	[7], [13], [36]	Rejected	0,283
H2b	[7], [13], [36]	Rejected	0,322
H3a	[4], [18], [37], [38]	Accepted	0,004
H3b	[39], [40]	Rejected	0,154
H4a	[7], [33], [41], [42]	Accepted	0,001
H5a	[13], [18], [43]	Rejected	0,723
H5b	[13], [18], [43]	Rejected	0,684
H5c	[13], [18], [43]	Rejected	0,529
H6a	[41], [44], [45]	Rejected	0,421

The relationships generated between the core competences in the universities are expressed by the effect of the exogenous variables (interdepartmental initiatives and knowledge transfer) on the endogenous variables (research, human resources, academic and educational system, image). Interdepartmental initiatives have a positive effect and explain 76.4% of the variance of the research core competence. This competence promotes the improvement of competences and skills in research by exchanging internal knowledge between professors in different knowledge areas [34]. This core competence is the basis for collaborative work and the equal distribution of the impact of research results and products [32], [48].

Causal diagram

The causal structure of the model of the recombination of intangible intellectual capital resources into core activities that become core competences, includes both balance-feedback cycles and reinforcement cycles (see Figure 2). Identifying outstanding intangible resources is necessary to develop the mission of public universities (Teaching, research and extension). Therefore, the growth or decline of variables related to productivity, quality, faculty competencies and relationships with different stakeholders will be affected by management actions and strategic orientations in a public university regarding intangible resources [49].

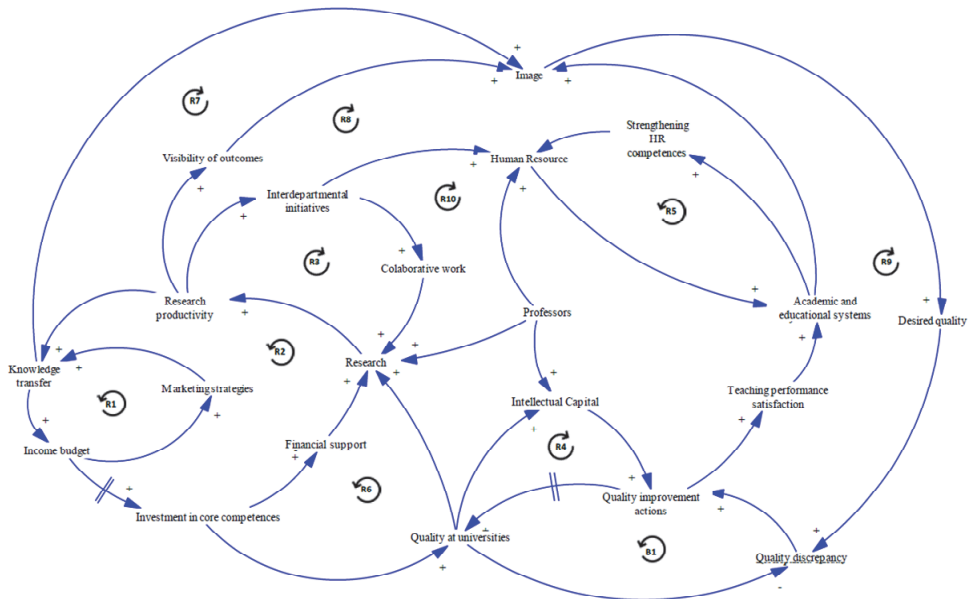


Fig. 2. Intellectual capital causal diagram

Reinforcement cycles explain how the involvement of universities in economic activities through knowledge transfer promotes access to new sources of income [51]. These activities make it possible to publicize and commercialize the experience and knowledge generated in universities. Also, these activities are used as services for different stakeholders such as local industry, multinational organizations and public authorities [52]. The balance cycle refers to the improvement of the quality of the services offered by the universities, and the improvement actions also promote the competitiveness of the education market in a global environment, through the transformation of the management models of the universities [42].

4 Discussion

Considering the relationships that are established between the intangible resources of intellectual capital, in the core activities that become core competences for public universities, the most representative observable variables belong to structural capital and human capital. This is the case for the observable variable 'tools and information systems



for collaborative work' (structural capital item). These tools improve performance and strengthen relationships between teachers from different departments [64], they optimize the joint development of mission activities (teaching, research and extension).

It is important to note that the hypotheses relating to the core competence of 'financial support' have been rejected. These hypotheses are as follows H5a, H5b y H5c. In recent decades, governments around the world have increasingly sought to control public spending, a reality that has not been foreign to the management and strategic direction of public higher education institutions. The result has been a lack of government funding for the development of missionary activities [65].

In addition, financial resources affect the efficiency and competitiveness of the services provided by public HEIs. As a result, public HEIs are under increasing pressure to improve the performance of their services [66]. Tools for assessing the productivity of public resources allocated must therefore be used [67].

5 Conclusions

The proposed simulation models contribute to the understanding of the problem under study. The problem is based on an appropriate differentiation between resources and intangible knowledge activities, the latter being the factors that drive the strengthening of competitive advantages in universities. Based on the Resource Based Theory, these competitive advantages can be expressed in terms of core competences. The core competences with the best performance are interdepartmental initiatives, knowledge transfer and image. Strategic direction is therefore essential to ensure collaborative working environments that enable differentiating knowledge resources to be generated and transferred to the various industrial and market sectors that require them.

Intangible resources do not by themselves provide institutional competitive advantage. These resources need to be commanded together through core competences defined in the institutional strategic plan. This process depends on the attributes and maturity level of IC management in each university. The intangible resources present in the core competences of universities belong to one or more of the central categories of intellectual capital (HC, SC, and RC). For example, the „research“ core competence includes the skills and experience of the teachers, the division of responsibilities in missionary activities, and the existence of strategic plans. These intangible resources do not belong to a single category of IC, as they are linked to HC and SC in universities.

Future studies should look at the role of each of the key categories of IC in universities. This will strengthen the analysis of the relationship between IC, core competences and university performance. Finally, the use of other methodologies, such as network theory and agent-based simulation, which help to discover the causality between intangible IC resources and core competences, is suggested for future work.

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