JOURNAL OF SMALL BUSINESS
STRATEGY

LEADERSHIP AND GOVERNANCE DECISIONS IN FAMILY BUSINESS PERFORMANCE: AN APPLICATION OF FUZZY SETS LOGIC

Ana Cristina Gonzalez
acgonzalez@icesi.edu.co
Universidad Icesi, Colombia

Yeny E. Rodriguez
yerodriguez@icesi.edu.co
Universidad Icesi, Colombia

Anibal Sossa
uasosa@icesi.edu.co
Universidad Icesi, Colombia

ABSTRACT

Leadership, governance and performance in family businesses are broadly studied, but results are contradictory. There is a need for deeper understanding of these relationships since emotional and behavioral aspects are complex in these types businesses. Questions on the how and the why of board functioning and ownership, and their influences on performance are scarce, given lack of data or a focus on quantitative data. To find a balance between qualitative and quantitative methods, we explore fuzzy sets logic as a methodology to expand knowledge in family businesses and present an application to build a representation of entrepreneurial performance results based on board of directors' composition and CEO's ownership, using case studies. Results indicate that the methodology offers alternative explanations to governance, leadership and performance dimensions in these businesses. Using fuzzy sets logic, we find that entrepreneurial performance is higher when outsiders' membership in boards of directors and CEO ownership are both high as well.

Keywords: Leadership, governance, family business, fuzzy set logic, business performance

INTRODUCTION

Leadership and governance are topics broadly addressed and discussed in family businesses. Leadership deals mainly with succession and business continuity, governance deals with agency or stewardship theories, as antecedents of business performance. Strategic leadership focuses on what top executives do, how they do it and their effects on the organization (Finkelstein, Hambrick, & Cannella, 2009, p. 4). The subject of strategic leadership research not only includes the executive leaders of organizations (i.e. the CEOs), but also other groups that have governance responsibilities and important influence. These include governing bodies like boards of directors. It is important to study strategic leaders because "the few people at the top of an enterprise have a major influence – through decisions and indecisions, boldness and timidity – on its form and fate" (Finkelstein, et al., 2009, p. 9). Moreover, if the unit of analysis is family businesses, it is necessary to include the family as a group that would influence decisions, as well.

Leadership, governance and performance in family businesses have been broadly studied, but results have been contradictory. Therefore, there is a need for deeper understanding of this relationship in family businesses since emotional, behavioral and organizational aspects are complex in these types of businesses. In addition, research on board process and functioning research is scarce, mainly due to lack of data or a focus on quantitative data. Thus, a balance between qualitative and quantitative methodologies is needed (Gersick and Feliu, 2014). Therefore, the purpose of this article is to explore fuzzy sets logic as an alternative methodology to examine the effects of board of directors and ownership on family business entrepreneurial performance.

Fuzzy-sets analysis is an analytic theory and method that extends on the concept of property space to bridge quantitative and qualitative approaches to measurement (Ragin, 2008, p. 82); it allows different configurations of cases conceived as combinations of qualitative attributes (Ragin, 2000, p. 181); and accounts for contingency and complex antecedent conditions (Woodside, 2010). While some researchers view cases with extreme values as outliers in conventional statistical methods such as regression, fuzzy-set analysis views these extreme cases as important and highly representative of the phenomenon under investigation (Sereikhuoch & Woodside, 2012, p.1).

Given that fuzzy set theory is case-oriented research, it contributes to explore feelings, and behaviors involved in decision-making. Therefore, it is a useful tool for family business literature, in particular, that related to leadership, governance, and their relationship to firm performance. The data we use in this article comes from the STEP Project (2016) for Family Enterprising, a global research project about entrepreneurial families' transgenerational entrepreneurship. We have access to an important amount of cases around the world that explores in detail, leadership and governance decisions and the outcomes in terms of entrepreneurial performance.

Specifically in this work, we ask the following research question: How can Fuzzy Sets Theory contribute to the understanding of family businesses' governance decisions and their relationship with entrepreneurial performance? Although we only use four of the STEP cases for the purpose of this paper, we suggest for future research to increase our sample and expand knowledge in the corporate governance and leadership fields in family businesses.

In this article, we review the literature, followed by the methodology and the illustration of the application of fuzzy sets on governance decisions and its discussion. We offer conclusions and suggest different venues for future research to take advantage of this methodological approach's potential in explaining family business managerial phenomena.

LITERATURE REVIEW

We begin the review with an introduction to fuzzy sets theory, followed by the literature on board of directors- performance relationship in family businesses and CEO's ownership level and its relationship with entrepreneurial performance.

Fuzzy Sets Theory

The meaning of the "fuzzy" term is unclear, however, in fuzzy set theory this term presents a new usage that is not related to its original meaning (Grint 1997; Kosko, 1993). In this context, "fuzzy" is applied to a set, whose objects can have different degrees of membership in it (Zadeh, 1995). It means that the object of study presents an ambiguous status with respect to the class in the set. According to Zadeh (1995), this ambiguity in the classes plays an important role in human thinking, in topics such as pattern recognition, communication of information, and abstraction.

The main advantage of fuzzy technique is that "researchers can analyze evidence in ways that directly reflect their theoretical arguments" (Ragin, 2000; p. 4), given that, fuzzy sets are based on theoretical and substantive knowledge. Unlike conventional quantitative approaches, whose focus is to explain variation in one or more dependent variables, not matter whether an independent variable is a subset of the outcome or a dependent variable. That is why Ragin (2000) states that conventional approaches have little use for set-theoretic relations.

Moreover, fuzzy sets and conventional quantitative approaches present different starting points. In fuzzy sets the research is case-oriented, while in conventional approaches the research is variable-oriented. In a case study, the goal is to examine many case's aspects in order to build a representation of each individual case from the interconnections among the aspects in each one of them. In other words, the variable-oriented study analyzes a small number of variables across a very large number of cases in order to construct a generic representation, based on patterns observed across many cases, using correlation among variables (Ragin, 2000, p.23).

Therefore, the inverse relationship between the number of cases and the number of variables is evident. In this way, it is important to note that the case-study approach is a good research strategy for studying "how" something takes place, but it does not provide a basis of generalization and of causation, as the variable-study can do. However, the in-depth study of a single case becomes relevant because this may be chosen given it is unique, extreme, or special in some way. The next step up, is then the investigation of multiple instances of the same outcome, from a single case study, in the way proposed by Mill (1843, 1967) with his "method of agreement."

Fuzzy sets is a technique of analysis of case-studies useful as tool of discovery. This technique injects new sophistication into the interrelation between theory and data, because it combines qualitative and quantitative assessment in a single instrument (Ragin, 2000). Currently, fuzzy sets are used in many

different fields, such as social sciences (Ragin, 2000), and business, finance and management (Bojadziev & Bojadziev, 2007). In particular, Jackson (2005) has studied an application of fuzzy sets in corporate governance. This author finds that employees have rights to representation within corporate boards in some countries explained by both union coordination and consensual political systems. The analysis covers 22 OECD countries, using cross-sectional and longitudinal data, and employs qualitative comparative analysis, and the application of fuzzy sets following Ragin (2000).

Fuzzy logic models present five steps in its analysis: i) definition of linguistic variables, ii) definition of decision rules, iii) evaluation of decision rules, iv) development of aggregation process, and v) development of defuzzification process. As follows, we explain each one of these steps.

i)   *Definition of linguistic process*
Fuzzy logic models use linguistic variables classified as inputs and outputs. Examples of linguistic variables in business contexts are risk investment, confidence, income and profitability, among others. These variables present different categories. The categories of linguistic variables are words. In the case of the linguistic variable risk investment, the categories can be low, medium low, medium, moderate, and high. Each linguistic variable presents a definition of universal sets called operating domain (Bojadziev & Bojadziev, 2007). In addition, each category is defined by a membership function ($\mu_A(x)$). In this case, a membership function is a curve that defines how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1.

It is assumed that the membership function ($\mu_A(x)$) is either piecewise continuous or discrete (Bojadziev & Bojadziev, 2007). Following the notation of Bojadziev & Bojadziev (2007) the membership rule that characterizes the elements (members) of a set $A \subset U$ can be established using the concept of membership function ($\mu_A(x)$) taking only two values, 1 and 0, indicating whether or not $x \in U$ is a member of A:

$$\mu_A(x) = \begin{cases} 1 & for\ x \in A \\ 0 & for\ x \notin A \end{cases}$$

Hence $\mu_A(x) \in \{0,1\}$.

The simplest membership functions are formed using straight lines. Of these, the most common are the triangular and the trapezoidal membership functions. Triangular function is a collection of three points forming a triangle. The trapezoidal membership function has a flat top. Figure 1 presents these membership functions.

This membership helps to define the risk investment of a person. For example, one person with a risk investment of 45 is medium low in terms of risk to degree 0.25, and medium for the degree 0.75. The degrees are found by substituting 45 for x into the second equation of $\mu_{medium\ low}(x)$ and the first equation of $\mu_{medium}(x)$.

ii)   *Decision rules*
Categories of input variables are related by means of decision rules, because the number of decision rules is calculated as the product of the number of categories of each input. The construction of these rules is where this approach demands researchers' theoretical clarity.
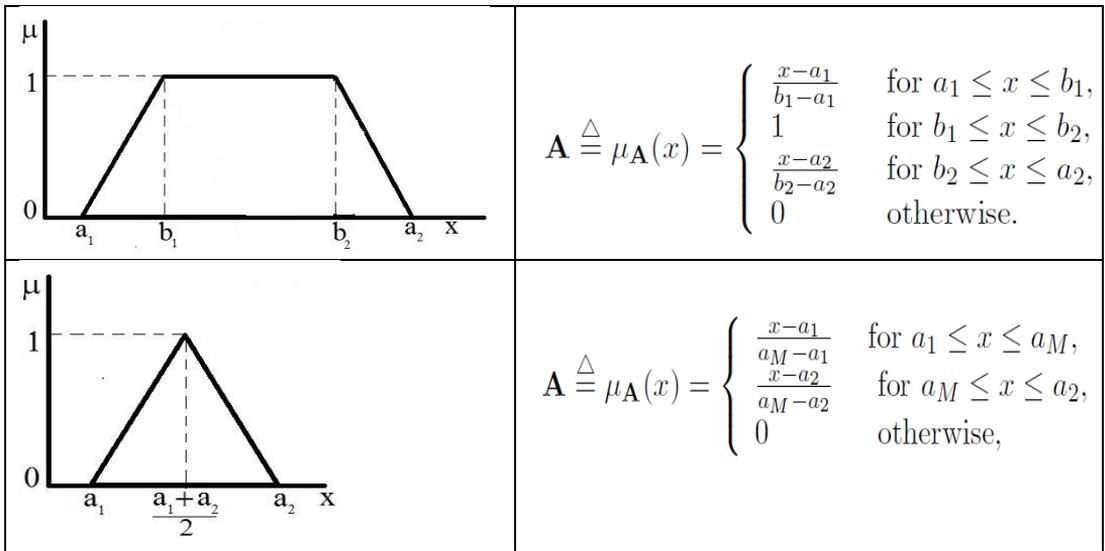
$$A \overset{\triangle}{=} \mu_A(x) = \begin{cases} \frac{x-a_1}{b_1-a_1} & \text{for } a_1 \le x \le b_1, \\ 1 & \text{for } b_1 \le x \le b_2, \\ \frac{x-a_2}{b_2-a_2} & \text{for } b_2 \le x \le a_2, \\ 0 & \text{otherwise.} \end{cases}$$

$$A \overset{\triangle}{=} \mu_A(x) = \begin{cases} \frac{x-a_1}{a_M-a_1} & \text{for } a_1 \le x \le a_M, \\ \frac{x-a_2}{a_M-a_2} & \text{for } a_M \le x \le a_2, \\ 0 & \text{otherwise,} \end{cases}$$

Figure 1. Trapezoidal and triangular membership functions

Figure 2 presents an example of the linguistic variable risk investment on the universal set $U = [0,100]$ by triangular numbers that specify the terms low, medium low, medium, moderate, and high.
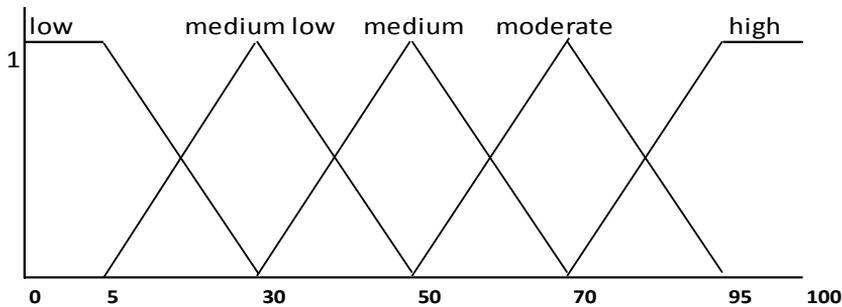

Figure 2. Terms of the linguistic variable risk investment

In this example, the terms' membership functions are as follows:

$$\mu_{low}(x) = \begin{cases} 1 & \text{for } 0 \le x \le 5 \\ \frac{30-x}{25} & \text{for } 5 \le x \le 30' \end{cases} \qquad \mu_{medium\ low}(x) = \begin{cases} \frac{x-5}{25} & \text{for } 5 \le x \le 30 \\ \frac{50-x}{20} & \text{for } 30 \le x \le 50 \end{cases}$$

$$\mu_{medium}(x) = \begin{cases} \frac{x-30}{20} & \text{for } 30 \le x \le 50 \\ \frac{70-x}{20} & \text{for } 50 \le x \le 70' \end{cases} \qquad \mu_{moderate}(x) = \begin{cases} \frac{x-50}{20} & \text{for } 50 \le x \le 70 \\ \frac{95-x}{25} & \text{for } 70 \le x \le 95 \end{cases}$$

$$\mu_{high}(x) = \begin{cases} \frac{x-70}{25} & \text{for } 70 \le x \le 95 \\ 1 & \text{for } 95 \le x \le 100 \end{cases}$$

iii)   Rules evaluation

The rules are evaluated to define specific values for all inputs. These values are called readings, which can be obtained by measurement, observation or estimation. Each reading must be matched against the appropriate membership function representing the categories of each linguistic variable, producing induced decision table.

iv)   Aggregation process

Aggregation process refers to finding the membership function image $\mu_A(\cdot)$ of fuzzy readings. These fuzzy terms are reduced to crisp values or singletons that are the actual intersection points between membership functions.

v)   Defuzzification process

In the defuzzification process, often called fuzzy average, an estimation of the output is produced, which represents the membership function of an aggregated fuzzy term. There is no unique way to perform the operation of defuzzification. For the purpose of this paper, we apply two methods: centroid and bisector, using the Matlab toolbox. Centroid represents the center of area under the curve. Bisector is the vertical line that will divide the region into two sub-regions of equal area.

Governance decisions and performance in family businesses

We want to apply fuzzy sets logic to understand how the presence of outsiders in the board of family businesses and CEO's level of ownership affect entrepreneurial performance. Governance systems pay the role of keeping the firm's goals and actions in line with the expectations of the firm's critical stakeholders via providing advice to and networking (service role), monitoring and aligning incentives of firm leadership (control role) (Hillman & Daziel, 2003). Given that firms are not similar in terms of who the

critical stakeholders are, governance mechanisms, processes, motivations and results vary as much as firms. Family firms as well are rather heterogeneous; therefore, corporate governance issues in family firms differ widely (Goel, Jussila & Ikaheimonen, 2014). Literature about family firm's corporate governance has mainly two theoretical perspectives: agency theory and stewardship theory. Agency perspective views family business leadership as selfish and driven by expropriating benefits for the family, i.e. family owners are self-serving at the expense of minority shareholders (Morck, & Yeung, 2003). Stewardship perspective views family business leadership driven by altruism towards all stakeholders and family in particular in pursuit of filial duty to provide for the next generation. Leaders under this perspective are characterized by self-actualization to the benefit of all stakeholders (Miller & Le Breton-Miller, 2006). In the family business field, it is important to understand that if we choose a particular perspective, it could change results or relationships, particularly the governance structure-performance one. Contradictory results are present and contingencies are being studied related to the family structure, leadership and ownership, board of directors' strategic participation, composition and processes. However, there is contradictory evidence on this point.

There are several questions directly related to governance decisions in family businesses. The first question we consider is why a private family-owned business would elect to establish a board of directors, particularly with outsiders, if it is not mandated by law. One potential answer to this question would be that any business has some need for external advice and counsel to better deal with ongoing business challenges. Providing advice and

counsel and even new ideas is a very important role of regular corporate boards (Hillman, Cannella, & Paetzold, 2000), even if it means some discomfort when executives have to justify their decisions to outsiders (Westphal, 1999). In addition, many business owners seek for resources (Pfeffer & Salancik, 1978, p. 145). Therefore, they choose to invite outsiders to participate in their boards of directors and that is why we choose this as the first input in our illustration.

Having advice and counsel from outside directors can serve two purposes. First, it can improve the decisions made by executives, as McDonald and Westphal (2003) and others have shown. In this case, the advice and counsel extends to situations of significant family conflict or disagreement (Lester & Cannella, 2006). Here, outside directors are likely to be linked to other family businesses and to have extensive family business experience to draw upon. Second, when decisions are made, the presence and support of outside directors may placate remaining family members, especially those who are not involved in the business, as they are more confident of the value of the decisions and trust that their interests have been considered (Lester & Cannella, 2006).

Family firm boards of directors have direct responsibilities in strategic choices like innovation, venturing or renewal and in monitoring and control, both of which could be reflected in performance (Daily, Dalton, & Cannella, 2003). These responsibilities will be easier to fulfill for outsiders than for insiders, especially if the insiders are not family members who are hesitant to challenge their boss or are concerned about keeping their jobs. As well, outsiders are more likely to ask questions not already considered by company managers or the CEO. These questions then

could lead to better strategic choices for the company (Blumentritt, 2006). Hence, boards of directors that include outside members contribute expertise and objectivity, alternative perspectives, farsighted investment, on-the job learning and core skill development (Miller & Le Breton-Miller, 2006) that may eventually explains performance, in particular, entrepreneurial performance, the output in our application. The definition of entrepreneurial performance that we use is the following: "The sum of an organization's innovation, renewal, and venturing efforts where innovation involves creating and introducing products, production processes and organizational systems[…] Renewal means revitalizing the Company's operations by changing the scope of its business, its competitive approaches, and acquiring new capabilities and then creatively leveraging them to add value to shareholders[…] Venturing means the [organization] will enter new businesses by expanding operations in existing or new markets". (Zahra, 1995): 227 in Nordqvist, Marzano, Brenes, Jimenez and Fonseca, 2011, p. 14).

Specifically, we expect that once a family opens its doors to outsiders in decision-making positions, this opening will lead to improved entrepreneurial performance given that the effects that are usually expected from boards with different views, such us innovativeness, and creativity will arise and their resource dependence role will be more successful (Miller & Le Breton-Miller, 2006). At the end, the presence of outsiders in family businesses boards is expected to increase their entrepreneurial performance, but that depends on the role of the CEO, which is affected by his/her ownership level. Accordingly, in our analysis with fuzzy sets, we expect outsiders' presence on the board to have a medium to

high impact on family firms' entrepreneurial performance, which tend to be higher as CEO's level of ownership increases.

CEO's ownership level and family business entrepreneurial performance

Our argument regarding the role of ownership dispersion as an input that affects entrepreneurial performance – the output –in our application of fuzzy sets theory has to do with the generation in charge of the business. As the generation in charge, the relationship between the composition of the board of directors and the role of the CEO and firm entrepreneurial performance changes, as well. We predict that when there is less ownership concentration (second and subsequent generations), the behavior of the family business is more like a non-family business and as this happens, entrepreneurial performance varies depending on the composition of both the board of directors and the CEO's ownership.

Studies focused on public companies have found that when founders are in charge as CEOs –which is usually in first generation businesses-or board chairs, firm financial performance is higher than when a non-family member is CEO or board chair- usually in subsequent generations (Villalonga & Amit, 2006). Moreover, these same authors found that when a second generation family member is the CEO, performance is the lowest. In this illustration, we argue that CEO's level of ownership can affect entrepreneurial performance for two reasons. First, CEOs with high ownership stakes have little fear of losing their jobs by introducing new ideas or challenging the owners (virtually always a relative), and this provides at least the potential for them to contribute to strategy, innovation and change more effectively than would be the case in a non-family CEO (Miller & Le Breton-Miller, 2006). Second, we use

the socioemotional wealth concept. Gómez-Mejía, Haynes, Núñez-Nickel, Jacobson, and Moyano-Fuentes (2007, p. 106) define it as "non-financial aspects of the firm that meet the family's affective needs, such as identity, the ability to exercise family influence, and the perpetuation of the family dynasty". These authors use the socioemotional wealth concept to explain how family businesses are less risk-averse and more willing to accept performance hazards when socioemotional wealth loss is at stake. Because family members have significant socioemotional wealth invested in the company, they are highly committed to the companies and to the continuity of the companies (Gomez-Mejia, et al., 2007). Family business owners may choose to take significant risks and accept short run lower performance in order to retain control over their businesses. This motivates them to provide a long term vision for the firm, which can contribute positively to entrepreneurial performance. Moreover, Anderson and Reeb (2003) found that family businesses are better performers and that when family members serve as CEO, financial performance is better than with non-family CEOs, suggesting that this is an effective organizational form. We think Fuzzy sets theory could help as expand this argument to entrepreneurial performance as well. However, Miller, Le Breton-Miller, Lester, and Cannella (2007) found that family businesses do not outperform non-family businesses when lone founder firms are taken out of the family business group. Miller et al. (2007) concluded that some founders are not interested in involving other family members, and therefore are not particularly interested in passing the business along to heirs. Goel, Jussila, and Ikaheimonen (2014) point out the need to understand family businesses governance from an evolutionary focus, meaning that family business governance and the business itself evolve across generations

and one way to understand the changes and its results is to understand the reasons behind them. The point here is that it is important to differentiate the type of family business when performance is the output and the different governance configurations.

In our case, we are interested in applying fuzzy sets to study the interrelation of outsiders in the board of directors and CEO ownership on family business (FB) in the firm entrepreneurial performance. As mentioned earlier, the application will be done using four case studies from the STEP Project for family Enterprising from Colombia, which are research cases about transgenerational entrepreneurship in family businesses.

Lastly, Gersick and Feliu (2014) state that an integration of theories and understanding the antecedents of contingencies and outcomes such as ownership dispersion and continuity, stakeholders benefits and satisfaction, leadership development and entrepreneurship are necessary to interpret governance systems successes and failures. Therefore, structure and process of board, as well as the relationship between family control and organization performance in private family businesses. In Table 1, we summarize our expected results from the leadership and governance relationship with entrepreneurial performance, based on the underlying theoretical discussion presented above, after applying fuzzy sets logic. As is explained later, these expected outputs are the decision rules that we use on our model. We apply fuzzy sets theory as follows.

Table 1

Expected Output for Entrepreneurial Performance from Leadership and Governance Decisions

Output : Entrepreneurial performance		Input 1: CEO's ownership (Leadership)			
		Low	Medium Low	Medium	High
Input 2: Presence of outsiders in board (Governance)	Low	Low	Low	Medium Low	Medium
	Medium Low	Low	Medium Low	Medium	High
	Medium	Medium Low	Medium Low	Medium	High
	High	Medium	Medium	High	High

APPLICATION OF FUZZY SETS IN LEADERSHIP AND GOVERNANCE DECISIONS IN FAMILY BUSINESS PERFORMANCE

In this section, we use fuzzy sets theory to evaluate qualitative criteria in leadership and governance decisions in family business entrepreneurial performance. We want to explore if the inclusion of outsiders in boards of directors and CEO's ownership in the firm explain firm entrepreneurial performance.

We use four STEP cases in order to apply our fuzzy set approach. The companies in the cases belong to four different industries: food, financial services, cargo and logistics, and newspaper. All these companies are in second generation. The food and financial services' companies present a high participation of outsiders in the board, while the companies of cargo and logistics and newspaper do not have board of directors. Regarding to CEO's ownership, the newspaper company CEO possess 5%, while in the others companies the

CEOs have values of ownership lower than 33%. Finally, concerning to entrepreneurial activities, the food company have developed activities such as new ventures, consulting and advisory initiatives for family members, and changes in family protocol and governance structures. In addition, the financial services company has been dedicated to activities related to technological change, new products and services, strategic alliances, and family protocol and governance structures. The activities that represent the entrepreneurial performance of Cargo and Logistics Company are focused on brand structure and entrepreneurial first and second generations, while the newspaper company developed activities related to: diversification of products, technological change, new ventures, and family protocol and governance structures.

The objective of our model is to estimate an entrepreneurial performance level as output, for any given values of inputs variables (presence of outsiders in boards and CEO's ownership).

For this model, we follow five steps: i) definition of linguistic variables, ii) definition of decision rules, iii) Rule evaluation, iv) development of aggregation process, and v) development of defuzzification process.

i)   *Linguistic variables definition*

In this leadership and governance model for family firms we have defined two inputs and one output. The inputs are inclusion of outsiders in boards of directors and CEO's ownership level. The output variable is entrepreneurial performance level. Each one of the linguistic variables included has four categories. Following Bojadziev and Bojadziev (2007) we denote these linguistic variables and its categories as:

Presence of outsiders in board $\triangleq A = \{A_1, A_2, A_3, A_4\} = \{L, ML, M, H\}$
CEO's ownership $\triangleq B = \{B_1, B_2, B_3, B_4\} = \{L, ML, M, H\}$
Entrepreneurial performance $\triangleq C = \{C_1, C_2, C_3, C_4\} = \{L, ML, M, H\}$
where $L \triangleq$ Low, $ML \triangleq$ Medium Low, $M \triangleq$ Medium, and $H \triangleq$ High.

The A_i, B_j, and C_k are fuzzy sets defined as:

$$A_i = \left\{\left(x, \mu_{A_i}(x)\right) \middle| x \in A_i \subset U_1\right\}, i = 1,2,3,4.$$

$$B_j = \left\{\left(y, \mu_{B_j}(y)\right) \middle| y \in B_j \subset U_2\right\}, j = 1,2,3,4.$$

$$C_k = \left\{\left(z, \mu_{C_k}(z)\right) \middle| z \in C_k \subset U_3\right\}, k = 1,2,3,4,$$

where $U_1 = \{x | 0 \leq x \leq 100\}$, $U_2 = \{y | 0 \leq y \leq 100\}$ and $U_3 = \{z | 0 \leq z \leq 100\}$, and the real numbers *x, y* and *z* represent values on a scale from 0 to 100 that measure the presence of outsiders in board, the CEOs ownership and the entrepreneurial performance. The terms of all linguistic variables presence of outsiders, CEOs ownership and entrepreneurial performance are described by a triangular membership function and have the same membership functions. Their analytical expressions are:

$$\mu_L(v) = \begin{cases} 1 & for\ 0 \le v \le 8 \\ \frac{30-v}{22} & for\ 8 \le v \le 30 \end{cases} \qquad \mu_{ML}(v) = \begin{cases} \frac{v-8}{22} & for\ 8 \le v \le 30 \\ \frac{50-v}{20} & for\ 30 \le v \le 50 \end{cases}$$

$$\mu_M(v) = \begin{cases} \frac{v-30}{20} & for\ 30 \le v \le 50 \\ \frac{70-v}{20} & for\ 50 \le v \le 70 \end{cases} \qquad \mu_H(v) = \begin{cases} \frac{v-50}{20} & for\ 50 \le v \le 70 \\ 1 & for\ 70 \le v \le 100 \end{cases}.$$

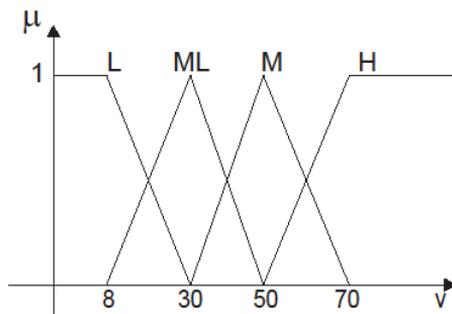These expressions are presented in Figure 3.

Figure 3. Terms of the inputs and output

ii)   Decision rules
As presented in Table 1 above, in our study the total number of rules is 16 derived of the product of the number of categories of inputs analyzed (CEO's ownership and Presence of outsiders in board). These rules have a conclusion in terms of the output (entrepreneurial performance), which was derived based on underlying theoretical constructs.

iii)   Rules evaluation
In each one of the four STEP cases, the rules are evaluated in order to define specific values for all inputs. For that, we estimate the readings for each case by observation, doing the exhaustive study of each case as follows. The food industry readings are 60 and 66, for CEO ownership and presence of outsiders in the board, respectively. In the case of financial services, the readings are 60 and 40,

respectively. The Cargo and logistics case presents 10 and 50 as readings, and lastly, the newspaper case presents 10 and 10.

Table 2 presents the induced decision table, which contains the readings for each case substituted in the corresponding membership functions for each case.

DISCUSSION

In general, our results show that the higher the CEO's ownership stakes and the higher presence of outsiders in the board of directors, the higher output, i.e. family business entrepreneurial performance. These results concur with Miller and Le Breton-Miller (2006) and Blumentritt (2006), but for entrepreneurial performance.

Table 2
Induced Decision Table by Sector

Case	Food Industry		Financial Services	
Input 1 \ Input2	$\mu_H(66)= 4/5$	$\mu_M(66)=1/5$	$\mu_M(40)=1/2$	$\mu_{ML}(40)= 1/2$
$\mu_H(60)=1/2$	$\mu_H(z)$	$\mu_H(z)$	$\mu_H(z)$	$\mu_H(z)$
$\mu_M(60)=1/2$	$\mu_H(z)$	$\mu_M(z)$	$\mu_M(z)$	$\mu_M(z)$

Case	Cargo and Logistics		Newspaper	
Input 1 \ Input2	$\mu_H(50)=0$	$\mu_M(50)=1$	$\mu_M(10)=10/11$	$\mu_{ML}(10)=1/11$
$\mu_L(10)=10/11$	$\mu_M(z)$	$\mu_{ML}(z)$	$\mu_L(z)$	$\mu_L(z)$
$\mu_{ML}(10)=1/11$	$\mu_M(z)$	$\mu_{ML}(z)$	$\mu_L(z)$	$\mu_{ML}(z)$

For each case only four cells contain nonzero terms. The result of this process will be used in next step.

iv)   Aggregation process
The following analytic expression presents the membership function image $\mu_A(\cdot)$ of fuzzy readings for each case (See table 3).

Table 3
Membership Function Image $\mu_A(\cdot)$ of Fuzzy Readings

Food industry	Financial Services
$$\mu_{agg}(v) = \begin{cases} \dfrac{v-30}{20} & for\ 30 \leq v \leq 34 \\ \dfrac{1}{5} & for\ 34 \leq v \leq 64 \\ \dfrac{v-50}{20} & for\ 64 \leq v \leq 71 \\ \dfrac{1}{2} & for\ 71 \leq v \leq 100 \end{cases}$$	$$\mu_{agg}(v) = \begin{cases} \dfrac{v-30}{20} & for\ 30 \leq v \leq 40 \\ \dfrac{1}{2} & for\ 40 \leq v \leq 100 \end{cases}$$
Cargo and Logistics	Newspaper
$$\mu_{agg}(v) = \begin{cases} \dfrac{v-8}{22} & for\ 8 \leq v \leq 28 \\ \dfrac{10}{11} & for\ 28 \leq v \leq 31,8 \\ \dfrac{50-v}{20} & for\ 31,8 \leq v \leq 50 \end{cases}$$	$$\mu_{agg}(v) = \begin{cases} \dfrac{10}{11} & for\ 0 \leq v \leq 8 \\ \dfrac{30-v}{22} & for\ 8 \leq v \leq 28 \\ \dfrac{1}{11} & for\ 28 \leq v \leq 48,2 \\ \dfrac{50-v}{20} & for\ 48,2 \leq v \leq 50 \end{cases}$$

The graphic representation of these functions for each case is presented in Figure 4. It is important to note in the graphs below that the area under the curve of the darker lines is used to estimate the fuzzy average, which represents the output, in our case entrepreneurial performance.
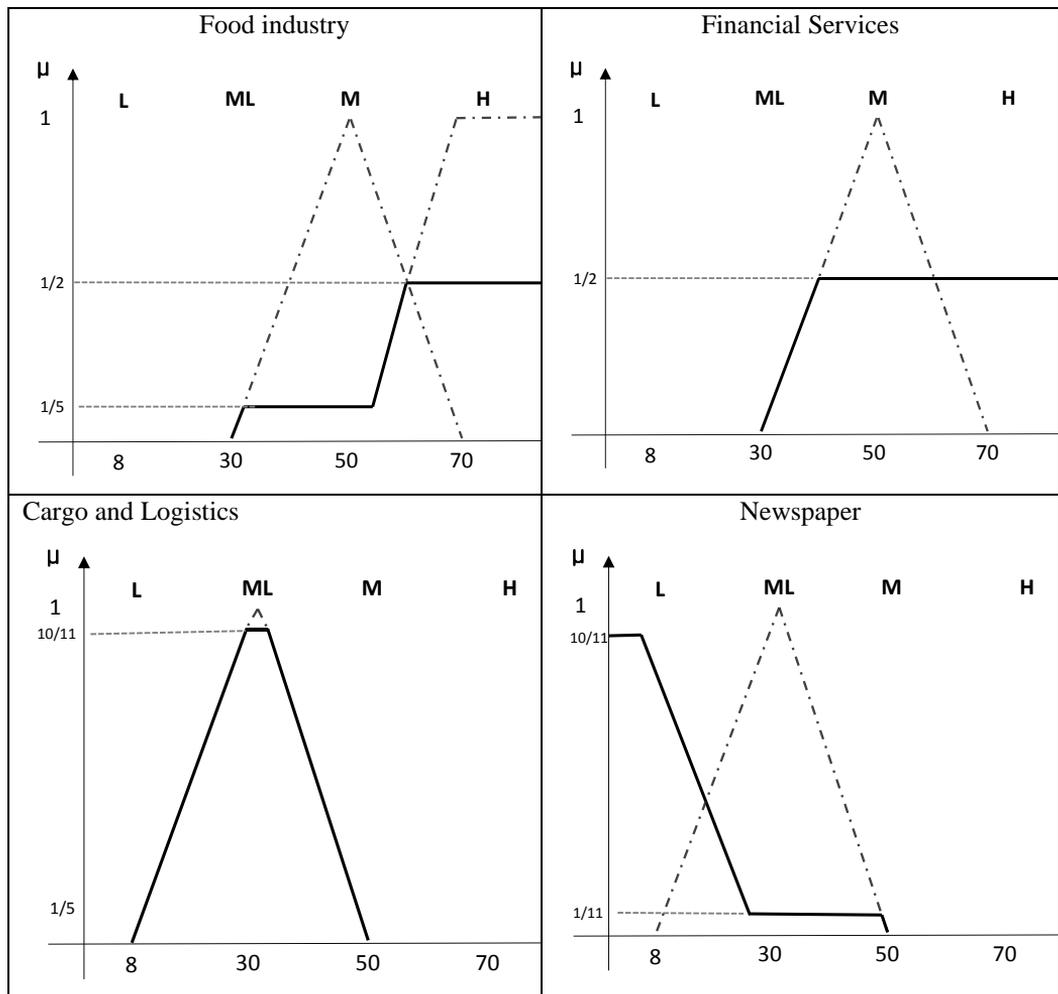
Figure 4. Functions graphic representation by case

v)   Defuzzification process

We apply centroid and bisector methods to estimate the output for each case. In Table 4 we present these estimations' results using the two methods mentioned. It is observed that the estimations of entrepreneurial performance are very close for each case, regardless of the method used.

Table 4
Entrepreneurial Performance for each Case

Case	Centroid Method	Bisector Method
Food industry	72.3	74
Financial Services	67.7	68
Cargo and Logistics	29.3	29
Newspaper	13.1	11

In addition, we find that socioemotional wealth arguments (Gómez-Mejía, et al., 2007) serve to explain that CEO higher level of ownership can contribute to entrepreneurial performance, given that he/she will have a long run perspective on performance, in spite of having short-term expectations. Specifically, the food industry case present the highest level of entrepreneurial performance, which coincides with the predictions, presented in table 1, i.e. they have high level outsiders in the board and, the CEO has a high level of ownership. In contrast, the newspaper case presents a low level of entrepreneurial performance, a low participation of outsiders in the board and a low CEO's ownership level. In comparison, the food industry case entrepreneurial performance is 6.7 times higher than the newspaper case. As for the other two family businesses (cargo and logistics and financial services), they present a medium level of entrepreneurial performance. The cargo and logistics case has a low level of CEO's ownership and a medium level of outsiders' participation in the board. In the financial services case, has a high level of CEO's ownership and a medium level of outsiders' participation in the board.

The main difference between this methodology and conventional methods is that fuzzy sets theory allows an estimation of a value for an output, which is a qualitative variable, difficult to measure. Fuzzy sets, permits researchers to explore deeper and directly on constructs otherwise measured by proxies. Given that we have found satisfactory and rational results with this approach, we expect to generalize by adding more cases. As a result, we offer an explanation of predict a considerable impact on how family business as a research field could apply this methodology to help family businesses generate value across generations.

CONCLUSIONS

For future venues, we think that the potential of this methodology is endless in family business research and practices. Case studies offer in-depth understanding on how and why questions behind other potential inputs in family businesses such as, generations in charge, historical perspectives, culture, socioemotional wealth, that could change the level of the output chosen. Moreover, different key performance indicators of these types of businesses like business continuity and/or longevity, social and financial performance, succession success, among others, can be explained using fuzzy sets theory. As Ragin (2000) states, we hope this work opens more possibilities of research by offering a new tool in the family business field.

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