

# Impact on the Transfer of a Management Model in the SMEs of Valle de Aburra, Colombia

Gastón Rodríguez, Jorge Betancur and Fredy Garcés

Facultad de Ciencias Empresariales, Institución Universitaria de Envigado, Colombia

Business school. University of Envigado, Envigado – Colombia

[grodriguez@correo.iue.edu.co](mailto:grodriguez@correo.iue.edu.co)

[jhbetancur@correo.iue.edu.co](mailto:jhbetancur@correo.iue.edu.co)

[jfgarces@correo.iue.edu.co](mailto:jfgarces@correo.iue.edu.co)

**Abstract:** The objective of the study is to show the impact of knowledge transfer from the university, using a model for business transformation in SMEs in Colombia. The research problem arose after making the diagnosis of each business enterprise, evidencing the need to strengthen its management model; by applying a business model designed for SMEs. For this purpose, the Research and Consulting Center (CIC) of The University of Envigado has designed and implemented a Management System for Business Transformation SIGET PROS. The methodology used was based on techniques for the collection and analysis of statistical information, making measurements before the transfer of knowledge and after the implementation of the transferred model. The SIGET PROS is characterized by immersion, which allows diagnostics to be made from within the companies and the construction of strategies, for each one of them, with a team of experts. The findings are presented in two complementary fields: 1) diagnosis of the initial results of each participating SME; and 2) a second diagnosis after the implementation of strategies, for the comparison of the results of appropriation of the transferred knowledge. The usefulness of the findings is in measuring the impact of the transfer of a management model (SIGET PROS), in a group of 50 SMEs. The conclusions indicate that the transfer of knowledge from the universities to the productive sectors allows achieving results that impact each SME.

**Keywords:** knowledge management, SMEs, Management Scanner, Management model, knowledge transfer.

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## 1. Introduction

The interest in the study of SMEs arose after identifying the business enterprises factors in Aburrá Sur - Colombia, which resulted in the need to design and develop a model to transform and strengthen the management of this type of enterprises.

As an approach, The University of Envigado with its group of researchers took on the task of designing a business management model that would adjust to the needs and facts of SMEs. The objective of this work is to show the impact of the application of the SIGET-PROS, in 50 SMEs from different productive sectors, which took place between the years 2019 and 2021. The time of application of the model in all the SMEs was 10 months, clarifying that not all started the application process at the same time. The implementation of the model began with the collection and processing of information, through questionnaires, interviews and focus groups. The results were classified in the Management Scanner (EG), which allowed comparing the results between the first (EG1) and the second (EG2), after carrying out strategic projects. In the analysis of statistical results, the median was used, as it was a measure of central tendency. The conclusions on the impact of knowledge transfer from the university to SMEs evolved around the results obtained in the EG from the 50 intervened companies, which all showed an increase in their final measurement.

## 2. Theoretical Framework

Modern Society recognizes the importance of knowledge management as a fundamental resource for Society and organizations (Adelstein & Cleeg, 2014), due to its unlimited potential which contributes to the growth and innovation of companies (Soto, Colomo and Popa, 2014 ) and its competitive projection in the market (V.H. Lee, Foo, Leong, & Ooi, 2016). In this sense, the collective learning of the company's employee's stands out, which constitutes a competition strategy (Prahalad and Hammel, 1990).

Taking into account the previous concepts, knowledge management in organizations constitutes a human intellectual capital that has the capacity to transform it, through learning, socialization and implementation, creating new strategies and developments (Azyabi and Fisher, 2014). Consequently, knowledge management arises from within organizations, enabling the strengthening of the company's "know how", as a way of strengthening each of its processes.

When organizations prioritize knowledge management within their employees, they have a greater capacity for creativity and innovation, since they are the ones who have the potential to identify and develop new business perspectives, which, supported by information systems, systematize knowledge, nurtured as a continuous flow of capabilities, which trigger learning generated by the same members of the organization. (Kaiser, Kragulj & Grisold, 2016).

Zapata (2004), considers that there are four (4) attributes in knowledge management models that are key to its transfer within the organization: coding, ease of teaching, uncertainty and complexity.

The codification of knowledge is done through company employees who transfer their knowledge (Bueno, 2002), so staff must be trained to develop the ability to spread and share knowledge among all members of the organization. (Argote and Miron-Spektor, 2011).

According to Lewandowski, Salako, and Garcia (2013), the attribute provided by the knowledge transfer of management models is ease of teaching, but without codifying it, teaching remains in the individual and does not transcend the organization as “Know How” of procedures that promote the management of organizational innovation (Arias, Ó., Betancur, J and Rodríguez, G. (2017).

The uncertainty of knowledge refers to the fact that at the time of its transfer it can be ambiguous and even lose context when applied. To eradicate uncertainty, the integration of coding with teaching should be sought, so that the transfer process transcends the organization (Cegarra, J., Sánchez, M. & Cegarra, D. (2011).

Drucker (1993) recognizes the importance of the transfer of knowledge of organizational models, noting that it is a complex process and therefore poses it as a challenge for the executives of the organizations of the future. Senge (1990) indicates that organizations that learn and unlearn and rebuild their paradigms develop capacities to stay in the midst of change, functioning as a complex behavior system.

For more than 13 years of research, this business management model manages to consolidate itself, with design and architecture focused on the needs of Latin American SMEs, as a methodological tool that seeks to contribute to the transfer of knowledge within organizations.

Its structure was designed under the concept of business management model (Ortiz, & Pedroza, 2006) with systems and subsystems of the whole and the parts, made up in its business architecture by: People, Management, Structure and Environment. In turn, each dimension is displayed in 13 attributes; the attributes are displayed in 47 variables and these contain a group of 197 sub variables. The architecture of the model works with the interdependence between the Dimensions, the Attributes, the Variable and sub variables; so that a change in any of the previous components generates new states of order (Watts, 2002). This interaction between the parties operates as an organized whole (Prigogine & Stengers, 2002), enabling the intervention of SIGET PROS in companies, which is evidenced in the results of appropriation of knowledge transferred to Colombian SMEs.

### **3. Methods**

The methodology used in the application of the knowledge management model in 50 SMEs is quantitative, qualitative and descriptive. An open invitation was made to SMEs from different productive sectors starting in 2019, the year in which 19 SMEs participated in the process. In 2020, 18 SMEs participated, and in 2021, 13 SMEs participated. All participating SMEs were the result of the open invitation.

Comparisons were made from the results Using the data, (Wolcott, 2003; Galeano, 2004) obtained in two measurements (EG1 and EG2) applied to each SME.

Scores were recorded in the EG taking the results of the interviews, questionnaires, focus groups and documentary review of each SME. The scores were assigned applying the GA characteristics described in Table 1.

The median was applied to the statistical data, as it is a more objective measure of central tendency than the arithmetic average. (Obando, J. 2007).

**Table 1:** Characteristics of the EG

The EG applies an information classification scale with 4 levels: Advanced, Viable, Alert and Risk

• LEVEL	• CHARACTERISTICS
• <b>ADVANCED</b>	<ul style="list-style-type: none"> <li>• These are characteristics of leading SMEs in their industry that create learning dynamics both within and beyond the company. They are constantly updated in all of their processes and make updates in systemic management methods. Its internal structure is dynamic, and high levels of worker participation are valued at all levels; they are a part of the changes at all levels, contributing positively to their economic sector's development.</li> <li>• These are high-quality features that demonstrate the company's success.</li> <li>• All of the characteristics that are considered to have a high grading, between 8 and 10, are listed here.</li> </ul>
• <b>VIABLE</b>	<ul style="list-style-type: none"> <li>• Characteristics of SMEs that recognize the value of investing in long-term initiatives, attempt to integrate some areas, and preserve some communication routes to allow for the flow of ideas and proposals. They have some investment plans in place, as well as personnel training and technological investments. They keep the transition going by providing training, updates, and technology transfer at all levels.</li> <li>• They are qualified aspects with a score between 6.0 and 7.9, indicating that the company is performing well, but that it can always do better by implementing improvement plans.</li> </ul>
• <b>ALERT</b>	<ul style="list-style-type: none"> <li>• Characteristics of SMEs with some opportunities for management engagement and limited outlets for the dissemination of innovative ideas; Few initiatives are being funded, and those that are, are currently in the short term.</li> <li>• These factors are scored between 4.0 and 5.9 because they reveal oversights in the company's various operations, which result in errors that reduce productivity and competitiveness.</li> </ul>
• <b>RISK</b>	<ul style="list-style-type: none"> <li>• They are characteristics of SMEs that have a linear management style, with few open spaces for involvement, a few employees, and low management and modernization methods.</li> <li>• They are usually graded from 0.0 and 3.9, indicating oversights, poor procedures, and major errors, failures that leave a negative impression and worsen and threaten the company's viability.</li> </ul>

The application of the knowledge management model lasted 10 months for all SMEs, during which time was implemented its architecture which is made up of Dimensions, Attributes and Variables that are integrated into the EG application.

The SIGET PROS uses a multi-criteria methodology that combines qualitative and quantitative criteria (Valenzuela-Jiménez, Giner-Fillol, & Ripoll Feliu, 2019), as well as a numerical score qualification assignment accompanied by descriptors that clarify and facilitate the analysis of results recorded in the EG. A committee of experts qualifies and classifies these quantitative and qualitative indicators, allowing for the evaluation and quantification of integrated project performance while also demonstrating knowledge transfer and strengthening for each SME.

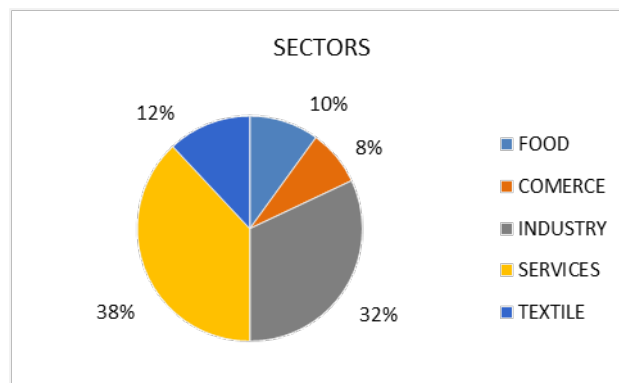
The SIGET PROS architecture is presented in the table 2:

**Table 2:** SIGET PROS architecture

DIMENSIONS	ATRIBUTES	VARIABLES
People	Human management	Organizational development; human talent development; social welfare
	Organizational Environment	Physical conditions; management style; rewards
	Organizational culture	Coexistence; communication
Structure	Finance	Internal funds generation; liquidity of the company; business cycle; business profitability vs. non-quality costs; fulfilment of the organizational strategic objectives.
	Technology	Clean technology; technological innovation; computer equipment; manufacturing technology or servo manufacturing; software
	Infrastructure	Strategic location; physical structure; space optimisation; security.
Management	Processes	Managerial; mission; support; assessment.
	Functions	Strategic; tactical; operational
	Institutional philosophy	Mission; vision; policies; principles and values
Environment	Political-legal	Legislation; tax and customs policies; business promotion policies
	Context	Clients; providers; competitors
	Social-environmental	National and international policies; local and departmental development plans
	International	Imports; exports

#### 4. Findings and discussion

The SIGET PROS shows how changing one of the sub variables affects the variable, attribute, and dimension to which it belongs; as a result, a comprehensive intervention, that is, intervening in a variety of sub variables with integrated projects aimed at achieving knowledge transfer for each SME, is required (Rodríguez, G and Betancur, J. (2011). To that goal, strategic projects are developed to intervene in the organization at the sites highlighted in EG1, generating results from the SME at an early stage A. EG2 is used again in a second measurement to determine and quantify the rise in the SME's growth in moment B. Depending on the efficiency and resources utilized in the execution of strategic projects, 10 months can elapse between moments A and B. The use of the SIGET PROS in 50 SMEs over a three-year period (2019-2021) is used as a benchmark in this study.



**Graph 1:** Distribution of companies by sectors.

During this time, the monitoring process was carried out on the 50 participating SMEs, indicating that while not all of them began in the same year, an initial EG1 measurement was applied to all of them, transformation projects were designed, and developed over a ten-month period, at the end of which a second EG2 information

was collected to measure the impact on knowledge transfer. Graph 1 Distribution of companies by sectors, indicates that most of the companies participating in this research 19 SMEs (38%) belong to the services sector; It is followed in participation by the industrial sector with 16 SMEs (32%); with lower percentages are the textile sector with 6 SMEs (12%), the food sector, 5 SMEs (10%) and the trade sector with 4 SMEs (8%). All the companies are SMEs, legally constituted and located in Valle de Aburrá, Colombia.

Table 3: Distribution of SMEs by sector and years.

MEDIAN	2019	2020	2021
FOOD	18,39%	13,90%	25,15%
COMERCE		11,94%	19,16%
INDUSTRY	20,92%	9,77%	13,05%
SERVICES	21,11%	10,63%	6,18%
TEXTILE	18,66%	13,71%	

Next, the analysis of the impact of the results of the EG will be overviewed by years:

In 2019, the sector with the greatest impact (21.11%) was the service sector, closely followed by the industry sector (20.92%). The textile sector and the food sector had a very similar impact (18.66% - 18.39%). This year no company in the commerce sector was intervened.

All sectors presented a positive impact on their results. The food and textile sectors had the highest impact (13.9% - 13.71%), followed by the trade and services sectors (11.94% - 10.63%); and the one with the least impact was the industry sector (9.77%). The confinements caused by the pandemic (year 2021) slowed down the impact and dynamism in the application of the EG in SMEs.

In reference to the year 2021, a growth in the application of the EG is observed, even higher than the year 2019 before the pandemic, in the food sector that presents the greatest rebound (25.15%) followed by the commerce sector (19.16%). In the industry and services sector, a decrease is observed compared to 2019, caused by the slow recovery of these sectors in the post-pandemic. This year there was no implementation of the EG in any SME in the textile sector. In general terms, it is highlighted that in the three (3) years in which the EG was applied, there was a growth in its results.

#### **4.1 Diagnosis results (EG)**

The procedure starts with a diagnostic tool called (EG), which is described as an instrument that "allows assessing and detect the transit processes of a strategic trajectory" (Limone, & Marinovic, 2013). The company's strategic initiatives are used, as well as evaluation tools that reflect progress on the projects' development. For this, an information collecting system is used, which allows for the measurement of each of the sub variables' behaviour from the time of diagnosis (EG1) through the implementation phase of the integrated projects and the completion of the established plans.

It is clarified that the results presented in EG1 and EG2, where the median was used as a measure of central tendency and not the mean, since the median is a descriptive measure that has the advantage of not being affected by extreme data, It does not depend on the values that the variable takes, but on the order of them. The median is a middle position statistic that divides a distribution into two halves, leaving the equal amount of values on either side. (Obando, J. 2007).

Taking the characteristics of the EG as a reference, the results are presented in the Table 4:

Table 4 demonstrates that due to the integration of their processes, human training, and an increase in internal demand, SMEs in the food sector progressed from the Alert level (5.81) to the Viable Level (6.65), representing a significant growth of 14.52 %. The commerce sector increased from 6.22 to 7.11, indicating a 14.22 % increase in the impact of knowledge transfer, owing to the expansion of management and technological innovation in information systems, which aided its growth.

**Table 4:** Results of EG 1 and EG 2.

MEDIAN	EG 1	EG 2
FOOD	5,81	6,65
COMERCE	6,22	7,11
INDUSTRY	6,28	7,10
SERVICES	6,41	7,64
TEXTILE	6,22	7,18

The industry sector increased from 6.28 to 7.11, with a 14.98 % increase in the impact of knowledge transfer, driving its production factor primarily due to an increase in internal demand, producing transformation dynamics, and implementing technology transfer at all levels. Colombia's industrial performance outperforms that of other economies in the region (Andi, 2021).

The services sector increased from 6.41 to 7.64, with an increase of 18.16% in the impact of strengthening knowledge, making it the sector with the biggest growth recorded in both this study and the economy monitoring index - ISE. (Andi, 2021).

In summary, when comparing the results of EG1 and EG2, the services sector grew the most in terms of the impact of knowledge transfer (18.16 %), followed by the textile sector (16.07 %), and a growth that was fairly evenly distributed across the industry (14.98 %), food (14.52 %), and commerce (14.22 %) sectors.

**Table 5:** Strengthening SMEs by Dimensions

SECTOR	GENERAL	PEOPLE	MANAGEMENT	STRUCTURE	SETTING
FOOD	14,52%	14,72%	21,92%	12,68%	12,59%
COMERCE	14,22%	14,71%	14,85%	10,75%	12,92%
INDUSTRY	14,98%	13,35%	16,92%	15,22%	14,51%
SERVICES	18,16%	14,87%	10,56%	12,11%	13,97%
TEXTIL	16,07%	14,82%	17,75%	14,98%	17,79%

Regarding the results of the SIGET PROS by Dimensions, comparing EG1 and EG2, it is observed:

The Management Dimension had the biggest impact on knowledge transfer, accounting for 21.92 % in the food sector, 17.75 % in the textile sector, and 16.92 % in the manufacturing sector. The rearrangement of SMEs' production and administrative processes, as well as the adoption of integration methods at all levels: managerial, tactical, and operational, reinforced management.

In the case of the People dimension, there was a comparable influence on knowledge transfer between sectors, with 14.87 % of the service sector and 13.35 % of the industry sector. In the food and service sectors, there is less strengthening (2.94 % for each one). This component included staff training to consolidate and develop their abilities and skills, as well as a follow-up and subsequent evaluation of the skills obtained by each SME's personnel.

In terms of the Structure Dimension, the impact of knowledge transfer was strongest in the industry sector (15.22 %), followed by the textile sector (14.98 %), which is closely related to the previous sector. The food and service industries were similar (12.68 % and 12.11 %). This sector has established strategies aiming at good manufacturing practices, such as employing non-polluting raw materials, reducing waste, and recycling unused raw resources.

The textile industry (17.79 %) has the biggest impact on knowledge transfer, followed by the industrial sector (14.51 %), and the service sector (13.97 %), with the commerce and services sector (13.97 %) performing evenly (12.92 % and 12.59 %). Alliances with suppliers were used by SMEs in this industry to avoid excessive increases in raw material prices, to stay competitive in the market, and to grow the number of clients.

#### **4.2 Discussion of the results.**

The analysis of the results is presented in the next section, which is done in light of previous studies to provide a variety of references.

Santos-Ferreira et al. (2021) indicated that in industrial enterprises it was possible to verify that the acquisition of knowledge had a positive impact, similar to this Research, since in both studies the enterprises were impacted by the acquisition of knowledge.

Voronov and Lavrinenko (2014) investigated the impact on subjective and objective indicators of competitiveness in SMEs; concluding that transferring and using knowledge in enterprises is considered a competitive advantage. In both investigations, a positive correlation has been established between knowledge management and the competitiveness of enterprises.

Jia, Kang and Gao (2016) design a model to solve problems in the aerospace industry; their model has 5 properties: input definition, reference material, associations, design support and modification element. This work is similar to the present investigation where the characteristics of common problems that need to be solved with the model are identified. Both (Jia, Kang and Gao, 2016 and this research) design management models to solve business problems.

The study of (Surya et al., 2021) examines economic growth as a determining factor in the strengthening of SMEs, in combination with factors such as government policies, capital support in business, and the strengthening of human resources; it is a mixed research methods (MMI) study with quantitative measurements and qualitative descriptions, showing results on the impact of the variables listed in the EG. As a result, the research discussed in this article enables us to identify the outcomes of the techniques applied as part of the SIGET PROS design.

Surya et al. (2021) identified the needs of each SME when doing fieldwork; the current study does so as well. While the aforementioned survey simply reflects the requirements and possibilities of SMEs, the work done in this project results in an intervention with proof of impact. According to Surya et al (2021), growth is only achieved in specific areas; however, growth is realized in all sectors (Table 5) and all engaged SMEs in this project.

Vargas-Garcia et al. (2019) conducted research to identify the impact of internal and external influences on the companies under consideration; a similar study was conducted in this study. Vargas-Garcia et al. (2019) demonstrated activities that must be taken in order for governmental and non-governmental groups to build action plans. This study, it carried out an intervention in the SMEs involved in the project, with the goal of strengthening, as indicated by the measurements acquired (Table 5)

Menne et al. (2022) developed a study focused on improving the performance of SMEs through the implementation of a strengthening model (sharia fintech) that strengthens marketing, human resources, productivity, and finances; this is a population-based study (Makassar, Indonesia), demonstrating the positive impact that the implementation of a government model (sharia fintech) has on strengthening the business enterprise of SMEs. Both studies (Menne et al., 2022 and this study) reflect the impact on strengthening SMEs with a focus on a variety of areas and understand the effect that the intervention of some variables has on the other variables of the business architecture. Both studies demonstrate the favorable impact of model implementation in all sectors and in all companies; both studies reflect the impact on strengthening SMEs with a focus on sustainability over time.

As a result, the cited studies highlight the importance of identifying the external and internal factors that influence SMEs' growth, causing negative consequences in some regions; similarly, the contrasted studies support the current investigation in the positive impact of actions aimed at strengthening, particularly when tools with a holistic approach are used to address various areas or dimensions of SMEs.

#### **5. Conclusions**

The results show that the transfer of knowledge of management models contribute to the strengthening of SMEs. The comparison of the findings of EG1 and EG2 reveal the impact of the transfer of the management model (SIGET PROS) in 50 SMEs in the Aburrá Valley, Colombia.

The impact of knowledge management transfer from the university to SMEs, through the application of the management model (SIGET PROS), is evidenced in the results obtained in the EG from the 50 intervened companies, in which all present an increase in its final measurement during the three (3) years, regardless of the surrounding circumstances. The results show that the business model contributes to the strengthening of this type of enterprise. (Betancur, J., Rodríguez G. and Rave, E. (2019).

The findings of EG1 and EG2, backed up by research, reveal that the SIGET PROS had a beneficial influence on knowledge transfer in all 50 SMEs that used it, contributing to their growth and survival in a highly competitive market.

This research, which was developed with the participation of entrepreneurs and with the support of local governments and the region's Chamber of Commerce, indicates that management models can be developed that are tailored to the specific context of regions and countries, contributing to the strengthening of the business enterprise of SMEs.

The entropy in which SMEs find themselves as a result of the growing influence of risk factors (OECD, 2020) necessitates that research and knowledge production centers focus their efforts on the construction of tools based on SMEs' expertise, the region's fabric production, and the countries' capabilities.

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