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Generation of products as intangible assets in research projects: Case study in Passifloras

Generación de productos como activos intangibles en proyectos de investigación: Estudio de caso en Passifloras

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Contents

ABSTRACT:
This article discusses the generation of products as intangible assets produced in the university environment by analyzing the results in research projects in cultivated species of the genus Passifloras at the National University of Colombia, Bogotá headquarters. This study is based on the experience of researchers of basic sciences in bioprospecting and the methodology used was the associated costs to develop knowledge. Results of the seven projects analyzed show large numbers of products generated in relation to those exposed in their initial proposals. Likewise, the projects have high research potential for social impact.
Keywords: Intangible assets, value of knowledge, Passifloras

RESUMEN:
El presente artículo se enmarca en la generación de productos como activo intangible producido en el ámbito universitario; analizando los resultados en proyectos de investigación en especies cultivadas del género Passifloras en la Universidad Nacional de Colombia-sede Bogotá. Este estudio se estructura desde la visión de la experiencia de investigadores de ciencias básicas en bioprospección y la metodología empleada se basó en los costos asociados para desarrollar el conocimiento. Los resultados demostraron que en los siete proyectos analizados se evidencia el gran número de productos generados en relación a los planteados en las propuestas iniciales de los mismos.
Palabras clave: Activos intangibles, valor del conocimiento, Passifloras

1. Introduction

The scientific knowledge that is produced in research projects developed by teachers-researchers of Colombian universities constitutes an intangible asset that is, to a large extent, a generator of social development and, to a lesser degree, a factor of production. In economic-accounting terms, an intangible asset means a non-monetary asset that cannot be seen, touched or measured physically (Brookings Institution, 2000; Edvinsson & Malone, 1997; Stickney & Weil, 1994; Barro, 1991).

Moreover, although teaching, publishing and dissemination have been traditionally effective means to transfer and assess the knowledge generated in the university environment, there are also methods to transfer it to society as a production factor, through patents, licenses or the creation of technology-based companies (spin off). This is a response to the fact that society increasingly demands from universities the usufruct of scientific and technological knowledge as a whole. Additionally, the transfer of knowledge in universities involves activities linked to the generation, application, use and exploitation of knowledge (Mehta & Madhani, 2008).

According to the Colombian Association of Universities ASCUN4 (2012), the infrastructure developed to support the processes of knowledge transfer that the academy must make towards the environment has not been strengthened. In addition, no references have been established to manage costs of research, development and transfer, and, most worrying, the existing regulation is not clear. Furthermore, the

transfer through patents from universities to the productive sector is not yet representative, because in most cases development is not transferred from the university to the social environment, due to internal or external factors that hinder the processes. One of these internal factors is the difficulty of determining the commercial value of the knowledge generated. It is evident that public universities must overcome the barriers that do not allow them to enter the entrepreneurial phase of knowledge, which limits them to a traditional approach to teaching and research, where the latter is not necessarily focused on the transfer of results to the productive sector (Morales, 2008). However, it is noteworthy that the production of knowledge in Colombian universities is more evident as a generator of social development than as a factor of production.

On the other hand, from the point of view of the accounting record in the National University of Colombia, only the portion of intangible assets (such as the knowledge generated) in research projects corresponding to the stage of development are recognized as such, and when it is not possible to separate in stages, everything will be recognized as an expense or cost for research (National University of Colombia. National Financial and Administrative Management, 2017. Project Implementation of the Normative Framework for the Government Entities - General Accounting Office of the Nation5).

In this context, this article arises from the need to assess quantitatively research products (training of human resources, social appropriation and generation of knowledge) obtained in seven projects in cultivated species of the Passifloras genus. The analysis is focused to a greater degree from the social perspective, in which knowledge is considered fundamental for social development, satisfying needs and solving problems of local communities and small and medium enterprises. Given that the results of the projects analyzed were generated in the research stage, this study is not based on the premise of knowledge as a factor of economic production.

The purpose is to draw the attention of researchers in basic sciences, so that they participate actively in the development of models for the valuation of knowledge in the stages of research and development in projects with a social impact; even more when the social impact of science and technology and its evaluation is a subject still in full development. Many questions and lines of development are open (Solis-Cabrera, 2015). To achieve this purpose, it was necessary to initially analyze the existing knowledge transfer schemes and the intellectual capital valuation models.

1.1. Theoretical framework

This section presents the definitions of the basic theoretical elements that are necessary to understand the different topics called knowledge, intellectual capital, knowledge measurement, knowledge as an intangible asset, valuation of intangible assets and valuation of knowledge according to the approaches of knowledge transfer.

Knowledge

Knowledge is defined and described as experiences, as well as the understanding of the environment of a problem that governs our behavior, in a way that allows us to obtain a required response (McQueen, 1999). Likewise, it is defined as a fluid mixture of framed experience, values, contextual information and information from experts that provide a framework to evaluate and incorporate new experiences and information (Ipe, 2003). It is common for several authors to relate the definition of knowledge with information; for example, knowledge is an understanding of information and its associated patterns (Singh, 2008). Knowledge is conceptualized as encoded information that includes information, interpretation, context, experience, wisdom, and so on (Fong, Ooi, Tan, Lee & Chong, 2011).

Additionally, the types of knowledge are defined as the ways in which man is able to classify and acquire information in order to face and solve all the problems that arise, such as scientific knowledge, which is the development or collection of new knowledge through the scientific method. Krogh, Ichijo, & Nonaka (2000) emphasize that knowledge is always linked to a specific context. Similarly, Ipe (2003) emphasizes that knowledge is context specific and related to the medium in which it is generated. In conclusion, knowledge is based on experiences, and its formation and transformation is influenced by the personality of each individual. Knowledge increases the value of an organization and the achievement of its objectives, mission and vision. From the scope of the individual, work-related knowledge is an essential element that determines the professional success of an employee, along with their abilities and skills (Fong, Ooi, Tan, Lee & Chong, 2011).

Intellectual capital

In contrast to the subjective characteristic of knowledge, intellectual capital is a concept closely related to organizations. This consists of knowledge, information and experiences that can be used by an organization to generate wealth (Stewart & Ruckdeschel, 1998). Likewise, intellectual capital is defined as possession of knowledge, applied experience, organizational technology, customer relations and professional skills that provide a company with a competitive advantage in the market (Montequín, Fernandez, Cabal & Guitiérrez, 2009). In conclusion, intellectual capital is a broader definition, because it emphasizes the sum of intangible assets not recognized by traditional financial statements (Castilla-Polo, Sanchéz-Hernández, Gallardo-Vazquez & Ruiz-Rodriguez, 2016).

Knowledge measurement

According to Cárdenas (2005) the valuation or measurement of knowledge is a field little explored in relation to goods and services that are not measured because they are not part of the negotiable goods in the market. There are several reasons that justify this situation: a) Existing methodologies for measuring intangible resources such as Know How do not apply to all products; b) There is not enough technical and scientific knowledge to measure them; c) The complexity of measuring knowledge due to its nature (Arango, Pérez & Gil, 2008; Nevado-Peña & López-Ruiz, 2000).

Knowledge as an intangible asset

Following the definition of the International Accounting Standards Board, an intangible asset must be non-monetary, without physical and identifiable substance. It is defined as a long-term resource, which has no physical appearance; it retains its intrinsic value independently of the variations generated by inflation; it is fully identifiable, that is, it has no control and is not subject to or dependent on other goods. In addition, it is controllable and generates future economic benefits (Funes-Cataño, 2010).

Due to the aforementioned considerations, knowledge is classified as an intangible asset, since it comprises human knowledge, know-how and intellectual property grouped into patents, copyrights, trademarks and patented technology, among others (Mehta & Madhani, 2008; Gonzáles de la Fe, 2009).

Valuation of intangible assets

Various methodologies have been developed for the valuation of tangible assets (Cuzco & Redrován, 2012; Chaves, 2004; Jaramillo, 2010). However, the development of intangible asset methodologies has limitations such as the impossibility of pricing elements that are not visible and are variable to the conditions of the environment. Several proposals have been implemented in the valuation of intangible assets with a quantitative and qualitative approach. The proposal most used and accepted is the proposal of the International Valuation Standards Council (IVSC). This method takes into account: a general framework, general rules, asset standards, valuation applications and codes of ethical principles (Moreno, 2011). From the qualitative point of view, the valuation of intangible assets (such as know-how) in the academic and business are based on the methods: cost, market value, and income or sales (Correa, Arango & Álvarez, 2012).

Assessment of knowledge according to knowledge transfer approaches

When it is sought to establish the way in which the knowledge that the university produces for society is integrated, it is important to indicate that there are two strategies to realize that integration depending on the direction that would like to be given to the knowledge. In this sense, there is a focus on the transfer for economic and social development, characterized by a strong relationship with the market and the productive sector. The purpose is for the transfer to support the premise of knowledge as a factor of production and cultural-social approach, (training, social appropriation and knowledge generation), considering it as fundamental to generate social development, satisfying needs and solving problems for communities (Correa, Arango & Álvarez, 2012; Castaño & Arias, 2015; Correa, Arango & Castaño, 2011).

On the other hand, it is important to highlight that various methodological proposals for knowledge valuation have emerged as an intangible asset that address two approaches -qualitative or quantitative- and their application depends on the objective of the valuation, the type of entity, and the availability of the information (Nevado & Lopez, 2007).

2. Methodology

The conceptual framework presented in this article has been based on the literature review of fields such as knowledge, scientific knowledge, intellectual capital, university technology transfer, valuation of intangible assets and valuation methods. These fields of study were identified through a search of academic literature available mainly through databases such as Science Direct and Scopus. The references in the articles found were later examined to find more relevant articles. Once these publications were identified, the ideas related to methods and techniques of economic valuation of knowledge were summarized. The findings that emerged from the literature were synthesized in order to gather all the relevant ideas to provide an integral approach and understand the phenomenon of the value of knowledge and its assessment in the university environment.

Case study: Projects in cultivated species of the genus *Passiflora edulis Sims* (gulupa) and *Passiflora tripartita* var *mollissima* (curuba)

For this study, seven research projects with objectives related to the generation of knowledge in *P. edulis*, and *P. tripartita* were selected. The projects were developed at the National University of Colombia, Bogota headquarters, co-financed by Colciencias, the Ministry of Agriculture and Territorial Development and/or entities of the productive sector, between the years 2009-2019.

3. Results

Types of projects

Initially, the seven projects were classified according to their basic research objectives (P1, P2, P3 and P4) and research and development (P5, P6, P7) [table1]. Subsequently, the analysis was based on the classification and quantification of the different results generated in the projects, such as: training of human resources (undergraduate, masters, doctorate, postdoctoral); social appropriation and generation of knowledge, in the two species of Passiflora. Then, the closest relationships were established between the budget items and the types of results achieved (table 2).

Generated products

The products generated according to the three types of results are presented in Table 1. It was observed that in projects P1, P2, P3 and P4, the research objectives were framed to a greater degree in basic sciences, a situation that is evidenced by a high number (48 graduates) of training products and knowledge generation (26 articles). In relation to projects P5, P6 and P7, it was determined that the research and development objectives were focused on reaching development products for communities and companies. Thus, the results in training were slightly smaller (14). However, in the first place, it is important to emphasize that the products proposed in training were initially lower (19) in relation to those that were achieved at the end of the investigations. For example, the training of 27 undergraduate and 35 postgraduate students (29 masters, 5 doctorates, 1 Postdoc) was achieved, for a total of 62 graduates.

From the seven projects a patent was generated for the development of a package (P7), a result obtained in one of the research and development projects. This product is aimed at the industrial sector, but only its monitoring and evaluation could determine its social economic impact and the benefit for the university in the future.

It is important to highlight that the number of patents produced by a country is one of the main indicators of innovation and development (Molina, 2010). However, the success and role of patents as dynamizers of scientific and technological development must be analyzed and adjusted in the environment of Colombian universities and even more in a developing society like ours (Rodríguez, Olaya & Duque, 2016). Botero´s (2017) approach is interesting, as it indicates that, for example, the Aarhus University of Denmark is implementing the open science model, abandoning to a large extent the protection of patents in its alliances with the private sector. They generate commitments among its researchers and private partners to openly publish the results of their research and not to patent what is derived from the basic research produced within the university in selected sectors.

Table 1
Types of products achieved in the seven projects of the study.
*Proposed; **Achieved; + Proposed and achieved

	Training	**Social Appropriation**	**Generation of knowledge**
P1	Undergraduate (1)* (6)** Masters (1)* (6)** Doctorate (1)* (2)*	Research book (1)+ Technical Document (1)+ Scientific events (0)* (18)** Workshops (2)*(4)**	Scientific articles (3)* (6)** Prototypes of products (2)+
P2	Undergraduate (0)* (5) ** Masters (3)* (5) **	Book (1)+ Producer seminars (1)+ Scientific events (0)* (10)** Workshops (0)* (1)** Course (1)+	Scientific articles (3)* (5)** Prototypes of products (2)+
P3	Undergraduate (0)* (5)** Masters (0)* (5)** Posdoctorate (1)+ Doctorate (3)+	Technical Documents(4)+ Scientific events (0)* (10)** Workshops (0)* (1)** Course (1)+	Scientific articles (8)* (10)** Prototypes of products (2)+
P4	Undergraduate (0)* (5)** Masters (1)* (5)**	Technological package (1)+ Scientific events (0)* (10)** Workshops (0)* (1)** Course (1)+	Scientific articles (1)* (5)** Prototypes of products (2)+
P5	Undergraduate (1)*(2)** Masters (2)* (3)**	Book (1)+ Patent (1)+ Technical Document (1)+	Scientific articles (2)+

		Course (1)+ Scientific events (1)+	
P6	Undergraduate(1)* (2)** Masters (1)* (3)***	Technical Document (1)+ Workshops (1)+ Research book (1)+ Events (1)+	Scientific articles (3)+
P7	Undergraduate (2)+ Masters (1)* (2)**	Technical Document (1)+ Course (1)+ Scientific events (1)+ Workshops (1)+	Scientific articles (1)+
Total	Undergraduate (5)*(27)** Masters (9)*(29)** Doctorate (4)*(5)** Posdoctorate (1)+	Research book (2)+ Technical Documents (8)+ Scientific events (2)*(50)** Workshops (4)* (9)** Producer seminar (1)+ Course (5)+ Technological package (1)+ Patent (1)+ Book (2)+	Scientific articles (21)*(32)** Prototypes of products (8)+

Table 2
Classification of the three types of products in relation to the types of costs associated with each of the seven projects. Values in thousands of pesos * Undergraduate and postgraduate

	Training*							
	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**Total**
Teams	828370	665000	1995000	1319700	528000	112404	293190	5741664
Materials	217000	180000	205000	209500	175000	66855	85881	1139236
Technical services	330000	0	30000	30000	176000	114000	6000	686000
Scientific personnel	586000	212000	1029000	558800	104503	174805	99368	2764476
Technical personnel	0	0	0	0	0	0	80860	80860
Total	**1961370**	**1057000**	**3259000**	**2118000**	**983503**	**468064**	**565299**	**10412236**
	Social	**Appropriation**						
Publication	22000	10000	15000	10000	0	0	5000	62000
Field Trips	75000	0	20000	0	0	0	0	95000
Travels	15000	0	6400	10000	11000	7000	0	49400
Academic events	20000	0	36000	10000	0	0	0	66000
Total	**132000**	**10000**	**77400**	**30000**	**11000**	**7000**	**5000**	**272400**
	Knowledge	**Generation**						

Publication	22000	10000	15000	10000	0	0	5000	62000
References	28000	20000	90000	30000	0	0	0	168000
Academic events	20000	0	36000	10000	0	0	0	66000
Total	**70000**	**30000**	**141000**	**50000**	**0**	**0**	**5000**	**296000**

Another aspect that was analyzed was the total costs of the salaries of scientific and technical personnel in the seven projects. This expense was discriminated between the financed and the counterpart value assumed by the university and/or another entity (Table 3). In this regard, it is important to mention that, in the projects classified as basic sciences, the budgets were higher and had counterpart values. On the contrary, projects P5 and P6 did not present financing values and P7 in low amount. This situation allows inferring that the number of products in the projects studied was directly proportional to their financial resources.

Table 3
Total human talent costs * of the seven projects executed.
* Scientist and technician. Values in thousands of pesos.

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**
Financed	48000	110000	218000	160000	0	0	72000
Counterpart	538000	102000	443700	398800	104503	174805	100272
Total	586000	212000	661700	558800	104503	174805	172272

4. Conclusions

Research projects are a fundamental part in the training of human talent and in problems specific to the Colombian reality.

The generation of knowledge must be formulated taking into account the communication mechanisms that will be used to publicize its results. The analysis of the types of results achieved in the seven projects studied was able to show the large number of products in relation to those indicated in their initial proposals.

The evaluated projects are part of the expenses on science and technology as a socio-economic objective and are researches with high potential for social impact.

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Bibliographic references

Arango, G., Pérez, H. & Gil, M. (2008). Propuestas de modelos de gestión del capital intelectual: Una revisión. *Contaduría Universidad de Antioquia, 52*, 105-130.

Barro, R. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics, 106*(2), 407-443.

Botero, C. (2017). Universidades: ¿Patentar o no patentar? esa es la cuestión. Bogotá, Colombia. Retrieved april 1, 2019, from https://lasillavacia.com/silla-llena/red-de-la-innovacion/historia/universidades-patentar-o-no-patentar-esa-es-la-cuestion

Brookings Institution. (2000). Understanding intangible sources of value. *Report of the Intangibles Task Force*. Washington, D.C.

Cárdenas, L. (2005). *Indicadores de medición del conocimiento los retos de la ciencia, frente a los procesos de conocimiento.* Medellin: Departamento de Ciencias Contables Universidad de Antioquia.

Castaño, C. & Arias, J. (2015). Aproximación a la valoración del know how de una institución del sistema regional de innovación en Antioquia. *Civilizar, 25*(28), 151-164.

Castilla-Polo, F., Sanchéz-Hernández, M., Gallardo-Vazquez, D. & Ruiz-Rodriguez, M. (2016). Diseño de un modelo de reputación para cooperativas oleícolas. *Revista de Contabilidad, 19*(1), 154-167.

Chaves, P. (2004). La valoración económica de los activos de propiedad intelectual. *Revista de Ciencias Jurídicas, 105*, 51-80.

Universidad Naconal de Colombia (2018). *Informe cierre de gestión 2015-2018. Proyecto implementación del marco normativo para las entidades del gobierno – contaduría general de la nación.*

Correa, C., Arango, J. & Castaño, M. (2011). Metodologías de valoración de activos tecnológicos. Una revisión. *Revista Pensamiento y Gestión, 31*, 83-108.

Correa, J., Arango, M. & Álvarez, K. (2012). Metodología de valoración para proyectos de transferencia tecnológica universitaria. Caso aplicado. *Revista Facultad Ciencias Económicas,* Universidad de Antioquia*, 20*(1), 91-106.

Cuzco, L. & Redrován, M. (2012). NIIF para PYMES: activos intangibles. Cuenca, Ecuador: Universidad de Cuenca.

Edvinsson, M. & Malone, L. (1997). *Intellectual capital.* London: Pitakus.

Fong, C., Ooi, K., Tan, B., Lee, V. & Chong, A. (2011). HRM practices and knowledge sharing: an empirical study. *International Journal of Manpower, 32*(5-6), 704-723. doi:http://doi.org/10.1108/01437721111158288.

Funes-Cataño, Y. (2010). Valuación de los activos intangibles. Caso de la UNAM. *Revista del Centro de Investigación,* Universidad La Salle*, 9*(33), 45-60.

Gonzáles de la Fe, T. (2009). El modelo de triple hélice de relaciones universidad, industria y gobierno: Un análisis crítico. *Ciencia, Pensamiento y Cultura, CLXXXV*(738), 738.

International Valuation Standards Council [IVSC]. (2017). *Estándares Internacionales de Valoración.* London: International Valuation Standards Council [IVSC]. Retrieved from https://fecoval.org/wp-content/uploads/2017/03/NORMA-I.-DE-VAL.-2017.pdf

Ipe, M. (2003). Knowledge sharing on organizations: A conceptual framework. *Human Resource Development Review, 2*(4), 30-39.

Jaramillo, F. (2010). *Valoración de empresas.* Bogotá: ECOE ediciones.

Krogh, G., Ichijo, K., & Nonaka, I. (2000). *Enabling knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation.* Oxford: Oxford University Press.

McQueen, R. (1999). Can collaborative technology support tacit knowledge creation in individuals? In Proceedings of the Fifth America's Conference on Information Systems. Atlanta, USA.

Mehta, A. & Madhani, P. (2008). Intangible Assets. *The Accounting World, 8*(9), 11-19.

Molina, O. (2010). La transferencia de conocimiento científico y tecnológico: un reto que deben afrontar las universidades Departamento de Propiedad Intelectual e Innovación, Dirección de Investigación Científica y Posgrado, UNAH.

Montequín, N., Fernandez, V., Cabal, F. & Guitiérrez, V. (2009). An integrated frame implementation in small and medium-sized enterprises. *Journal of Information Science, 32*(6), 525-538.

Morales, S. (2008). El emprendedor académico y la decisión de crear spin off: un análisis del caso español. *Tesis doctoral*. Uniersidad de Valencia, Valencia, España.

Moreno, A. (2011). Revisión crítica de los modelos para la gestión y valoración de intangibles (1ª parte). *Partida Doble, 233*, 20-31.

Nevado, D. & Lopez, V. (2007). Medir los intangibles: claves para determinar el valor de la empresa. Caso de estudio España. *Estrategia Financiera, 236*, 1-20.

Nevado-Peña, V. & López-Ruiz, D. (2000). ¿Cómo medir el capital intelectual de una empresa? *Revista Partida Doble, 115*, 42-53.

Rodríguez, H., Olaya, E. & Duque, G. (2016). Valoración de nuevas creaciones derivadas de proyectos de investigación en universidades colombianas. Una revisión integral. *V Congreso Internacional de Gestión Tecnológica y de la Innovación*, Bucaramanga.

Singh, S. (2008). Role of leadership in knowledge management: a study. *Journal of Knowledge Management, 12*(4), 3-15.

Solis-Cabrera, F. (2015). Medir el impacto social de la ciencia y la tecnología: ¿viable o utópico? *Revista Iberoamericana de Ciencia Tecnología y Sociedad, 10*(1), 57-59.

Stewart, T. & Ruckdeschel, C. (1998). Intellectual capital: The new wealth of organizations. *Performance Improvement, 37*(7), 56-59.

Stickney, C. & Weil, R. (1994). *Financial Accounting.* Forth Worth: The Dryden Press.

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5. National University of Colombia. National Financial and Administrative Management, 2017. Project Implementation of the Normative Framework for the Government Entities - General Accounting Office of the Nation Universidad Nacional.

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