
Perceived environmental uncertainty and strategic alliances in small and medium-sized enterprises

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Abstract: This study analyses the importance that small and medium-sized enterprises attach to forming strategic alliances according to the environmental uncertainty they perceive. The uncertainty is obtained by applying Duncan's (1972) typology, combining environmental dynamism and complexity. A sample of small and medium-sized enterprises from the Canary Islands (Spain) was studied during 2005, and the Rasch methodology was applied together with non-parametric tests (Kruskal-Wallis and Mann-Whitney). The conclusion reached is that the greater the uncertainty perceived, the greater the importance small and medium-sized enterprises attach to strategic alliances. Furthermore, the group of small and medium-sized enterprises that perceive their environment as being highly uncertain and that attach more importance to forming strategic alliances are characterised by being larger than other small and medium-sized enterprises. This study makes an important contribution by considering the perceptions of managers of small and medium-sized enterprises as key determining factors in understanding these firms' strategic processes. This contribution is reinforced through the use of the Rasch methodology.

Keywords: uncertainty; perceptions; strategic alliances; Rasch; small and medium-sized enterprises.

Reference to this paper should be made as follows: García-Pérez, A.M., Yanes-Estévez, V. and Oreja-Rodríguez, J.R. (2012) 'Perceived environmental uncertainty and strategic alliances in small and medium-sized enterprises', *Int. J. Entrepreneurship and Small Business*, Vol. 17, No. 3, pp.355–377.

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1 Introduction

The firm's environment is defined as the set of relevant factors outside the organisation (Duncan, 1972) and constitutes a strong conditioner of its strategic behaviour (Fahey and Narayanan, 1986). One specific aspect of that statement is presented by the transaction costs theory (Coase, 1937; Williamson, 1975, 1985) and the resource dependence theory (Pfeffer and Salancik, 1978). Those two perspectives assume that one of the motivations for the formation of strategic alliances is the need to reduce environmental uncertainty, mainly in innovative sectors with high technological change. Even Hamel (1991) indicates that, in turbulent environments with rapid technological changes, uncertainty, market fragmentation and globalisation, strategic alliances are formed as the only viable option to acquire technological products or processes.

In this context, small and medium-sized enterprises are strong candidates to form strategic alliances since they have limited resources and less market power than large firms (Barnir and Smith, 2002). According to Miles et al. (1999) and Baum et al. (2000), the formation of strategic alliances is possibly one of the strategies most used by small and medium-sized enterprises to acquire resources and learning. Paradoxically, these organisations form fewer strategic alliances than large firms (Dollinger and Golden, 1992; Hoffmann and Schlosser, 2001) basically because of the difficulty of managing complex interorganisational relations and the lack of a culture of cooperation.

The aim of this study is to analyse the importance that small and medium-sized enterprises attach to the establishment of strategic alliances according to the level of environmental uncertainty they perceive. Environmental uncertainty is the lack of information that *the subject experiences* about the external environment of the firm (Kreiser and Marino, 2002; Lawrence and Lorsch, 1967). According to Kraatz (1998), the

main function of interorganisational networks is to access information about the environment and from this stems the importance of the link between *environmental uncertainty-strategic alliances*. The degree of environmental uncertainty is established using Duncan's (1972) cell typology, which combines the dynamism and complexity to measure the uncertainty (Daft et al., 1988; Elenkov, 1997; May et al., 2000; Sawyerr, 1993). To this end, the environment is considered a subjective reality based on the perceptions of the individuals.

In small and medium-sized enterprises, the decision maker's perceptions have a direct effect on the firm's strategic behaviour because the power to make decisions tends to be concentrated in the top managers (Kim and Choi, 1994), who are the individuals closest to the firm's competences and markets (Escribá-Estévez et al., 2008). Thus, the role of small and medium-sized enterprise managers in strategic decisions is more pronounced than in the case of large firms (Szarka, 1990). If the role of the strategist or decision maker in making strategic choices in small and medium-sized enterprises is ignored, it will be very difficult to understand this decision making process, as indicated by Zahra and Pearce (1990). It should be taken into account that in this type of organisation, strategic choices are more conditioned by the perceptions of the decision maker than by formal, objective analysis and diagnosis of the firm's situation, as mentioned by Parnell et al. (2000).

Thus, this study provides a subjective and individual vision of the small and medium-sized enterprise entrepreneur, providing, on the one hand, his/her perception of the degree of environmental uncertainty and on the other, the importance that he/she attaches to strategic alliances as a strategic option for the firm. These two perceived realities are connected in order to find relationships between them for analysing the information that really is taken into account when making the decision. This is one of our main contributions.

This contribution is strengthened by applying one of the family of Rasch measurements models (Wright and Mok, 2004), namely, the Rasch rating scale model (Andrich, 1978, 1988). The Rasch (1980) models permit an individualised analysis of each firm.

In pursuit of the proposed objective, the following section presents the principal theoretical bases supporting this work. This is followed by the research design, with comments on the main characteristics of the Rasch (1980) models, information treatment and the scales used. The next section presents the results obtained after the application of the Rasch (1980) methodology and non-parametric tests (Kruskal-Wallis and Mann-Whitney), which give rise to the conclusions and future lines of research.

2 Perceived environmental uncertainty and strategic alliances

2.1 Perceived environmental uncertainty

The utility of environmental scanning for the organisation lies in obtaining a diagnosis of the external reality and consequently designing a strategic response in line with that diagnosis. In this respect, there is a certain consensus in the literature about choosing environmental uncertainty (for example, Daft et al., 1988; Duncan, 1972; Sawyerr, 1993). It is defined as a subject's lack of information about events outside his/her organisation (Lawrence and Lorsch, 1967).

The form of operationalising uncertainty will depend on the vision of the environment that is followed in the research and on its objectives (Achrol, 1988; Huber and Daft, 1987; Tan and Listcher, 1994). If the environment is considered as a source of information, and the research focuses on how firms acquire and process external data, then dynamism and complexity are the dimensions to be used to define uncertainty (Daft et al., 1998; Elenkov, 1997; May et al., 2000; Saywerr, 1993). This is the position taken in this study.

Environmental dynamism is defined as the level of difficulty to predict changes in the environmental variables, which is in line with the ideas of Duncan (1972), among others. On the other hand, complexity is considered to refer to the level of knowledge required to understand the environment (Sharfman and Dean, 1991).

Table 1 Duncan's (1972) cell typology

		<i>Dynamism</i>	
		<i>Static</i>	<i>Dynamic</i>
Complexity	Complex	Moderately low perceived uncertainty	High perceived uncertainty
	Simple	Low perceived uncertainty	Moderately high perceived uncertainty

Source: Adapted from Duncan (1972)

One of the most accepted and widely used ways to integrate the dimensions of uncertainty is the cell typology proposed by Duncan (1972) (Table 1). Four quadrants are derived from that typology: they represent different levels of uncertainty by combining a high or low degree of dynamism (dynamic or static environment, respectively) with a high or low level of complexity (complex or simple environment, respectively).

With regard to the quantification of uncertainty, this study falls within the school of thought that defines the environment as a subjective reality based on the perceptions of individuals¹ (e.g., Babakus et al., 2006; Duncan, 1972; Lewis and Harvey, 2001; May et al., 2000). Hence, the environment that exists is that perceived by each individual according to his/her mental schemata. These subjective impressions of the environment are the ones that drive the strategic decisions and actions of the firm (Nadkarni and Barr, 2008). By considering these mental images, this paper includes the reality that, in effect, is taken into account when deciding.

With regard to environmental scanning in the case of small and medium-sized enterprises, most studies that consider it have the sole objective of identifying how it conditions certain strategic and organisation features. The aspects that are associated with the environmental characteristics of small and medium-sized enterprises include the sophistication of the strategic and operational planning (Matthews and Scott, 1995), product innovation (Freel, 2005) and strategies and performance (Covin and Slevin, 1989; Pelham, 1999).

However, there are few recent works that address the environment of small and medium-sized enterprises in greater detail. It can be seen from these studies that the managers or owners of small and medium-sized enterprises seem to be more concerned about external information than large firms are (Smeltzer et al., 1988), devote even more time to environmental scanning (Johnson and Kuehn, 1987) and clearly display their sensitivity to the environment (Dyer and Ross, 2008; Verdú-Jover et al., 2006).

The studies coincide in stressing how important it is for small and medium-sized enterprises to obtain information about their environment for them to be competitive irrespective of the strategy they follow (Beal, 2000) and various studies have focused on how to conduct that analysis. In that regard, it has been shown that small and medium-sized enterprises are less likely to use formal market analysis activities (Mohan-Neil, 1995) than large firms are. In fact, they mainly rely on the verbal exchange of information with suppliers, distributors and customers (Johnson and Kuehn, 1987) or with individuals with whom they frequently interact (Smeltzer et al., 1988). These informal external communications networks may serve as the stimulus for small and medium-sized enterprises to start attaching importance to strategic alliances and as the first step in establishing them.

2.2 Strategic alliances and perceived environmental uncertainty

Gulati (1998) defines strategic alliances as voluntary agreements between firms and entailing the exchange, sharing or co-development of products, technologies or services. Meanwhile, Wheelen and Hugar (2000) consider that a strategic alliance is an agreement between firms that goes beyond their normal dealings but not as far as a merger or integration.

These strategic alliances may have different scopes, from the most formal agreements (for example, joint venture), via a wide range of intermediate contractual forms (for example, long-term contracts, licenses, franchises ...), to the most informal (for example, trust based agreements) and, according to Nooteboom (1999), can be both vertical (between purchasers and/or suppliers) and horizontal (between competitors) or diagonal (between firms in different sectors). In this work, the term strategic alliance is used in a broad sense and consequently does not distinguish between all the types that exist.

Street and Cameron (2007) conduct an extensive review of the factors considered antecedents of alliances and networks in small and medium-sized enterprises, as well as the factors that condition the process and performance of these agreements. More specifically, strategic alliances provide value to small and medium-sized enterprises because they (Sarkar et al., 2001):

- 1 Offer strategic resources that small and medium-sized enterprises could not obtain in any other way.
- 2 Offer an efficient solution to their small size and its disadvantages in costs.
- 3 Can increase their market power of innovation since they can be strategic resources by generating collective networks of knowledge that serve as a basis for the development of improvements in products, services or processes (Verhees and Meulenbergh, 2004). Small and medium-sized enterprises devoted to technological innovation have used research and development alliances to exchange information, transfer technology and manage risk (Dickson et al., 2006).

Environmental uncertainty has been an aspect traditionally associated with alliances as a form of strategic choice (Auster, 1992; Pfeffer and Salancik, 1978). Environmental uncertainty also has a moderating effect on the relationship between strategic alliances and the performance of the firms (for example, Street and Cameron, 2007).

In that respect, and for a sample of Scandinavian firms with fewer than 500 employees, Dickson and Weaver (1997) find a significant interaction between

managerial orientation, the perception of the environment and the use of strategic alliances. Sarkar et al. (2001) draw the conclusion that strategic alliances lead to better market performance and that this effect is more intense in the case of small and medium-sized enterprises and in unstable environments (technological, market and competitive instability). However, in their work on the effect of perceived environmental uncertainty on internal or external interpersonal networks and on the performance of 153 small and medium-sized enterprises in the high technology sector, Sawyerr et al. (2009) find that the increase of internal, not external, networks responds to the increase in perceived environmental uncertainty and improves the performance of those small and medium-sized enterprises. Furthermore, Dollinger and Golden (1992) consider three dimensions of the environment (munificence, dynamism and complexity) and use four types of strategic alliances for small and medium-sized enterprises (confederate, conjugate, agglomerate and organic). They find that only in the case of munificent environments is there a positive relationship between the collective strategies and performance of small and medium-sized enterprises. In their study on the perceived uncertainty, networks and export performance of Scandinavian small and medium-sized enterprises, Babakus et al. (2006) find that the relationship between the networks established by those firms and perceived uncertainty is very tenuous and attribute it to the cultural values of those countries.

Hence, it is clear that this is a field of research which is, as Kraatz (1998) states, still quite fragmented in its development, and with conflicting results, as Sutcliffe and Zaheer (1998) point out. An example of this discrepancy in the results is found in the opinions that argue external networks may not be very effective when environmental uncertainty is relatively high (Boyd and Fulk, 1996; Daft and Macintosh, 1981; Daft and Weick, 1984; Milliken, 1987).

This research 'puzzle' is due to the differences in the contributions about environmental uncertainty and strategic alliances when considering different types of environmental uncertainty. In this respect, the predominant uncertainty is inherent to the alliance itself and different sectors, among which the pharmaceutical and bio technological sectors, as opposed to mature industries, stand out. There are also differences when proposing definitions and ways of considering strategic alliances and when choosing units of analysis (for example, samples of large firms, small and medium-sized enterprises and case studies).

The objective of this study is more specific since it relates the entrepreneur's perception of environmental uncertainty with the importance that he/she attaches to strategic alliances as a way to compete in his/her environments.

3 Research design

3.1 The Rasch (1980) models

The Rasch (1980) models have recently begun to be applied in the area of business management and administration (for example, Drehmer et al., 2000; Fischer et al., 2006; Salzberger and Sinkovics, 2006; Yanes-Estévez et al., 2010). However, since their initial

proposal by Rasch in 1960, they have been widely used in other fields such as medicine, psychology and education and offer broad possibilities in other areas.

One of the great advantages of using the Rasch (1980) models is that it overcomes certain assumptions of the application of Likert type scales widely used in the business and management field. Those suppositions are (Fischer et al., 2006):

- 1 that all the items have the same impact on the scoring of the scale
- 2 that all the categories maintain the same distance from the adjacent category.

Hence, the Rasch (1980) models constitute the only available technique for the construction of linear measurements (Bond and Fox, 2007) from ordinal observations (Fischer, 1995; Linacre, 2004). They are considered as models of conjoint probabilistic analysis (Perline et al., 1979).

One of the most significant characteristics of the Rasch proposal is that it is a technique developed at the level of the individual. Thus, it does not have to be assumed that the data follow a normal distribution (Engelhard, 1984) since the distributions are unknown and should not be subject to assumptions a priori (Rost, 1990).

The process begins with the design of a model that psychometrically complies with the desirable characteristics of the measure (Engelhard, 1984). Once the ideal model has been obtained, it is the data that fit the model. The difference between the observed data and those described by the Rasch (1980) models enables us to identify the invalid or biased sources of information (Schmitt, 1981). Thus, the Rasch methodology highlights the subjects and variables that do not follow the ideal model and generate misfits. This information at the individual level is, without doubt, another of the great advantages of this approach since its study permits not only the analysis of information derived from the subjects and items that fit the model, but also the identification of which one does not follow the ideal patterns and why.

The model used in this work is one of the family of Rasch measurements models (Wright and Mok, 2004), namely, the Rasch rating scale model. This model was developed by Andrich (1978, 1988) specifically for the treatment of information from ordinal multiple category score scales, such as Likert type scales. The parameters are estimated by the maximum likelihood method, using the *Winsteps* software (Linacre, 2007) which considers the PROX and JMLE algorithms (joint maximum likelihood estimation).

In this study, the Rasch rating scale model (Andrich, 1978, 1988) is applied twice: once for the information obtained about the dynamism and the other for the complexity of the environment. The two resulting sets of measures (Table 6) are those used to classify small and medium-sized enterprises according to the level of uncertainty that they perceive, in line with the proposals of Duncan (1972).

3.2 Information gathering

The setting for this study is the Canary Islands (Spain). It is a region in which the business world is characterised by its high fragmentation, which is clear when it is considered that 45% are microfirms, and 83% of all firms belong to the services sector (Confederación Canaria de Empresarios, 2006).

Table 2 Technical specifications

<i>Characteristics</i>	<i>Empirical work</i>
Methodological procedure	Self-administered personal surveys
Types of questions	Attitudinal and closed
Universe population	Individuals with decision making roles in firms
Geographical context	Canary Islands (Spain)
Type of sample	Non-probabilistic
Initial sample	207 small and medium-sized enterprises
Sample after measurement analysis	172 and 168 small and medium-sized enterprises in the analysis of dynamism and complexity, respectively
Final sample used	148 small and medium-sized enterprises
Date of fieldwork	February–May 2006
Treatment of information	Winsteps 3.68.1 and SPSS 17.0

Source: The authors

The information required to conduct this work was obtained by means of a questionnaire. The population universe is made up of individuals with a decision making role in small and medium-sized enterprises in the Canary Islands (Spain). Due to the impossibility of knowing the size of such a population, the sampling method chosen was non-probability sampling (Table 2), which is used in special situations and when information is lacking (Neuman, 1997), as in this case. Within the range of options for this sampling method, convenience sampling (Neuman, 1997; Zikmund et al., 2010) was chosen as it is recommended for obtaining a large number of completed questionnaires quickly and economically and when other means of obtaining a sample are impractical (Zikmund et al., 2010). In addition, convenience sampling is ‘the well-disguised norm’ in many studies in managerial cognition (Johnson et al., 1998), like this paper.

The initial sample comprised 207 small and medium-sized enterprises classified according to the number of employees and in line with the segments established by the European Commission Recommendation of 7 May 2005 (DOCE 20.05.2003)². After the separate application of the Rasch rating scale model (Andrich, 1978, 1988) to the data for dynamism and for complexity, and due to the elimination of misfits [considering the limits established by Linacre (2002)], there were valid samples of 172 small and medium-sized enterprises for dynamism and 168 for complexity. The final sample comprised 148 small and medium-sized enterprises, which were the firms that remained in the two valid samples and, therefore, those for which the measures of dynamism and complexity had been obtained (Table 2). That final sample comprised 41.2% microfirms, 43.2% small firms and 15.5% medium-sized firms. Most of the firms conducted activities related to retail (40.5%) or other services (42.6%)³.

3.3 *Measurement scales*

To conduct the analysis of environmental dynamism and complexity, a scale was constructed on the basis of the relevant variables of an island environment that were identified by Oreja-Rodríguez (1999) (Table 3). To that end, Lewis and Harvey’s (2001) subscale integration methodology and the necessary geographical adaptation (Miller, 1997) of the study were applied.

Table 3 Sub-scales for perceived environmental uncertainty

<i>Sub-scale</i>	<i>Variables</i>	<i>Sub-scale</i>	<i>Variables</i>
Geographical	Insularity	Economic	Development in Canary Islands
	Orography		Demand situation
	Natural resources		Level of demand incomes
	Demography		Distance to main markets
Political-legal	Political situation in Canary Islands		Market segmentation
	Sector legislation		Financial resources
	Labour legislation		Human resources
	Consumer defence/quality		Technological resources
Socio-cultural	Consumer motivation		Physical barriers
	Attitude to the firm		Economies of scale
	Professional training		External dependence
			Exchange rate

Source: Adapted from Oreja-Rodríguez (1999)

The reliability of the measurements of dynamism and complexity were analysed both for the firms and for the items on the scales, using indicators provided by the Rasch methodology. The levels obtained were satisfactory to conduct the analysis, in accordance with Nunnally (1987) (Tables 4 and 5).

Table 4 Reliability of the measures of dynamism

	<i>Raw score</i>	<i>Count</i>	<i>Measure</i>	<i>Model error</i>	<i>INFIT</i>		<i>OUTFIT</i>	
					<i>MNSQ</i>	<i>ZSTD</i>	<i>MNSQ</i>	<i>ZSTD</i>
<i>Of the firms</i>								
Mean	71.2	24.8	-.20	.22	1.01	-.1	1.00	-.1
St. dev	17.1	.8	.83	.03	.41	1.6	.40	1.5
Real reliability: .91					Model reliability: .93			
<i>Of the items</i>								
Mean	485.6	169.6	.00	.08	1.01	.0	1.00	-.1
St. dev	87.8	2.5	.59	.00	.19	.19	.17	1.6
Real reliability: .98					Model reliability: .98			

Source: The authors

The validity of the measures was evaluated by analysing the misfits, at an overall level as well as at the individual levels of the firms and items. At an overall level (Tables 4 and 5), the validity of the model is adequate since the OUTFIT and INFIT⁴ values are close to the expected level of 1. In the analyses at individual levels, 35 and 39 small and medium-sized enterprises were eliminated from the analyses of dynamism and

complexity respectively, since their values generated significant misfits for the model (Linacre, 2002). Those characteristics show both the overall validity of the model and the individual validity with the fit of each item and firm.

Table 5 Reliability of the measures of complexity

	<i>Raw score</i>	<i>Count</i>	<i>Measure</i>	<i>Model error</i>	<i>INFIT</i>		<i>OUTFIT</i>	
					<i>MNSQ</i>	<i>ZSTD</i>	<i>MNSQ</i>	<i>ZSTD</i>
<i>Of the firms</i>								
Mean	76.0	24.5	.04	.20	1.00	-.2	1.00	-.1
St. dev	14.7	2.2	.49	.03	.42	1.7	.41	1.6
	Real reliability: .81				Model reliability: .83			
<i>Of the items</i>								
Mean	510.4	164.6	.00	.08	1.01	-.1	1.00	-.2
St. dev	82.4	2.5	.45	.00	.25	2.4	.24	2.3
	Real reliability: .97				Model reliability: .97			

Source: The authors

The indicator that suggests the possibility of there being more than one dimension in the constructs is the principal components analysis of residuals (PCAR). In the case of dynamism, the variance explained by the measures is 45.5% (close to 50%), the variance explained by the items (30.3%) is four times higher than the unexplained variance in the first test (5.4%) and the eigenvalue of the first test is below three. With regard to complexity, the variance explained by the measures is 32.5%; the variance explained by the items (25.3%) does not exceed four times the unexplained variance in the first test (7.9%) while the eigenvalue of the first test is below three. Although these values denote a certain tension of multidimensionality, especially in the case of complexity, they do not justify the existence of a second dimension due to the relatively low level of eigenvalues. In light of the above, it can be accepted that it complies with condition of unidimensionality required for Rasch (1980) models to be applied.

In the case of the importance that decision makers attach to strategic alliances, it is considered a one-dimensional construct with a single item.

In all the questions, the respondents gave an evaluation that ranged from 1 (low level of dynamism, complexity and importance attached to alliances) to 5 (high level of dynamism, complexity and importance attached to alliances).

4 Results

4.1 Analysis of perceived environmental uncertainty

The measures obtained by the small and medium-sized enterprises after the application of the Rasch rating scale model (Andrich, 1978, 1988) to the dynamism and complexity of the environment (Table 6) are placed in a double entry matrix to obtain the level of uncertainty that they perceive (Figure 1), in accordance with Duncan (1972)⁵.

Table 6 Measures of the dynamism and complexity of firms

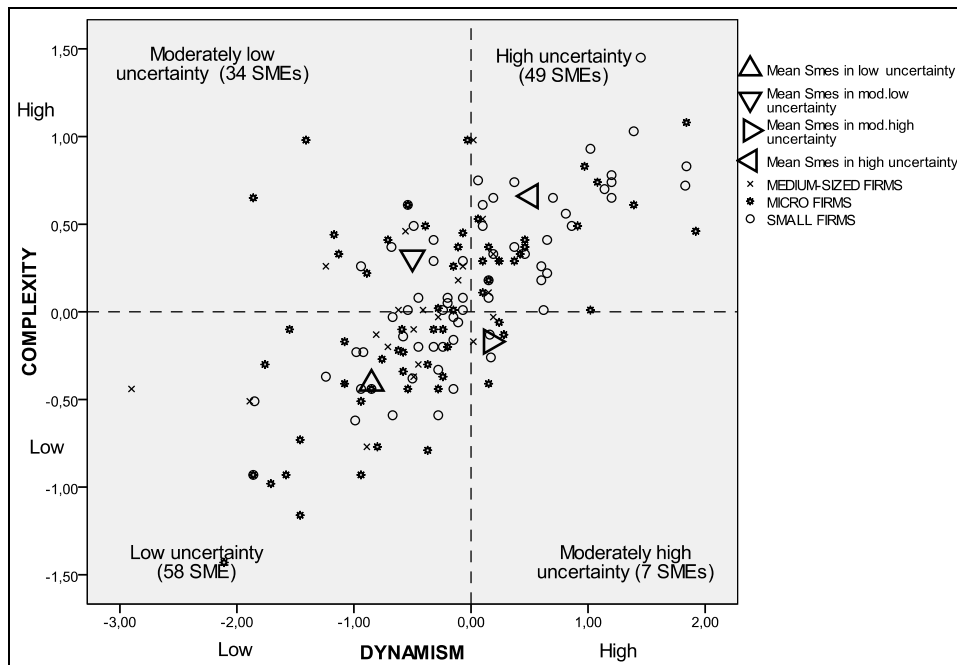
Small and medium-sized enterprises			Dynamism						Complexity						
Firm	Size	Measure	INFIT			OUTFIT			Measure	INFIT			OUTFIT		
			MNSQ	ZSTD	ZSTD	MNSQ	ZSTD	ZSTD		MNSQ	ZSTD	ZSTD	MNSQ	ZSTD	
F1	MIC	-1.58	1.81	2.30	1.60	1.58	1.60	-.93	1.34	1.30	1.37	1.30	1.30		
F3	SM	-.45	.72	-1.20	-.120	.50	-1.20	.80	.66	-1.50	.65	-1.50	-1.50		
F4	MIC	.24	.51	-2.20	.50	.56	.50	.29	.42	-2.90	.46	-2.90	-2.50		
F6	MIC	-.54	.47	-2.6	-.2.70	.45	-2.70	-.44	.70	-1.30	.69	-1.30	-1.40		
F7	MIC	-.58	.79	-.80	-.80	.78	-.80	-.34	1.21	.90	1.19	.90	.80		
F8	MIC	-.80	1.50	1.80	1.40	1.39	1.40	-.77	1.82	2.80	1.65	2.80	2.10		
F10	SM	.19	.59	-1.80	-.1.60	.63	-1.60	.65	.38	-2.90	.35	-2.90	-3.10		
.....															
F226	MIC	.37	.44	-2.6	-.2.4	.48	-2.4	.29	.52	-2.20	.53	-2.20	-2.10		
F227	MIC	-.58	.50	-2.4	-.2.4	.50	-2.4	-.23	.48	-2.70	.49	-2.70	-2.50		
F231	SM	.60	1.01	.10	.00	.97	.00	.26	.61	-1.70	.60	-1.70	-1.80		
F232	MIC	.06	.35	-3.4	-.3.4	.34	-3.4	.53	.39	-2.90	.38	-2.90	-2.90		
F233	SM	.65	1.28	1.00	.80	1.20	.80	.22	1.46	1.70	1.41	1.70	1.50		
F234	SM	.17	1.98	2.90	2.80	1.94	2.80	-.26	1.92	3.00	1.87	3.00	2.90		

Notes: SIZE = microfirm; SM = small firm; MED = medium-sized firm. This table shows some of the small and medium-sized enterprises' measurements provided by the Rasch (1980) model. Due to restrictions of space, not all the measurements are shown but are available to any interested party.

Source: The authors

Figure 1 shows that the largest group of small and medium-sized enterprises (58 small and medium-sized enterprises) perceives a low uncertainty environment while the second largest group (49 small and medium-sized enterprises) perceives a high uncertainty environment. The smallest group comprises the seven small and medium-sized enterprises that perceive a moderate uncertainty environment caused by high dynamism. In the case of the firms that perceive an environment with moderate uncertainty, their averages are closest to the central position in Figure 1 and are mainly the averages of the firms that perceive moderately high uncertainty. In general, more medium-sized enterprises in the Canaries perceive high complexity (72 small and medium-sized enterprises) than perceive high dynamism (56 small and medium-sized enterprises). Table 7 displays some characteristics of the small and medium-sized enterprises in each quadrant.

Figure 1 Environmental uncertainty perceived by small and medium-sized enterprises



Source: The authors

All the groups are dominated by firms that fall within the category of ‘other services’, with the exception of the case of moderately low uncertainty due to the complexity that most of the small and medium-sized enterprises in the retail sector perceive. The latter result reflects the growing complexity of the sector because of its regulatory framework and the arrival of other types of establishment, such as national and international chains, which increases competitive rivalry.

With regard to the age of the small and medium-sized enterprises, the youngest firms represent the highest percentages in all levels of uncertainty except in the case of moderately high uncertainty due to the dynamism. In the latter environment, although there is only a difference of one firm, firms with an age between 21 and 30 years old predominate. The explanation may be that, since they are small and medium-sized

enterprises with a degree of maturity and relatively well-established in the business world, they are more able to interpret and understand the complexity of the environment, but it is still difficult for them to monitor the changes taking place in that environment.

Table 7 Frequencies according to perceived environmental uncertainty

	<i>Low uncertainty</i>	<i>Moder. low uncertainty</i>	<i>Moder. high uncertainty</i>	<i>High uncertainty</i>
Sector of activity				
Industry	9 (15.5%)	3 (8.8%)	1 (14.3%)	1 (2.0%)
Construction	2 (3.4%)	3 (8.8%)	--	5 (10.2%)
Retail	20 (34.5%)	17 (50.0%)	2 (28.6%)	21 (42.9%)
Other services	27 (46.6%)	11 (32.4%)	3 (42.9%)	22 (44.9%)
Primary	--	--	1 (14.3%)	--
Total	58 (100%)	34 (100%)	7 (100%)	49 (100%)
Age				
0–10 years	19 (32.8%)	12 (35.3%)	2 (28.6%)	15 (30.6%)
11–20 years	12 (20.7%)	7 (20.6%)	--	11 (22.4%)
21–30 years	11 (19.0%)	7 (20.6%)	3 (42.9%)	11 (22.4%)
Over 30 years	10 (17.2%)	4 (11.8%)	2 (28.6%)	3 (6.1%)
No data	6 (10.3%)	4 (11.8%)	--	9 (18.4%)
Total	58 (100%)	34 (100%)	7 (100%)	49 (100%)
Size				
Microfirm	27 (46.6%)	14 (41.2%)	3 (42.9%)	17 (34.7%)
Small	21 (36.2%)	14 (41.2%)	2 (28.6%)	27 (55.1%)
Medium-sized	10 (17.2%)	6 (17.6%)	2 (28.6%)	5 (10.2%)
Total	58 (100%)	34 (100%)	7 (100%)	49 (100%)

Source: The authors

Finally, in the case of the size of the small and medium-sized enterprises, microfirms predominate in three of the quadrants. The fourth quadrant, with perceived high uncertainty, is dominated by small firms. This leads us to think that the larger the firms, the more aware they are of the high complexity and high dynamism of their sectors.

4.2 Importance of strategic alliances according to perceived environmental uncertainty

Once the small and medium-sized enterprises are classified according to the level of uncertainty that they perceive in their environment, the next step is to analyse the importance that they attach to strategic alliances.

In an initial analysis (Table 8), it can be seen that the sample as a whole does not stand out for attaching too much importance to strategic alliances since most of the small and medium-sized enterprises are in the lower half of the values for importance, with a median of 3.0.

Table 8 Cross tabulation of strategic alliances and perceived uncertainty

		<i>Strategic alliance</i>					<i>Total SMEs*</i>	<i>Median</i>
		<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>		
Low uncertainty	Count	21	13	10	10	1	55	2.0
	Expected frequency	13.8	11.1	14.2	12.3	3.6	55.0	
	Percent within low uncertainty	38.2	23.6	18.2	18.2	1.8	100.0	
	Percent within strategic alliances	<i>60.0</i>	<i>46.4</i>	<i>27.8</i>	<i>32.3</i>	<i>11.1</i>	<i>39.6</i>	
	Percent of total	15.1	9.4	7.2	7.2	.7	39.	
Moderate uncertainty	Count	10	7	8	9	4	38	3.0
	Expected frequency	9.6	7.7	9.8	8.5	2.5	38.0	
	Percent within moderate uncert.	26.3	18.4	21.1	23.7	10.5	100.0	
	Percent within strategic alliances	<i>28.6</i>	<i>25.0</i>	<i>22.2</i>	<i>29.0</i>	<i>44.4</i>	<i>27.3</i>	
	Percent of total	7.2	5.0	5.8	6.5	2.9	27.3	
High uncertainty	Count	4	8	18	12	4	46	3.0
	Expected frequency	11.6	9.3	11.9	10.3	3.0	46.0	
	Percent within high uncertainty	8.7	17.4	39.1	26.1	8.7	100.0	
	Percent within strategic alliances	<i>11.4</i>	<i>28.6</i>	<i>50.0</i>	<i>38.7</i>	<i>44.4</i>	<i>33.1</i>	
	Percent of total	2.9	5.8	12.9	8.6	2.9	33.1	
Total SMEs*	Count	35	28	36	31	9	139	3.0
	Expected frequency	35.0	28.0	36.0	31.0	9.0	139.0	
	Percent within strategic alliances	100.0	100.0	100.0	100.0	100.0	100.0	
	Percent of total	<i>25.2</i>	<i>20.1</i>	<i>25.9</i>	<i>22.3</i>	<i>6.5</i>	<i>100.0</i>	

Note: *Small and medium-sized enterprises

Source: The authors

To analyse the possible differences due to the perceived environmental uncertainty, only three levels of uncertainty were considered after the application of Duncan's (1972) proposal: low, moderate and high uncertainty⁶ (Table 8). The contingency table (Table 8) shows that the small and medium-sized enterprises that perceive high uncertainty are those that are most frequently among the higher values for importance, and the median is 3.0. Thus, those firms attach greater importance to the formation of strategic alliances. Those alliances will be one way of obtaining more information that reduces the perceived level of environmental uncertainty. A distinctive characteristic of this group of firms is that they are small firms while the other groups mostly comprise microfirms (Table 9). This leads us to think that these organisations, with more than one dimension, are more strategically mature than the rest and develop a broader set of operations, markets and customers; thus they propose the establishment of strategic alliances to continue growing and to mitigate environmental uncertainty.

Table 9 Frequencies of the small and medium-sized enterprises according to the importance of strategic alliances

	<i>Low uncertainty</i>	<i>Moderate uncertainty</i>	<i>High uncertainty</i>
Sector of activity			
Industry	9 (15.5%)	4 (9.8%)	1 (2.0%)
Construction	2 (3.4%)	3 (7.3%)	5 (10.2%)
Retail	20 (34.5%)	19 (46.3%)	21 (42.9%)
Other services	27 (46.6%)	14 (34.1%)	22 (44.9%)
Primary	--	1 (2.4%)	--
Total	58 (100%)	41 (100%)	49 (100%)
Age			
0–10 years	19 (32.8%)	14 (34.1%)	15 (30.6%)
11–20 years	12 (20.7%)	7 (17.1%)	11 (22.4%)
21–30 years	11 (19.0%)	10 (24.4%)	11 (22.4%)
Over 30 years	10 (17.2%)	6 (14.6%)	3 (6.1%)
No data	6 (10.3%)	4 (9.8%)	9 (18.4%)
Total	58 (100%)	41 (100%)	49 (100%)
Size			
Microfirm	27 (46.6%)	17 (41.5%)	17 (34.7%)
Small	21 (36.2%)	16 (39.0%)	27 (55.1%)
Medium	10 (17.2%)	8 (19.5%)	5 (10.2%)
Total	58 (100%)	41 (100%)	49 (100%)

Source: The authors

The next group of small and medium-sized enterprises that attach some importance to alliances comprises the firms that perceive moderate uncertainty (median 3.0) because of either the high complexity of their environment or the level of dynamism. In this case, it appears that the managers trust that the alliances help them to clarify and simplify the structure of relationships between the environmental variables as well as to face unforeseen changes in external circumstances. It should also be taken into account that the firms that perceive moderate uncertainty have a characteristic that differentiates them from the other groups. More specifically, they are mostly small and medium-sized enterprises in the retail sector (Table 9), which has a complex legal framework and in recent years has seen the appearance of larger scale retail formats, large retail outlets and distribution chains (Confederación Canaria de Empresarios, 2006). This fact leads to a perception of increasing complexity or dynamism in their environment and alliances are proposed as a way to confront them.

Finally, most of the small and medium-sized enterprises that perceive low environmental uncertainty attach less importance to strategic alliances (median 2.0), as Table 8 shows.

Although the analysis of the frequencies (Table 8) reveals some differences in the importance that small and medium-sized enterprises attach to the formation of strategic alliances, depending on the type of environment that they perceive, the next step was to test whether these differences are significant. To that end, the Kruskal-Wallis test

(chi-squared statistic) was applied between the groups of small and medium-sized enterprises reflecting the three levels of perceived environmental uncertainty and the importance that they attach to strategic alliances (with values from 1, very little importance, to 5, very great importance). The result reveals that there are significant differences between the importance that the three groups attach to strategic alliances since the asymptotic significance is below 0.05, at 0.02 (Table 10). The order of the level of importance that each group of firms attaches to strategic alliances is shown in the table of rank (Table 11). This table shows that group 1 (low perceived uncertainty) has the lowest rank and group 3 (high perceived uncertainty) the highest.

Table 10 Test statistics^{a, b}

<i>Strategic alliances</i>	
Chi-squared	12.139
GI	2
Asymp. sig.	.002

Notes: ^aKruskal-Wallis test^bGrouping variable: GROUP uncertainty*Source:* The authors**Table 11** Ranks

	<i>Group uncertainty</i>	<i>N</i>	<i>Mean rank</i>
Strategic alliances	Low uncertainty (1)	55	56.75
	Moderate uncertainty (2)	38	72.46
	High uncertainty (3)	46	83.80
	Total	139	

Source: The authors**Table 12** Test statistics^a

<i>Strategic alliances</i>	
Mann-Whitney U	760.000
Wilcoxon W	2300.000
Z	-3.544
Asymp. sig. (bilateral)	.000

Note: ^aGrouping variable: GROUP uncertainty*Source:* The authors**Table 13** Ranks

	<i>Group uncertainty</i>	<i>N</i>	<i>Mean rank</i>	<i>Sum of ranks</i>
Strategic alliances	Low uncertainty (1)	55	41.82	2,300.00
	High uncertainty (3)	46	61.98	2,851.00
	Total	101		

Source: The authors*Source:* The authors

Finally, it is interesting to identify the groups between which there are significant differences regarding the importance that the small and medium-sized enterprises attach to strategic alliances according to the environmental uncertainty that they perceive. To that end, the Mann-Whitney test was applied to each possible pairing of the groups of small and medium-sized enterprises (low-moderate uncertainty, low-high uncertainty and moderate-high uncertainty) with the Bonferroni correction also taken into account⁷. The results of these tests reveal that there are only significant differences between the group of firms that perceive low environmental uncertainty (group 1) and the group that perceives high environmental uncertainty (group 3) (Table 12). The differences in the degree of importance that each group attaches to strategic alliances are shown in the table of ranks (Table 13). This table shows that the group of firms that perceives low environmental uncertainty attaches less importance to strategic alliances than the group comprising firms perceiving high uncertainty.

5 Conclusions and future lines of research

5.1 Conclusions

This study analyses the importance of one of the strategic options for small and medium-sized enterprises to reduce environmental uncertainty: the establishment of strategic alliances. The relevance of this strategic option lies in the fact that the use of alliances enables small and medium-sized enterprises to share information, resources, knowledge and experience in order to face today's turbulent environments. Hence, the following conclusions can be drawn from this work:

- The largest group of small and medium-sized enterprises in the Canary Islands (Spain) comprises the firms that perceive an environment of low uncertainty, followed by the group that perceives an environment of high uncertainty. In all the environments, there is a predominance of microfirms that are between 0 and 10 years old and belong to the other services sector. Although there is an exception in the group of firms that perceive low uncertainty based on complexity, in which there are more retail small and medium-sized enterprises. One explanation of this result might be provided by the study on trade that was undertaken by the Ministry of Industry, Tourism and Trade, in which the Spanish Region with the highest level of regulation, considering the average for the period studied (1998–2006), is the Canary Islands (Casares and Martín, 2009).
- If we analyse the environment perceived by small and medium-sized enterprises by considering the two dimensions of uncertainty individually, we find that there are more small and medium-sized enterprises that perceive high complexity than high dynamism. Thus, it is patently clear that it is difficult for small and medium-sized enterprises to understand and connect what is happening around them.
- There are significant differences in the importance attached to strategic alliances by the small and medium-sized enterprises that perceive low environmental uncertainty and by those that perceive more uncertainty. Thus, as higher uncertainty is perceived, the small and medium-sized enterprises attach more importance to strategic alliances

as a way to overcome that uncertainty and acquire the necessary information about their environment.

- The small and medium-sized enterprises in the group that perceives an environment of high uncertainty attach more importance to the formation of strategic alliances are characterised by their larger size, with small firms predominant in the group, as opposed to the microfirms that are predominant in the other groups. In that respect, it is appropriate to reflect on the size of firms and their interorganisational relationships; in other words, as the firms grow, they become more aware of how to face their environment and, therefore, establish more professional and proactive interorganisational relationships (Gilmore et al., 2000), with better performance resulting from those relationships. This fact probably leads them to attach greater importance to strategic alliances. However, the smallest small and medium-sized enterprises do not usually establish interorganisational relationships but, if they do, they are more social and reactive (Gilmore et al., 2000) and it is probable that they obtain poorer performance and therefore attach less importance to such alliances.

It is also possible that the group of small and medium-sized enterprises that perceives more uncertainty in their environment is a group of innovative firms that need to establish interorganisational links in order to share knowledge and experience in the development of new processes, products and/or markets.

5.2 Future lines of research

Apart from the above conclusions, this work is significant in that it serves as a starting point to develop new lines of research that will provide greater knowledge of the strategic behaviour of small and medium-sized enterprises. One of those lines would be to analyse the role that firm size plays at the time when they are most, or least, prone to establish strategic alliances, depending on the perceived level of environmental uncertainty. There could also be an in-depth analysis of the separate effects that the different dimensions of uncertainty, such as complexity and dynamism, have on alliances. Another research line could focus on analysing the effects on the performance of small and medium-sized enterprises after they have established strategic alliances, given the environmental conditions. Similarly, it would be interesting to study the type of alliance that small and medium-sized enterprises develop according to the type of environment that they face: who they form an alliance with (large firm/small and medium-sized enterprises, customer/supplier/competitor/other firm); ways of forming the strategic alliances (for example, joint venture, license, franchise,...); duration of the relationship; repeat of a relationship as a result of experience (with the same or another partner) or exchange of resources that takes place in the strategic alliance. Finally, to continue studying the importance that small and medium-sized enterprises attach to strategic alliances according to their perceptions of environmental uncertainty and to exploit all the advantages offered by the Rasch (1980) methodology, future studies could address the analysis of the misfits that this methodology provides. This would enable us to find out which small and medium-sized enterprises do not behave as the model predicts and the possible causes of that differential behaviour that could condition their competitiveness and even their survival.

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Notes

- 1 The other option that exists in the literature is to consider the environment as an objective and external entity to the decision maker (for example, Dess and Beard, 1984; Keats and Hitt, 1988; Rasheed and Prescott, 1992).
- 2 Microfirm (0–9 employees), small firm (10–49 employees) and medium-sized firm (50–250 employees).
- 3 These percentages demonstrate that the sample is representative.
- 4 The OUTFIT statistics reflect the model's sensitivity to unexpected behaviours that affect the responses to items that are distant from the measure of dynamism/complexity perceived by the firms. The INFIT statistics are sensitive to unexpected behaviours close to those measurements (Wright and Mok, 2004). Both can be expressed in the form of MNSQ (mean-square) and ZSTD (standardised z value).
- 5 Since they are measurements of the subjects, negative values in the measurements indicate low levels of complexity and dynamism while positive values indicate high levels in the two dimensions.
- 6 The groups of firms perceiving moderately low and moderately high uncertainty have been grouped together in order to conduct the differential analyses considering three groups of firms whose sizes are more, or less, homogeneous.
- 7 It significant differences will be deemed to exist when the critical level is below 0.017 ($0.05/3 = 0.017$).