ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

FUZZY ASSOCIATION RULES FOR INNOVATION COLLABORATION FACTORS OF SMES IN DEVELOPING COUNTRIES: A COMPARISON OF BOLIVIA AND TURKEY

M.Sc. THESIS

America Rocio QUINTEROS CONDORETTY

Department of Industrial Engineering

Engineering Management Programme

MAY, 2014

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

GELİŞEN ÜLKELERDEKİ KOBİ'LERDE İNOVASYON İŞBİRLİĞİ FAKTÖRLERİ İÇİN BULANIK BİRLİKTELİK KURALLARI: BOLİVYA VE TÜRKİYE KARŞILAŞTIRILMASI

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To my family …

FOREWORD

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TABLE OF CONTENTS

Page

FOREWORD ..... **ix**
TABLE OF CONTENTS ..... **xi**
ABBREVIATIONS ..... **xv**
LIST OF TABLES ..... **xvii**
LIST OF FIGURES ..... **xix**
SUMMARY ..... **xxiii**
ÖZET ..... **xxv**
1. INTRODUCTION **1**
1.1 Aim of the study 1
1.2 Objectives of the study 2
1.3 Literature Review 2
1.3.1 Definition and characteristics of SME 2
1.3.1.1 SMEs Barriers 3
1.3.2 Innovation 3
1.3.2.1 Definition of Innovation 3
1.3.2.2 Types of innovation 4
1.3.2.3 Innovation measurement 4
1.3.2.4 Innovation obstacles 4
1.3.3 Collaboration 4
1.3.3.1 Collaborative network 5
1.3.3.2 R&D Collaboration 5
1.3.3.3 Inter-firm Collaboration 5
1.3.3.4 Need of SMEs to be part of a Collaboration 5
1.3.4 Research & Development by SMEs 6
2. SME CHARACTERISTICS AND COLLABORATIONS **7**
2.1 SMEs in Latin America and Bolivia 7
2.1.1 Categorization of SMEs in Bolivia 7
2.1.2 Number of SMEs in Bolivia 8
2.1.3 R&D Investment in Bolivia 9
2.2 SMEs in Europe and Turkey 9
2.2.1 Categorization of SMEs in Europe 9
2.2.2 SMEs in Turkey 9
2.3 Comparison of innovation indicators between Bolivia and Turkey 10
3. DATA AND METODOLOGY **13**
3.1 Fuzzy association rules literature 13
3.1.1 Data Mining literature 13
3.1.2 Association Rules 13
3.1.3 Fuzzy set theory 14
3.2 Fuzzy association rules methodology 15
3.2.1 F-APACS Method 16
3.3 Sample and Data Source 18

4. INNOVATION AND SYNERGY FUZZY MODELLING 19
4.1 Factors that Affect Innovation 19
4.1.1 Size of the firm 20
4.1.2 The rate of white collar employees 21
4.1.3 Age of the firm 21
4.1.4 Being in a high or low technological industry 22
4.1.5 Financial resources 23
4.1.6 Capital structure 24
4.1.7 Shareholders structure 24
4.1.8 Number of patents that the firm has obtained 25
4.1.9 Number of patents that the firm has applied for 26
4.1.10 Level of customers' collaboration to innovation 26
4.1.11 Structure of the sales channels 27
4.1.12 Reaction to change 27
4.1.13 Industry trend/ Life cycle stage 28
4.1.14 Speed of change 29
4.1.15 Collaborative / competitive industry 30
4.1.16 R&D structure 30
4.1.17 Turnover rate 31
4.1.18 Open innovation ability 32
4.1.19 Learning organization 32
4.1.20 Resource allocation policy 33
4.1.21 Relation with other institutes 34
4.1.22 Relation with universities 35
4.1.23 Competitive relation inside the firm 36
4.1.24 Labor productivity 36
4.1.25 Level of customers' contribution to innovation 37
4.1.26 Innovation level of the firm 38
4.1.27 Number of qualify workers 38
4.1.28 Annual productivity 39
4.1.29 Annual profit 40
4.1.30 Level of suppliers' contribution to innovation 40
4.1.31 Level of sales channels' contribution to innovation 41
4.2 Factors that Affect Synergy 42
4.2.1 Attitude towards alliance 42
4.2.2 Inter-organizational communication 43
4.2.3 Organizational structure 43
4.2.4 Company's pace 44
4.2.5 Inter-organizational trust 45
4.2.6 Scope of the alliance 46
4.2.7 Dysfunctional conflict 46
4.2.8 Commitment capabilities to alliance 47
4.2.9 Values and company culture 48
4.2.10 Funding balance 49
4.2.11 Structure of the alliance 50
4.2.12 Communication, coordination and information sharing systems 50
4.2.13 Performance culture 51
4.2.14 Reward and compensation systems 52
4.2.15 The clarity of vision, goals and objectives 52
4.2.16 Type of leadership 53

4.2.17 Administrative capacity 54
4.2.18 Brand / firm reputation 55
4.2.19 Organizational resources 56
4.2.20 Technological resources 56
5. APPLICATION AND RESULTS 59
5.1 Preliminary Analysis 59
5.1.1 Sector of the firms 59
5.1.2 Distribution according the firm-size 61
5.1.3 Respondents position 61
5.2 Association Rules of innovation collaboration factors 61
5.2.1 Attitude towards alliance 61
5.2.2 Level of customers' collaboration to innovation 63
5.2.3 R&D structure 65
5.2.4 Open Innovation Ability 68
5.2.5 University-firm relations 70
5.2.6 Relation with other institutes 72
5.3 Association rules retated to the trend, age and size of the industries 77
5.3.1 Rules according to the industry trend 77
5.3.2 Rules according to the age 77
5.3.3 Rules according to the firm size 78
6. CONCLUSIONS 83
REFERENCES 85
APPENDICES 89
CURRICULUM VITAE 109
..... 109

ABBREVIATIONS

ECLA	**:** The Economic Commission for Latin America (the Spanish acronym is CEPAL: Comisión Económica para América Latina y el Caribe).
CN	**:** Collaborative Network
GDP	**:** Gross Domestic Product
OCDE	**:** Organización para la Cooperación y el Desarrollo Económicos
SME	**:** Small and Medium Enterprise
UNIDO	**:** United Nations Industrial Development Organization

LIST OF TABLES

Page

Table 2.1: Category of Enterprises in Bolivia according to INE (National Statistics Institute of Bolivia)..... 7
Table 2.2: Category of Enterprises according to the Ministry of Productive Development and Plural Economy..... 8
Table 2.3: Category of Micro and Small Enterprises according to the ante-project....8
Table 2.4: Category of Enterprises in Bolivia according to INE (National Statistics Institute of Bolivia)..... 8
Table 2.5: Source of R&D Investments in Bolivia by Sector.....9
Table 2.6: Classification of SMEs according to the European Comission..... 9
Table 2.7: Indicators of Innovation linkages of Bolivia versus Turkey.....11
Table 2.8: Indicators of Knowledge absorption of Bolivia versus Turkey.....11
Table 2.9: Indicators of Knowledge creation of Bolivia versus Turkey.....11
Table 2.10: Indicators of Knowledge impact of Bolivia versus Turkey.....12
Table 2.11: Indicators of Knowledge diffusion of Bolivia versus Turkey..... 12
Table 4.1: List of factors that affect Innovation in SMEs..... 19
Table 4.2: List of factors that affect Synergy in SMEs.....42
Table 5.1: Number of firms accoding to their size. 61
Table 5.2: Number and percentage of respondents' positio….....61
Table 5.3: Comparison of association rules of Bolivia and Turkey according to the business life cycle stage of the SME.....79
Table 5.4: Comparison of association rules of Bolivia and Turkey according to the age of the SME.....81
Table 5.5: Comparison of association rules of Bolivia and Turkey according to the size of the firm..... 82

LIST OF FIGURES

Page

Figure 4.1: Fuzzy numbers of the linguistic terms for attribute size of the firms… 21
Figure 4.2: Fuzzy numbers of the linguistic terms for attribute rate of white collar employees…..…….... 21
Figure 4.3: Fuzzy number of the linguistic terms for attribute age of the firm..... 22
Figure 4.4: Fuzzy numbers of the linguistic terms for attribute being in a high or low technological industry.…….……...23
Figure 4.5: Fuzzy numbers of the linguistic terms for attribute financial resources of the firm. ……...… 23
Figure 4.6: Fuzzy numbers of the linguistic terms for attribute capital structure of the firm. ……..……..… 24
Figure 4.7: Fuzzy numbers of the linguistic terms for attribute shareholders structure of the firm.……...…… 25
Figure 4.8: Fuzzy numbers of the linguistic terms for attribute number of patents that the firm has obtained. ……..……..…… 25
Figure 4.9: Fuzzy numbers of the linguistic terms for attribute number of patents that the firm has applied for..……...… 26
Figure 4.10: Fuzzy numbers of the linguistic terms for attribute level of customers' collaboration to innovation..……. 27
Figure 4.11: Fuzzy numbers of the linguistic terms for attribute the structure of sales channels of the firm. ……..……..... 27
Figure 4.12: Fuzzy numbers of the linguistic terms for attribute reaction to change of the firm. …….....……. 28
Figure 4.13: Fuzzy numbers of the linguistic terms for attribute Industry trend….. 29
Figure 4.14: Fuzzy numbers of the linguistic terms for attribute the speed of change of the firm. ……...……..… 29
Figure 4.15: Fuzzy numbers of the linguistic terms for attribute the collaborative / competitive industry of the firm. ……..……...… 30
Figure 4.16: Fuzzy numbers of the linguistic terms for attribute R&D structure of the firm……...…..…… 31
Figure 4.17: Fuzzy numbers of the linguistic terms for attribute the turnover rate of the firm. ……...……31
Figure 4.18: Fuzzy numbers of the linguistic terms for attribute the open innovation ability of the firm..……..……..……32
Figure 4.19: Fuzzy numbers of the linguistic terms for attribute the learning organization of the firm. ……..…… 32
Figure 4.20: Fuzzy numbers of the linguistic terms for attribute the basic resources allocation of the firm. ……..…… 33
Figure 4.21: Fuzzy numbers of the linguistic terms for attribute the contingency resouces allocation of the firm. ……..…… 34
Figure 4.22: Fuzzy numbers of the linguistic terms for attribute the relation with other institutes. ……..…35

Figure 4.23: Fuzzy numbers of the linguistic terms for attribute the relation with univerisities. ……35
Figure 4.24: Fuzzy numbers of the linguistic terms for attribute the competitive relation inside the firm of the firm. ……36
Figure 4.25: Fuzzy numbers of the linguistic terms for attribute labor productivity of the firm.…… 37
Figure 4.26: Fuzzy numbers of the linguistic terms for attribute level of customers' contribution to innovation of the firm..…… 37
Figure 4.27: Fuzzy numbers of the linguistic terms for attribute the innovation level of the firm. ……38
Figure 4.28: Fuzzy numbers of the linguistic terms for attribute the number of quality workers of the firm.…… 39
Figure 4.29: Fuzzy numbers of the linguistic terms for attribute the annual productivity of the firm.……39
Figure 4.30: Fuzzy numbers of the linguistic terms for attribute of the annual profit of the firm…… 40
Figure 4.31: Fuzzy numbers of the linguistic terms for attribute level of suppliers' contribution to innovation of the firm.…… 41
Figure 4.32: Linguistic terms for attribute level of sales channels' contribution to innovation of the firm. …… 41
Figure 4.33: Fuzzy numbers of the linguistic terms for attributes attitude towards alliance of the firm; and inter-organizational communitacion…… 43
Figure 4.34: Fuzzy numbers of the linguistic terms for attribute the organizational structure of the firm. …… 44
Figure 4.35: Fuzzy numbers of the linguistic terms for attribute the company's pace of the firm. ……45
Figure 4.36: Fuzzy numbers of the linguistic terms for attribute the inter-organizational trust of the firm. …… 45
Figure 4.37: Fuzzy numbers of the linguistic terms for attribute the scope of the alliance of the firm. ……46
Figure 4.38: Fuzzy numbers of the linguistic terms for attribute the dysfunctional conflict of the firm. ……47
Figure 4.39: Fuzzy numbers of the linguistic terms for attribute the commitment capabilities to alliance of the firm..…… 48
Figure 4.40: Fuzzy numbers of the linguistic terms for attribute values and company culture of the firm. …… 48
Figure 4.41: Fuzzy numbers of the linguistic terms for attribute funding balance of the firm. …… 49
Figure 4.42: Fuzzy numbers of the linguistic terms for attribute the structure of the alliance of the firm. …… 50
Figure 4.43: Fuzzy numbers of the linguistic terms for attribute the communication, coordination and information sharing systems of the firm..……..51
Figure 4.44: Fuzzy numbers of the linguistic terms for attribute the performance culture of the firm. ……52
Figure 4.45: Fuzzy numbers of the linguistic terms for attribute the reward and compensation system of the firm. ……52
Figure 4.46: Fuzzy numbers of the linguistic terms for attribute the clarity of vision goals and objectives of the firm. ……53
Figure 4.47: Fuzzy numbers of the linguistic terms for attribute the type of leadership of the firm. ……54

Figure 4.48: Fuzzy numbers of the linguistic terms for attribute the administrative capacity of the firm..……55
Figure 4.49: Fuzzy numbers of the linguistic terms for attribute brand/firm reputation of the firm. ……...55
Figure 4.50: Fuzzy numbers of the linguistic terms for attribute the organizational and technological resources of the firm. ……...56
Figure 5.1: Sector of Bolivian participating firms.…….....…..59
Figure 5.2: Sector of Turkish participating firms.…….....…… 60
Figure 5.3: Sector of the total participating firms (Bolivian and Turkish)……... 60
Figure 5.4: Resources that an SME with a R&D lab is ready to share with an alliance.……..66
Figure 5.5: Resources that an SME with a R&D department/unit is ready to share with an alliance. …… 67
Figure 5.6: Resources that an SME with outsourced R&D activities is ready to share with an alliance. …… 68

FUZZY ASSOCIATION RULES FOR INNOVATION COLLABORATION FACTORS OF SMES IN DEVELOPING COUNTRIES: A COMPARISON OF BOLIVIA AND TURKEY

SUMMARY

"The whole is greater than the sum of its parts", a famous phrase of Aristotle, describes in simple words the power of a Network. When companies, universities, and the government of the same field from a specific region join forces working together and sharing resources to go through the same goal by reaching their own objectives, new forces come up allowing companies to get a competitive advantage. Consequently, the companies working together with related entities based on mutual trust are able to grow as well as influence the development of their region.

In this context, this study constitutes an extension of a previous study done by Altay (2012): "A collective intelligence model for assessing collaborative innovation power including risks" which analyses Turkish SMEs. The current study, by applying the same innovation and synergy SMEs-survey, aims to analyses the innovation and synergy structures of SMEs in Bolivia comparing the results obtained with Turkish SMEs.

51 SMEs from Turkey and 27 from Bolivia were polled. They were mostly micro, small and the minority were medium size companies. These companies principally operate in food, clothing and textiles, electronic and machineries, commerce, and service industries. The survey respondents were mainly departmental managers and top managers.

After applying F-APACS method, a large collection of fuzzy association rules about innovation collaboration criteria was extracted. The attitude towards alliance was analyzed determining the reasons why SMEs are unwilling or willing to collaborate, same for the openness innovation ability and the level of customers' collaboration to innovation considering the method or means that the firms get in contact with their customers. In addition, association rules based on the SME's R&D structure, university-firm relations and the relation with other institutes were extracted. Finally, association rules related to organizational characteristics of the firms were summarized based on the trend, age and size of the industries.

GELİŞEN ÜLKELERDEKİ KOBİ'LERDE İNOVASYON İŞBİRLİĞİ FAKTÖRLERİ İÇİN BULANIK BİRLİKTELİK KURALLARI: BOLİVYA VE TÜRKİYE KARŞILAŞTIRILMASI

ÖZET

Aristoteles'in ünlü bir sözü olan "Bütün, parçaların toplamından daha fazladır" basit bir deyişle bir ağın gücünü anlatmaktadır. Belirli bir bölgeden ve aynı branştaki şirketler, üniversiteler, ve hükümet birlikte çalışarak hem kendi hedeflerine ulaşıp hem de aynı hedefe gitmek için kaynaklarını paylaştıkları ve güçlerini birleştirmiş olmalarından dolayı yeni güçlü şirketlerin rekabet avantajını elde etmektedirler. Bu şekilde, karşılıklı güvene dayalı, ilgili kuruluşlar ile birlikte çalışan şirketler büyümeye devam edebilmekle beraber bölgenin gelişimini de etkileyebilemektedir.

KOBİ'ler gelişen ülkelerin motoru olarak kabul edilirler. Literatür gösteriyor ki gelişen ülke ekonomilerinde yenilik işbirliği KOBİ'lerin yenilik kapasitelerini desteklemekte ve yenilik için itici güç olan ana iki parçanın etkileşmesinden dolayı giderek anlamlı hale geliyorlar. Bir yanda özel ve devlet sektörünün AR-GE aktiviteleri, diğer yanda da şirketlerin yenilikçi ürünleri ve süreçlerini yaratma, benimseme ve yayma kapasiteleri.

Güçlü uluslararası rekabet, zorlu piyasalar, hızla değişen teknolojilerle ve en sonunda küresel rekabetin artmasından dolayı, yenilik şirketler için büyük bir önemli konu haline gelmiştir.

Yenilikçilik sürekli yeni fikirler ve buluşlar arama ve uygulama kapasitesidir. Yenilik hem bir işi yapmanın yöntemlerini hem de teknolojisindeki gelişmeleri içermektedir. Şirketler bilimsel araştırma merkezleri ve üniversitelerle işbirliği yaparak ve bilgiye erişerek bir rekabet avantajı elde edebilirler. Rekabet yeteneği şirkerlerin işbirliği taranfından güçlendirilmektedir çünkü bu işbirliği sayesinde bilgi ve deneyim erişimine ulaşmak kesinleşmektedir. Ayrıca, işbirliği sayesinde üye şirketler yatırım ve riskleri paylaşarak yenilik faaliyetlerine odaklanabilmektedirler.

KOBİ'lerin yenilik yapmaları için farklı engelleri vardır. KOBİ'lerin genellikle yenilik projelerine girişm yapması için yetersiz iç para kaynaklarına sahip olmaktadır ve dış fon elde etmek için büyük firmalardan çok daha fazla zorluk çekmektedirler. Ayrıca, üst yönetim genellikle değişiklikleri ve yenilik süreci riskli olan ve pahalı olarak algıladığından dolayı uygulamak için cesaret eksikliğinden dolayı yeniliğin sürdürülmesi şirketlerin engellerinden biridir.

İşbirliği bir faaliyet programının planlaması, uygulanması ve değerlendirilmesi için üye firmaları birlikte çalışarak ve bununla beraber bilgi, kaynak ve sorumlulukları paylaşarak ortak bir hedefe doğru odaklayan bir süreçtir. Ağ organisazyolar bir genişleme ve konsolidasyon süreci halinde devam etmektedir. Ayrıca, endüstriyel üretim, hizmet, lojistik ve taşımacılık, eğitim gibi farklı sektörlerde uygulanmaktadır.

Büyük işletmelere nazaran KOBİ'lerin en önemli yetkinliği esnekliktir. Ayrıca, işbirliği içinde KOBİ'lerin de bu yetkinlikten yararlanabilmektedirler. Sadece bu

avantajları ve olası dezavantajların farkında olarak, bir işbirliğinin KOBİ üyesi ortakları toplama ve ortaklarının arasındaki güven gelişimi üzerinde dikkatli olarak gelecekteki sorunları engelleyebilmektedir. Bir işbirliği hızla uymak için potansiyel üyeleri ona katılmadan önce hazır olması lazım. Örneğin, ortak çalışabilir altyapı, işletim kuralları ve işbirliği anlaşmasını hazırlanması gerekmektedir. Buna ek olarak, teşvikler ve adalet sisteminin oluşturulması bir işbirliğin katılan şirketlerin tutulması için vazgeçilmez konulardır.

KOBİ işletmeleri pazar ile ilgili önceliklerinin yanı sıra, rekabetçi stratejiler de belirlemeleri gerekmektedir. Ortaklık oluşturmak işbirliğindeki stratejilerin formülasyonunu desteklemektedir. Ürün ve süreç geliştirme yeniliği ve iyileştirilmesi bir işbirliğinin verimliliği için çok önemli olmaktadır. Bu nedenle, uygun yönlerdirme ve doğru stratejiler ile desteklenen bir işbirliği üyeleri için kazanç ile sonuçlanmaktadır. İşbirliğine üye olmayan şirketlere göre stratejik bakış ve işbirliğinin içinde olmak KOBİ'lerin daha yüksek performansa ulaşmasına yardım etmektedir.

Ar-Ge iç kapasitesi olarak bir tasarım ofisi büyük bilgi ağlarının kullanımını kolaylaştırarak kolektif yenilik başarısını etkilemektedir. KOBİ'lerin iç araştırma kapasiteleri dış bilimsel ve teknik bilgi kendi yararına kullanmada daha fazla yardımcı olmaktadır ve ayrıca yenilikçi ağları kullanmak için de destek çıkmaktadır. Dolaysıyla KOBİ'lerin dış kurumlardan bilgiye erişmek için bir Ar-Ge işbirliğinin parçası olmadan önce kendi Ar-Ge kapasitelerinin geliştirilmesi ve yapılandırmasını gerekmektedir.

142 ülkenin sıralamasından oluşan inovasyon yeteneklerini ve sonuçları kapsayan 2013 Küresel Yenilik Endeksi raporuna göre, Bolivya, 30,48 puan ile 95. Türkiye ise 36,03 puanla 68. sırada yer almaktadır.

Bu bağlamda, bu çalışma daha önce Altay (2012) tarafından yapılmış olan ve Türkiye'deki KOBİ'leri inceleyen "A collective intelligence model for assessing collaborative innovation power including risks" adlı çalışmanın bir uzantısıdır. Bu çalışma ile, aynı inovasyon ve sinerji anketi Bolivya'daki KOBİ'lere de uygulanarak, Bolivya ve Türkiye'deki KOBİ'lerin karşılaştırılmasının yapılmasını amaçlamaktadır.

Onbir grubun yenilik parametreleri sınıflandırılmasında ittifaklar inovasyon kapasitesini etkileyen onun çalışma faktörleri Altay (2012) tarafından tanımlanmıştır: sanayi, kurumsal demo-grafik, mali özellikleri, örgüt kültürü, müşteri ilişkileri, satış kanalları, tedarikçiler, çalışan, fikri mülkiyet, inovasyon ve Ar-Ge politikası, ve enstitüleri ve üniversiteleri ile ilişkililer. Ayrıca, yenilikçiliği etkileyen ana sinerji parametreleri dört set halinde listelenmiştir: örgütsel ve maddi faktörler, örgütsel ve maddi olmayan kriterler, ittifak ve somut faktörler, ve ittifak ve maddi olmayan kriterler.

Türkiye'den 51 ve Bolivya'dan 27 KOBİ işletmeleri arasında AR-GE işbirliklerinin sinerji ve inovasyon potensiyelini ölçmek için anketler yapılmıştır. Bu firmaların çoğu genelde mikro ölçekli firmalardan oluşmaktadır. Bu işletmeler çoğunlukla giyim ve tekstil, elektronik ve makine, ticaret ve endüstri ve son olarak da gıda sektöründe faliyet gösteren firmalardan oluşmaktadır. Anketler ağırlıklı olarak şube ve üst düzey yöneticiler tarafından doldurulmuştur.

KOBİ'lerin verilerine Bulanık APACS yönteminin uygulaması ile büyük bir bulanık birliktelik kuralları kümesi elde edilmiştir. İşbirline karşı firmaların, birliktelik kuralları ile incelenerek, hangi nedenlerle istekli veya isteksiz oldukları belirlenmiştir. Aynı şekilde, inovasyon işbirliklerine açıklık ve müşterilerin inovasyona katkısının

nedenleri de, işletmelerin müşteri ile görüşme yolları düşünülerek belirlenmiştir. Benzer birliktelik kuralları, işletmenin Ar-Ge yapısı, üniversite-firma ilişkileri ve firma-bilimsel kurum ilişkileri için de oluşturulmuştur. Son olarak da işletmenin yaşı, büyüklüğü ve sektörün eğilimleri incelenerek birliktelik kuralları oluşturulmuştur.

Bolivya'da firmaların yerel rekabet yoğunluğu düşük olmasına rağmen, pazarda ayakta kalabilmek için kalifiye işçiler sahip olmak ve teknoloji açısından kendi boşluklarını doldurmak için üniversitelerle işbirliği yapmaya istekli olmaktadırlar. Buna karşılık, Türk firmalarının yerel rekabet yoğunluğunun yüksek olmasından dolayı açık olan bu boşluğu doldurmak yerine Türk pazarında daha iyi bir rekabet avantajı elde etmek için üniversitelerle işbirliğine hevesli olmaktadırlar. Bu nedenle, Ar-Ge işbirliğine üye olan Bolivyalı KOBİ'ler işbirliğine daha bağlı olabilmektedirler ve sonuç itibarıyla şiddetle taahhüt edilebilmektedir. Halbuki Ar-Ge işbirliğine üye olan Türk KOBİ'ler herhangi bir eksikliği doldurmak amacı yerine, oldukça yoğun rekabet olan bir pazarda daha fazla pazar payı kazanmak amacıyla üyelerinin sinerji ve bağlılığını artırmaya çalışarak belirli amaçlar belirterek daha aktif bir rol oynamaları gerekmektedir.

1. INTRODUCTION

Micro, small and medium-sized enterprises (SMEs) are the backbone of Latin America and Europe's economy. For Europe they are the key of its competitiveness and for Latin America they represent key stakeholders to increase the growth potential of this region (Matt & Ohlhsuden 2011; OECD/CEPAL, 2013). In the EU25 99% of all enterprises, SMEs represent about 25 million companies and employ almost 95 million people (Matt & Ohlhsuden, 2011). In Latin America, they are a fundamental component of the production network in the region, making up about 99% of all firms and employ about 67% of the total workforce. However, its contribution to GDP is relatively low, which exposes weaknesses in their productivity levels (OECD/CEPAL, 2013). Thus, it seems important to identify the factors for sustainable success of SMEs (Matt & Ohlhsuden, 2011).

Whereas only about 10% of Latin American SMEs export part of its production, in Europe exporting SMEs fraction is at least 40% of the total. SMEs in Latin America are a very heterogeneous, ranging from informal self-employment microenterprises to innovative company with high efficiency and export capacity. A better articulation between economic actors that increases the efficiency and effectiveness of support institutions is needed to increase productivity and competitiveness of SMEs in the region. The integration of clusters and business networks to global value chains can help diversify exports, create new jobs and acquire additional technological capabilities in accordance with international best practices, thereby strengthening competitiveness (OECD/CEPAL, 2013).

1.1 Aim of the study

A collaborative network is a broader concept than a cooperative network, a coordinated network or a network since the establishment of it takes more time than other kinds of alliance. Nevertheless, there is a lack of performance indicators that evaluate on the one hand globally the collaborative networks and on the other hand individually to every member entity. Hence, by developing a statistical model for

building a collaborative network would let set up the basis for creating future performance indicators based on the level of innovation and synergy of company members of this collaboration (Camarinha-Matos & Afsarmanesh, 2006). SME's innovation development process through collaboration should begin by assessing the behavior and attitude towards collaboration of the SME's potential members (Edwards et al., 2005).

In this context, this study constitutes an extension of a previous study done by Altay (2012): "A collective intelligence model for assessing collaborative innovation power including risks" which analyses Turkish SMEs. The current study, by applying the same innovation and synergy SMEs-survey, aims to analyses the innovation and synergy structures of SMEs in Bolivia comparing the results obtained with Turkish SMEs.

1.2 Objectives of the study

Under the above context, the current study has the following main objectives:

- To apply Altay's suvey of synergy and innovation to Bolivian SMEs.
- To analyze the structures of innovation and synergy of Bolivian and Turkish enterprises.
- To determine association rules related to the criteria that affect the decision of the SMEs to commit to an R&D alliance.
- To assess the similarities and dissimilarities between Turkish and Bolivian SMEs in terms of the extracted association rules.

1.3 Literature Review

1.3.1 Definition and characteristics of SME

Uzor (2011) states that SMEs are heterogeneous group of enterprises ranging from small workshop enterprises to medium size manufacturing enterprises as well as the service provider such as restaurants and hotels. Some are traditional handicraft and livelihood enterprises that are small by nature and common in the informal sector in developing countries. The heterogeneity of SMEs reflects the nature of labour force in terms of paid and unpaid labour, skilled and unskilled labour or technology, and labour

or machine intensive enterprises. It is therefore difficult to have a universally accepted definition of SMEs. Heterogeneity characteristics however help to explain why the SMEs exist because their economic activities tend to cover diverse income groups in an economy.

SMEs are relative terms used to define various small-scale business activities in the formal and informal industry (UNIDO, 2004).

SMEs are defined using quantitative and qualitative criteria. The quantitative criteria define the arbitrary boundaries of small enterprises by showing employment capacity, level of invesment capital or sales turnover. Such arbitrary boundaries provide information for statistical analysis and for the administration of small enterprise development programs (Staley and Morse, 1965). The qualitative measures define the functional characteristics of the small enterprises such as the nature of technology, organization and management skills. (Uzor, 2011)

1.3.1.1 SMEs Barriers

Financing of innovation by banks and shortage of skilled labor were considered the most important external barriers. As internal barrier were considered: lack of time, inadequate R&D, design and testing within the firm and inadequate financial means. (Hadjimanolis, 1999).

There are few studies about SME's innovation in developing countries, at least in South America. However, a couple of scholars focus on SME innovation in developing countries. For example, Hadjimanolis, A. (1999) analyses the impact of barrier to innovation for SMEs in Cyprus. This study notes that SMEs' owner/manager understanding of external barriers to innovation do not affect innovation level neither economic performance. Therefore, internal barriers are more critical and should be considered more than external ones.

1.3.2 Innovation

1.3.2.1 Definition of Innovation

O'Sullivan and Dooley (2009) define innovation as "the process of making changes, large and small, radical and incremental, to products, processes, and services that

results in the introduction of something new for the organization that adds value to customers and contributes to the knowledge store of the organization.

Casper and Waarden (2005) asserts that there are four keys for systematic innovation capability: integration of leadership, culture, skills and processes lead and promotes the increase of innovation.

1.3.2.2 Types of innovation

According to some authors there are four times of innovation: product innovations, process innovations, marketing innovations and organizational innovations. Product and process innovation are considered to be contain in technological process and product innovations (Emeksizoglu, 2008).

Innovation has turned into a great important issue for companies because of the strong international competition, demanding markets and speedily changing technologies that end in the increasing of global competition. (Denton, 1999; Emeksizoglu, 2008).

1.3.2.3 Innovation measurement

Souitaris (2006) states that factors that appear in a production functions as, input of R&D, labor, sum of investment and product output may be used to measure innovation input and output. Moreover, technical change factor such as patents, R&D expenditures, personnel, innovations, diffusion rates can be also considered to measure innovation. There are three most widely used innovation indicators as R&D, patents and sales and exports (Oslo Manual, 2006).

1.3.2.4 Innovation obstacles

Knights (1996) states that there are four sort of innovation's obstacles: social, organizational, economic and government. Furthermore, Emeksizoglu (2008) proclaims that the top management is one of the obstacles in the companies to sustaining innovation for the reason that they usually lack the courage to implement changes and that innovation process is perceived as risky and costly.

1.3.3 Collaboration

Collaboration is a process in which entities work together planning, implementing and evaluating a program of activities towards a common goal by sharing information, resources and responsibilities (Camarinha-Matos & Afsarmanesh, 2006).

1.3.3.1 Collaborative network

Camarinha-Matos (2008) defines a Collaborative Network (CN) as “a network consisting of a variety of entities (e.g. organizations, people, and even intelligent machines) that are largely autonomous, geographically distributed, and heterogeneous in terms of their operating environment, culture, social capital and goals, but that collaborate to better achieve common or compatible goals, and whose interactions are supported by computer network."

Networked organizations are going through an expansion and consolidation process. Moreover, they are applied in different sectors such as industrial manufacturing, services, logistics and transportation, education, etc. (Camarinha-Matos, 2008).

1.3.3.2 R&D Collaboration

The main driving force for innovation comes from the interaction of two parts. On the one hand from the private and public R&D activities, and, on the other hand, from the capacity of companies to create, embrace and spread innovative processes and products (ECLAC, 2008).

1.3.3.3 Inter-firm Collaboration

Westerlund & Rajala (2009) examined how different learning orientation stimulate networking highlighting that explorative learning orientation fosters a firm's multi-actor collaboration through product co-innovation.

1.3.3.4 Need of SMEs to be part of a Collaboration

The most important competence of an SME over a large company is flexibility. Moreover, in a collaboration SMEs can take advantage of this competence. Only by being aware of those advantages and possible disadvantages, an SME member of a collaboration can prevent future problems being careful about picking partners and working on developing trust between its partners (Narula, 2004). To conform speedily a collaborative network it is essential that potential members are ready beforehand and prepared to participate in such collaboration (common interoperable infrastructure, operating rules and collaboration agreement). In addition, the creation of a system of

incentives and fairness are indispensable issues for keeping companies involved in a collaborative network (Camarinha-Matos & Afsarmanesh, 2006).

1.3.4 Research & Development by SMEs

Bougrain & Haudeville (2002) state that a design office as an R&D internal capacity influences the success of the collective innovation by facilitating the use of massive information networks.

Bougrain & Haudeville (2002) evaluate how SME's internal research capacities help them to exploit external scientific and technical knowledge and to use networks of innovators. Their results suggest that SMEs need to develop and configure their own R&D capacities before to be part of an R&D collaboration to access to knowledge from external institutions.

Large firms tend to use a smaller percentage of their R&D budgets to outsource and engage in strategic alliances than SMEs (Narula, 2004).

In alliances, because of having limited opportunities to fail and having the risk of technological knowledge, SMEs behave very meticulously about selecting partners (Narula, 2004).

2. SME CHARACTERISTICS AND COLLABORATIONS

2.1 SMEs in Latin America and Bolivia

These companies are characterized by a great heterogeneity in their access to markets, technology and human capital, as well as its relationship with other companies, factors affecting productivity, export capacity and growth potential. (OCDE/CEPAL, 2013)

In Bolivia it is clear that the emergence of micro and small enterprises (MSEs) has generated a significant contribution to job creation, as well as its contribution to the GDP. These businesses let improve the distribution of income and family savings and acts as a generator of new ventures.

2.1.1 Categorization of SMEs in Bolivia

The National Statistics Institute of Bolivia (INE – for its acronym in Spanish) has categorized the enterprises according to the number of employees as it is shown in Table 2.1.

Table 2.1 : Category of Enterprises in Bolivia according to INE (National Statistics Institute of Bolivia).

Category of enterprise	Stretch of Employment
Large enterprise	50 and more workers
Medium enterprise	15 to 49 workers
Small enterprise	5 to 14 workers
Micro enterprise	1 to 4 workers

The current normative for the categorization of companies in Bolivia was stablished by the Ministry of Productive Development and Plural Economy. This categorization has considered four variables: employment, productive assests, annual sales and annual exportation as it is showed in Table 2.2. Moreover, it was stablished that in order to belong to one of them, a company has to fulfill at least two of the mentioned variables.

Table 2.2 : Category of Enterprises according to the Ministry of Productive Development and Plural Economy.

Category of Enterprise	Employment [workers]	Productive Assets [US$]	Annual Sales [US$]	Annual Exportations [US$]
Micro	≤ 9	≤ 34.171,5	≤ 136.868	≤ 17.085,75
Small	10-19	34.171,7 -341.715	136.686,22 -683.430	17.085,97 -170.857,50
Medium	20-49	341.715,22 -1.366.860	683.430,22 -2.733.720	170.857,72 -1.708.575
Large	≥50	≥1.366.860,22	≥2.733.720,22	≥1.708.575,22

In 2010, the same ministry changed a little bit the categorization of micro and small enterprises according to the Table 2.3.

Table 2.3 : Category of Micro and Small Enterprises according to the ante-project.

Category of Enterprise	Employment [workers]	Assets Value [US$]	Sales Value [US$]
Small	11-50	114.000	≤ 340.000
Micro	≤10	4.500	≤ 22.700

2.1.2 Number of SMEs in Bolivia

According to one study called MYPE 2008 made by INE Bolivia in the three main cities (La Paz, Santa Cruz and Cochabamba) there are 216.064 enterprises. Based on the economic sector, most of the enterprises are working in the commerce sector (54,41%) followed by services (34,03%) and industry (11,56%) as detailed in Table 2.4.

Table 2.4 : Category of Enterprises in Bolivia according to INE (National Statistics Institute of Bolivia).

Economic Sector	Number of Micro and Small enterprises	Percentage
Industry	24.975	11,56
Commerce	117.550	54,41
Services	73.539	34,03
Total	216.064	100,00

2.1.3 R&D Investment in Bolivia

Table 2.5 : Source of R&D Investments in Bolivia by Sector

N°	Investor Sector	2010	2011
1	Own funds	9.869.830	16.954.951
2	Firms	810.729	744.089
3	Gobierno	66.116.195	46.000.465
4	Domestic Credit	0	0
5	Foreign Credit	11.693.571	550.000
6	Foreign	41.550.548	880.764.178
7	Others	0	0
	Total	130.040.873	945.013.683

2.2 SMEs in Europe and Turkey

2.2.1 Categorization of SMEs in Europe

According to Hantal (2008) the European Commission clasiffies the SMEs as follows:

Table 2.6 : Classification of SMEs according to the European Commission.

Category of Enterprise	Employment [workers]	Annual Turnover [million of €]	Annual Balance [million of €]
Micro	<10	≤2	≤2
Small	<50	≤10	≤10
Medium	<250	≤50	≤43

2.2.2 SMEs in Turkey

In Turkey, more than 80 % of the production is private and 99.5 % of the industry is conformed by SMEs. The R&D investment in Turkey is 0,64 %, which is a low rate compared with other developed countries. Total number of R&D personnel is increased from 20,1 % in 1996 to 22,3% in 2000 (Innovation Policy: Turkey 2003).

According to Emeksizoglu (2008), Turkish small companies have 13 times more patents than big ones. However, big companies are the ones who produce those products that are licensed. She also states that Turkish companies give importance to innovation mostly to reach new markets and to increase profitability. Companies use suppliers of service, equipment and software, professional congresses, meetings, literature, fairs and exhibitions to get information and technology for innovation mostly. Risk perception regarding innovation, deficiency of financial sources, very

high cost and deficiency of technical personnel in company are the obstacles for companies to research and implement innovations.

2.3 Comparison of innovation indicators between Bolivia and Turkey

According to the 2013 Global Innovation Index (GII) report, which consists of a ranking that covered 142 countries' innovation capabilities and results, Bolivia was ranked in the 95th position with a score of 30.48, whereas Turkey was located in the 68th place with a score of 36.03.

Concerning political environment, Turkey has a higher government effectiveness than Bolivia. Nevertheless, Bolivia enjoys a slightly better press freedom as well as a more favorable political stability of absence of vilence and terrorism. In terms of regulatory environment, Turkey is greatly located in a much better position than Bolivia since it has a more virtuous regulatory quality and rule of law. Even though Bolivian business environment aids resolving insolvency, Turkish business environment in a greater degree facilitates the starting of a business and is notably much more superior at smoothing the way for paying taxes.

In relation to human capital and research, the Bolivian education indicator is ahead of the Turkish one in terms of a more noteworthy expenditure on this area, especially in relation to public expenditure on education per pupils. However, Turkey has a more elevated rate of tertiary enrolment and a little bit higher school life expectancy than Bolivia. As for R&D, Turkey enjoys a further large number of researchers as well as a superior gross expenditure on R&D.

With regard to infraestructure, Bolivia is positioned behind Turkey due to its limited use and access of Information and communication technologies (ICTs). Besides in Turkey there are a better government's online service, in Bolivia people has much more online e-participation.

To some extent, Bolivia has higher environmentnal performance, whereas Turkey retrieves a greater amount of GDP per unit of energy as well as a better logistics performance.

In the financial area, Bolivia is at the forefront in terms of microfinance institutions gross loan portfolio, and it has a higher rate of credits as well as presents a more favorable market access for non-agricultural exports. While in contrast, Turkey has a

higher rate of investments since boosts the protection of investors, and its levels of trade and competition in the market are higher revealing an intensive local competition.

Finnally, different innovation indicators are displayed in the following tables.

Table 2.7 : Indicators of Innovation linkages of Bolivia versus Turkey.

Indicator	Bolivia	Turkey
University/industry research collaboration	39.1	42.8
State of cluster development	40.1	49.2
GERD financed by abroad	28.9	1.3
Joint venture/strategic alliance deals	7.0	10.6
Innovation linkages	28.8	25.9

* http://www.globalinnovationindex.org

Table 2.8 : Indicators of Knowledge absorption of Bolivia versus Turkey.

Indicator	Bolivia	Turkey
Royalties and license fees payments (% of service imports)	7.3	18.7
High-tech imports	30.4	22.2
Communications, computer and information services imports, %	21.6	9.2
Foreign direct investment net inflows	28.5	21.8
Knowledge absorption	24.0	17.9

* http://www.globalinnovationindex.org

Table 2.9 : Indicators of Knowledge creation of Bolivia versus Turkey.

Indicator	Bolivia	Turkey
Scientific and technical publications	4.3	31.0
Citable documents H index	6.6	26.3
Knowledge creation	5.5	28.6

* http://www.globalinnovationindex.org

Table 2.10 : Indicators of Knowledge impact of Bolivia versus Turkey.

Indicator	Bolivia	Turkey	
Growth rate of GDP per person engaged	57.4	73.8	
New business density	3.3	6.6	
Total computer software spending	9.3	62.4	
ISO 9001 quality certificates	7.1	17.7	
Knowledge impact	26.9	40.1	

* http://www.globalinnovationindex.org

Table 2.11 : Indicators of Knowledge diffusion of Bolivia versus Turkey.

Indicator	Bolivia	Turkey	
High-tech exports	1.6	4.7	
Communications, computer and information services exports, %	30.2	2.7	
Foreign direct investment net outflows	48.8	49.3	
Knowledge diffusion	26.8	18.9	

* http://www.globalinnovationindex.org

3. DATA AND METODOLOGY

3.1 Fuzzy association rules literature

3.1.1 Data Mining literature

According to Suh (2011), data mining is a large part of Knowledge Discovery in Databases (KDD), the field that refers to the overall process of transforming raw data into useful knowledge. Data mining involves application of specific algorithms to databases to extract potentially useful knowledge.

Data mining is a tool utilized in different industries to supply valuable information that serves for the effective and strategic support of decision-making. Nature of the information retrieval in data-mining systems depends on the information needs of the organization. Thus, data-mining systems have to be prudently customized to fit the need of the users (Lotfi & Sadreddini, 2009). Data mining has captured the attention of industries as it has a variety of applications in marketing, finance, and retail. Moreover, it has been acknowledged as an important tool for database research (Suh, 2011).

3.1.2 Association Rules

Definition

Let $I = \{i_1, i_2, \dots, i_m\}$ be a set of items, in other words, a collection of attributes.

Let $T = \{t_1, t_2, \dots, t_n\}$ be a collection of transactions where each of them is a subset of the items in I.

An association rule in a transactional database with the form $X \rightarrow Y$, where X and Y are sets of items appearing in transactions. X is called the antecedent and Y the consequent. $X, Y \subset I$ and $X \cap Y = \emptyset$.

For instance, a rule might be that a customer purchasing bread and milk will also buy eggs with 90% likelihood. Thus, data mining in a transactional database is applied to retrieve such rules (Suh, 2011).

An association rule is interesting only if it is novel, externally significant, unexpected, nontrivial, and actionable. An association mining system facilitates the process to extract interesting rules for further interpretation by the user (Helm, 2007).

To determine whether an association rule is interesting, support and confidence are the two measures widely used (Lotfi & Sadreddini, 2009; Helm, 2007).

Support

The support of the rule X→Y is the percentage of transactions in T that contains X∩Y. It is presented by the formula:

$$supp(X \rightarrow Y) = \frac{|X \cap Y|}{n} \quad \textbf{(3.1)}$$

Where $|X \cap Y|$: number of transactions that contain all the items of the rule

n: total number of transactions

Confidence

The confidence of the rule X→Y describes the percentage of transactions containing X, which also contain Y. It is represented by the formula:

$$conf(X \rightarrow Y) = \frac{|X \cap Y|}{|X|} \quad \textbf{(3.2)}$$

The process of mining association rules has two main parts: 1) identifying all the item sets in the data that are adequate for mining association rules and show at least a certain frequency to be worth mining; and 2) generating rules out of the discovered frequent item sets (Helm, 2007).

3.1.3 Fuzzy set theory

With the aim of mining quantitative data, fuzzy association rule mining approach was developed as a result of expanding the classical association rule mining (Helm, 2007).

Georg Cantor, the main inventor of the set theory, defined a set as follows: "By a set we mean an aggregation M of certain unequal objects m in our opinion or in our thought (which are called elements of M) to a whole."

The extraordinary power of fuzzy set theory is that instead of using quantitative variables, utilizes linguistic variables in order to represent ambiguous or uncertain concepts. Furthermore, it is very suitable for highly complex models and for processes

that inseparably implicate human reasoning, perception or decision-making (Ross, 2004).

Fuzzy sets

Lotfi A. Zadeh was the first to introduce the concept of fuzzy sets in 1965. According to him "fuzzy sets are generalized sets which allow for a graded membership of their elements. Usually the real unit interval [0;1] is chosen as the membership degree structure." (Helm, 2007).

Ma & Chan (2010) matheatically describes a fuzzy set as follows:

Let X be a universe. A fuzzy value on X is characterized by a fuzzy set A in X. The membership function $\mu_A: X \rightarrow [0,1]$ is defined for the fuzzy set A, where $\mu_A(x)$, for each $x \in A$, represents the degree of membership of x in the fuzzy set A. Hence, the fuzzy set is describe as follows:

$$A = \begin{cases} \sum_{x \in X} \frac{\mu_A(x)}{x} \text{ if x is discrete} \\ \int_{x \in X} \frac{\mu_A(x)}{x} \text{ if x is continuous} \end{cases} \quad \textbf{(3.3)}$$

3.2 Fuzzy association rules methodology

Since the definition of linguistic terms has been established in fuzzy theory and it is used in this technique, the rules having these terms are called fuzzy association rules (Chan & Au, 1998).

A great collection of information can be extracted from databases applying diverse algorithms (Suh, 2011). For instance, Lotfi & Sadreddini (2009) establish the following steps for a fuzzy association rule construction:

1. Defining fuzzy sets and membership functions
2. Computing Normalized Mutual Information for each pair of attributes
3. Selecting potential frequent item sets using computed normalized mutual information.
4. Generating association rules in terms of selected attributes and fuzzy sets
5. Calculating adjusted difference for each generated rule

6. Filtering rules based on adjusted difference
7. Joining filtered rules for generating rules with more antecedents
8. Repeating the process until new rules generate.

3.2.1 F-APACS Method

Chan & Au (1998) define F-APACS as a technique that instead of utilizing intervals, it makes use of linguistic terms to portray the disclosed regularities and exceptions. This method applies adjusted difference analysis to identify interesting associations among attributes having the advantage that it does not need any user-supplied thresholds. Since the definition of linguistic terms has been established in fuzzy theory and it is used in this technique, the rules having these terms are called fuzzy association rules. The steps of this method are described as follows.

Step 1. Definition of fuzzy sets and membership functions.

Let

$I_v, v = 1, 2, \dots, n$ be the vth*attribute that can be quantitative or categorical*,

$\mathcal{I} = \{I_1, I_2, \dots, I_n\}$ be the set of attributes where $I_v \in \mathcal{I}$,

$\mathcal{D}$ be the set of transactions where $d \in \mathcal{D}$, and

$d[I_v]$ be the value i_v in d for attribute I_v

Let

$I_v \in \mathcal{I}, dom(I_v) = [l_v, u_v] \subseteq \Re$ be a quantitative attribute,

$\mathcal{L}_{vr}, r = 1, 2, \dots, s_v$ be the linguistic terms associated with some quantitative attribute,

L_{vr} be Fuzzy set of $\mathcal{L}_{vr}$,

$\mu_{L_{vr}}: dom(I_v) \rightarrow [0,1]$ be the membership function, and

Then, the fuzzy sets $L_{vr}, r = 1, 2, \dots, s_v$ are then define as

$$L_{vr} = \begin{cases} \sum_{dom(I_v)} \frac{\mu_{L_{vr}}(i_v)}{i_v} & \text{if } I_v \text{ is discrete} \\ \int_{dom(I_v)} \frac{\mu_{L_{vr}}(i_v)}{i_v} & \text{if } I_v \text{ is continuous} \end{cases} \quad \textbf{(3.4)}$$

For all $i_v \in dom(I_v)$

For each question of the innovation and synergy surveys fuzzy sets were designed and are describe in detail in chapter 4.

Step 2. To decide if the association between a linguistic term, $\mathcal{L}_{jk}$ and $\mathcal{L}_{pq}$is interesting, it should be determined whether

$$Pr(\mathcal{L}_{pq}|\mathcal{L}_{jk}) = \frac{\text{sum of degrees to which objects characterized by } \mathcal{L}_{pq} \text{ and } \mathcal{L}_{jk}}{\text{sum of degrees to which objects characterized by } \mathcal{L}_{jk}} \quad \textbf{(3.5)}$$

is significantly different from

$$Pr(\mathcal{L}_{pq}) = \frac{\text{sum of degrees to which objects characterized by } \mathcal{L}_{pq} \text{ and } \mathcal{L}_{pq}}{M} \quad \textbf{(3.6)}$$

where

$$M = \sum_{u=1}^{s_p} \sum_{i=1}^{s_j} deg_{\mathcal{L}_{pu}\mathcal{L}_{ji}} \quad \textbf{(3.7)}$$

Step 3. The maximum likelihood estimate of the variance of the standardized difference is calculated using the following equation:

$$\gamma_{\mathcal{L}_{pq}\mathcal{L}_{jk}} = \left(1 - \frac{\sum_{i=1}^{s_j} deg_{\mathcal{L}_{pq}\mathcal{L}_{ji}}}{M}\right)\left(1 - \frac{\sum_{i=1}^{sp} deg_{\mathcal{L}_{pi}\mathcal{L}_{jk}}}{M}\right) \quad \textbf{(3.8)}$$

Step 4. The sum of degrees to which records are expected to be characterized by $\mathcal{L}_{pq}$ and $\mathcal{L}_{jk}$ are calculated using the formula 5:

$$e_{\mathcal{L}_{pq}\mathcal{L}_{jk}} = \frac{\sum_{i=1}^{s_j} deg_{\mathcal{L}_{pq}\mathcal{L}_{ji}} \sum_{i=1}^{sp} deg_{\mathcal{L}_{pi}\mathcal{L}_{jk}}}{M} \quad \textbf{(3.9)}$$

Step 5. The standardized difference was measured with the equation 6:

$$z_{\mathcal{L}_{pq}\mathcal{L}_{jk}} = \frac{deg_{\mathcal{L}_{pq}\mathcal{L}_{ji}} - e_{\mathcal{L}_{pq}\mathcal{L}_{jk}}}{\sqrt{e_{\mathcal{L}_{pq}\mathcal{L}_{jk}}}} \quad \textbf{(3.10)}$$

Step 6. The significance of the difference is evaluated based on the adjusted difference that was calculated using the following formula:

$$d_{\mathcal{L}_{pq}\mathcal{L}_{jk}} = \frac{z_{\mathcal{L}_{pq}\mathcal{L}_{jk}}}{\sqrt{\gamma_{\mathcal{L}_{pq}\mathcal{L}_{jk}}}} \quad \textbf{(3.11)}$$

Step 7. The interestingness was determined as follows:

If $\left|d_{\mathcal{L}_{pq}\mathcal{L}_{jk}}\right| > 1.96$, that is to say 95% of the normal distribution, then the association between $\mathcal{L}_{jk}$ and $\mathcal{L}_{pq}$ is interesting.

If $d_{\mathcal{L}_{pq}\mathcal{L}_{jk}} > +1.96$, then $\mathcal{L}_{jk}$ is positively associated with and $\mathcal{L}_{pq}$.

If $d_{\mathcal{L}_{pq}\mathcal{L}_{jk}} < -1.96$, then $\mathcal{L}_{jk}$ is negatively associated with and $\mathcal{L}_{pq}$.

In order to apply the previous formulas, MATLAB R2010a software was used.

3.3 Sample and Data Source

The database consists of 78 firms, in which 51 are Turkish and 27 are Bolivian. All the firms of this sample are classified as SMEs. In the case of Turkey, the SMEs are mostly located in Istanbul, whereas Bolivian SMEs are mainly from the cities of Cochabamba, Santa Cruz and La Paz.

During February 2013, a postal questionnaire was mailed to approximately 500 Bolivian SMEs, and following letters were sent on the second and fifth weeks after the initial mail-out. In total, 27 usable responses were received which is not surprising considering that Bolivian SMEs still do not have the culture to use digital means to communicate.

The method F-APACs was converted into algorithms and introduced to MATLAB (version 7.10.0). The data from Bolivia and Turkey was input into MATLAB and a collection of association rules was extracted.

4. INNOVATION AND SYNERGY FUZZY MODELLING

This study uses the survey designed in Altay (2012), and extends it to an international level by applying the same survey in Bolivia. This chapter is reserved for exploring the similarities and dissimilarities between the SME trends of collaboration innovation in two developing countries.

4.1 Factors that Affect Innovation

Altay (2012) defined in her study factors that affect innovation capacity in alliances classifying innovation parameters in eleven groups as shown in Table 4.1.

Table 4.1 : List of factors that affect Innovation in SMEs.

Criteria Group	Criteria
Industry related criteria	• Number of firms in the industry • Industry trend • Being in a collaborative / competitive industry • Speed of change
Enterprise Demo-graphics related criteria	• Age of the firm • Workforce size
Financial features related criteria	• Financial resources • Annual profit • Annual productivity • Capital structure
Organizational culture	• Shareholder structure • Leadership level • The learning organization character of the firm • Resource e allocation policy • Competitive relations among the firms
Customer relations related criteria	• Level of collaboration with customer • Level of customers' contribution to innovation
Sales channels related criteria	• Structure of the sales channels • Reaction to change • Level of sales channels' contribution to innovation

Table 4.1 (continued): List of factors that affect innovation in SMEs.

Criteria Group	Criteria
Criteria related with suppliers	• Level of suppliers' contribution to innovation
Employee relations criteria	• The rate of white collar employees • Number of qualified workers • Labor productivity • Turnover rate
Intellectual properties	• Number of patents that the firm has obtained • Number of patents that the firm has applied for
Innovation and R&D policy	• Open innovation ability • R&D structure • Innovation level of the firm
Relations with institutes and universities	• Relation with universities • Relation with other institutes

Based on the survey designed by Altay (2012) the same linguistic terms were considered for the application of the surveys. In this way, for an eleven-point and seven-point Likert-Scaled questions, Altay has stablished three main linguistic terms. In the case of eleven-point Likert-Scale questions, the option 1 represents the 1^{st} scale, the option 2 the 6^{th}, and the option 3 the 11^{th}. Whereas, in the case of seven-point Likert-Scale, the option 1 represents the 1^{st} scale, the option 2 the 4^{th}, and the option 3 the 7^{th} scale. However, in order to apply fuzzy association rules and to give an interesting and clear meaning to the results, two more linguistic terms, were added in between each of those options.

4.1.1 Size of the firm

The size of the firm was asked in the 1^{st} question classifying the companies into tree groups:

- Option 1: Micro
- Option 2: Small
- Option 3: Medium

A firm was defined to be micro if it has less than 10 workers, small if it has 10 or more but less than 50, and medium if it has 50 or more but less than 250 employees.

The fuzzy numbers assigned to these options are presented in the figure below.

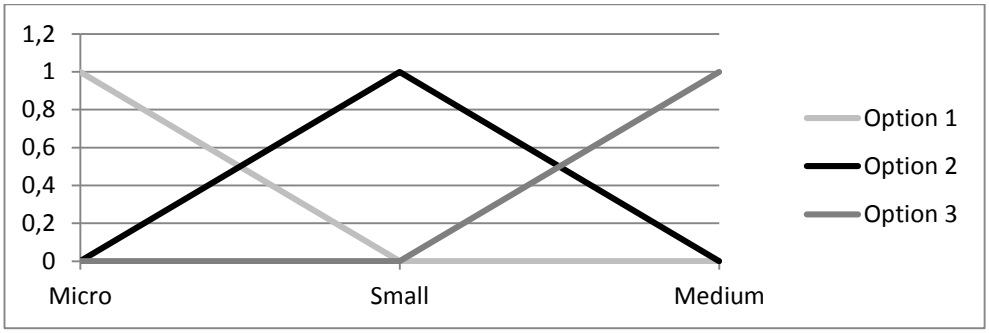

Figure 4.1 : Fuzzy numbers of the linguistic terms for attribute size of the firms.

4.1.2 The rate of white collar employees

The rate of white collars employees in SMEs was asked in the 2nd inquiry with an eleven-point Likert-Scale. The main linguistic terms determined for this criterion are:

- Very low rate.
- Low Rate.
- Medium Rate.
- High Rate.
- Very High Rate.

The fuzzy values of these linguistic terms are given in Figure 4.2 where the horizontal axis represents the eleven points of the Likert Scale, while the vertical axis signifies the membership function that varies for each Likert-Scale point.

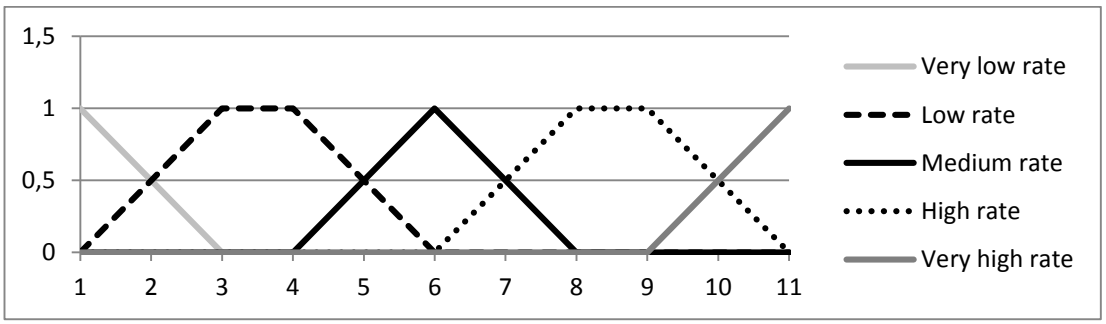

Figure 4.2 : Fuzzy numbers of the linguistic terms for attribute rate of white collar employees.

4.1.3 Age of the firm

The Age of the firms are retrieved in the 3rd question with an eleven-point Likert-Scale. The following five linguistic terms were determined for this factor:

- New
- Fairly New
- Industry Average
- Fairly Old
- Old

The fuzzy values of these linguistic terms are displayed in Figure 4.3 where the horizontal axis represents the eleven points of the Likert Scale, while the vertical axis signifies the membership function that varies for each Likert-Scale point.

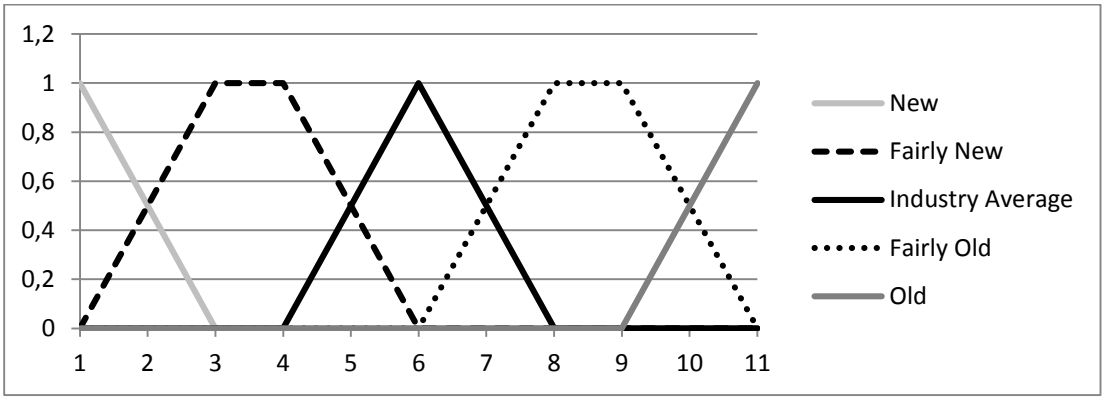

Figure 4.3 : Fuzzy number of the linguistic terms for attribute age of the firm.

4.1.4 Being in a high or low technological industry

In the 4th query of the questionnaire firms are asked about their company nature's technological industry. Thus, the firms indicate if their industry require a high or low technology by responding to an eleven-point Likert-Scale question. The five linguistic terms contemplated for this attribute are:

- Manual industry
- Requires technology in some production processes
- Requires technology in all production processes
- Requires technology in some processes other than production
- Requires technology in all processes

The fuzzy values of these linguistic terms are displayed in Figure 4.4 where the horizontal axis represents the eleven points of the Likert Scale, while the vertical axis signifies the membership function that varies for each Likert-Scale point.

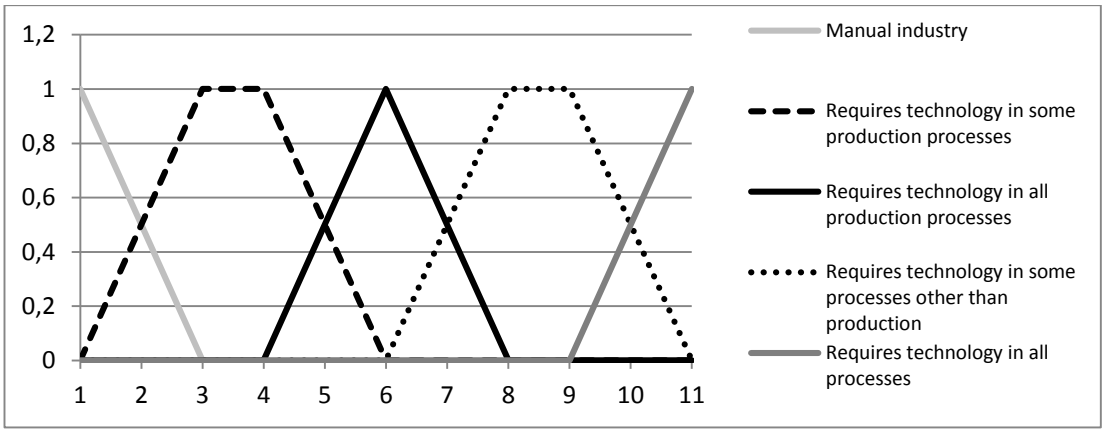

Figure 4.4 : Fuzzy numbers of the linguistic terms for attribute being in a high or low technological industry.

4.1.5 Financial resources

The financial resources are asked in the first part of the 5th question with an eleven-point Likert-Scale. In this query firms are inquired to define the structure of their financial resources by declaring if they rely mostly on credits and/or on cash. The following five linguistic terms were defined for this criterion:

- Highly relies upon credits
- Relies mostly on credits
- Relies on both credits and also has some cash
- Relies mostly on cash
- Highly relies upon cash

The fuzzy values of these linguistic terms are displayed in Figure 4.5.

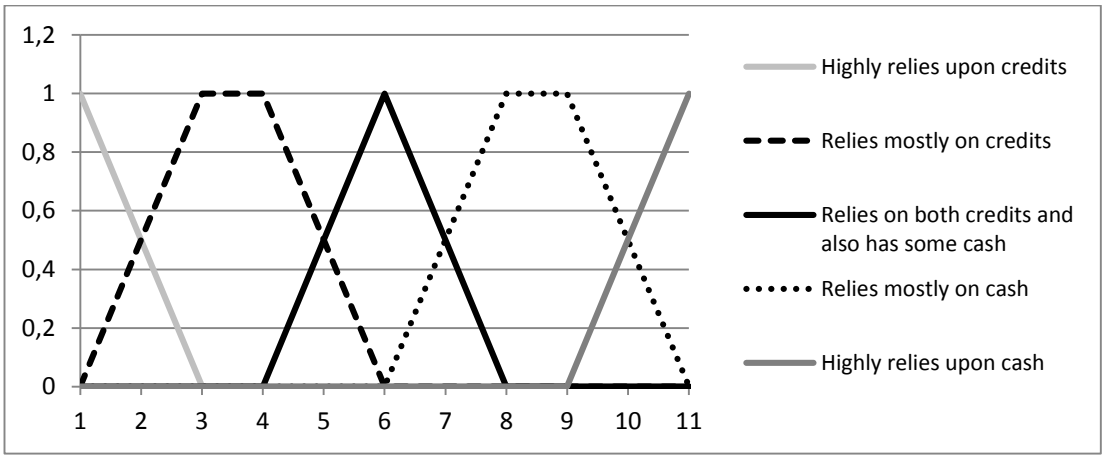

Figure 4.5 : Fuzzy numbers of the linguistic terms for attribute financial resources of the firm.

4.1.6 Capital structure

The Capital structure of the firm is inquired in the second part of the 5th question with an eleven-point Likert-Scale. In this query, firms are asked to define the structure of their financial resources by indicating if they depend mostly on borrowed funds and/or capital of shareholders. The following five linguistic terms were defined for this factor:

- Totally depends on borrowed funds
- Depends mostly on borrowed funds
- Depends on both borrowed funds and capital by shareholders
- Depends mostly on capital by shareholders
- Totally depends on capital of shareholders

The fuzzy values of these linguistic terms are displayed in Figure 4.6.

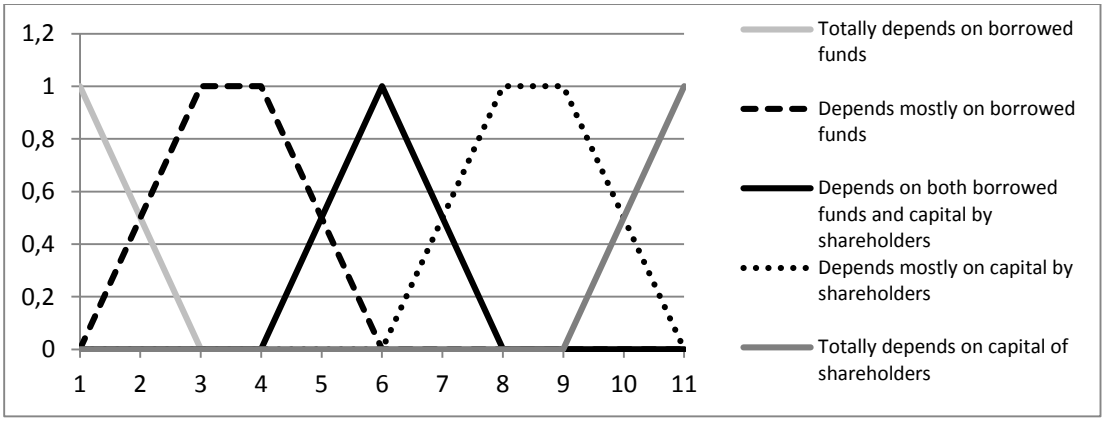

Figure 4.6 : Fuzzy numbers of the linguistic terms for attribute capital structure of the firm.

4.1.7 Shareholders structure

The shareholders structure of the firms were asked in the 7th question with an eleven-point Likert-Scale. The following five linguistic terms were determined for this criterion:

- Open to public offerings
- Partly offered to public
- Relies on stock certificates
- Partly use government bonds

- Relies on government bonds

The fuzzy values of these linguistic terms are presented in Figure 4.7.

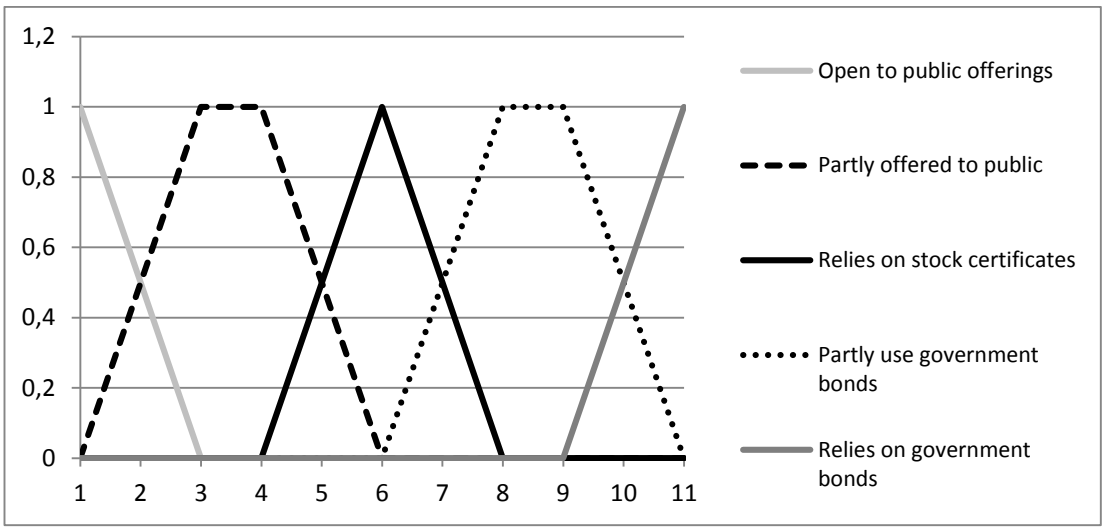

Figure 4.7 : Fuzzy numbers of the linguistic terms for attribute shareholders structure of the firm.

4.1.8 Number of patents that the firm has obtained

In question 7th firms are asked about the number of patents that they have obtained up to now. This query only has three alternative options:

- Option 1: More than one
- Option 2: One
- Option 3: None

The fuzzy values assigned to this options are visualized on the figure below.

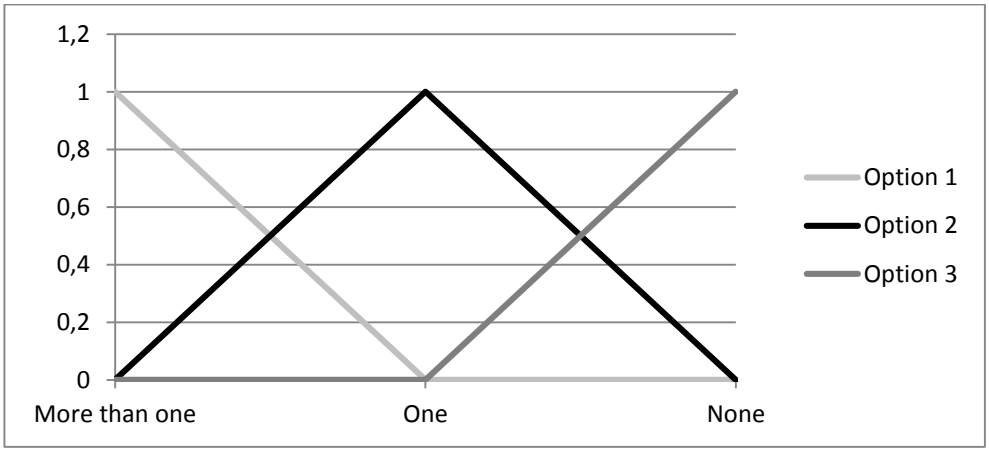

Figure 4.8 : Fuzzy numbers of the linguistic terms for attribute number of patents that the firm has obtained.

4.1.9 Number of patents that the firm has applied for

In question 8th the firms are inquired about the number of patents that they have applied for up to now. This question only has three alternative options:

- Option 1: More than one
- Option 2: One
- Option 3: None

The fuzzy values assigned to this options are visualized on the figure below.

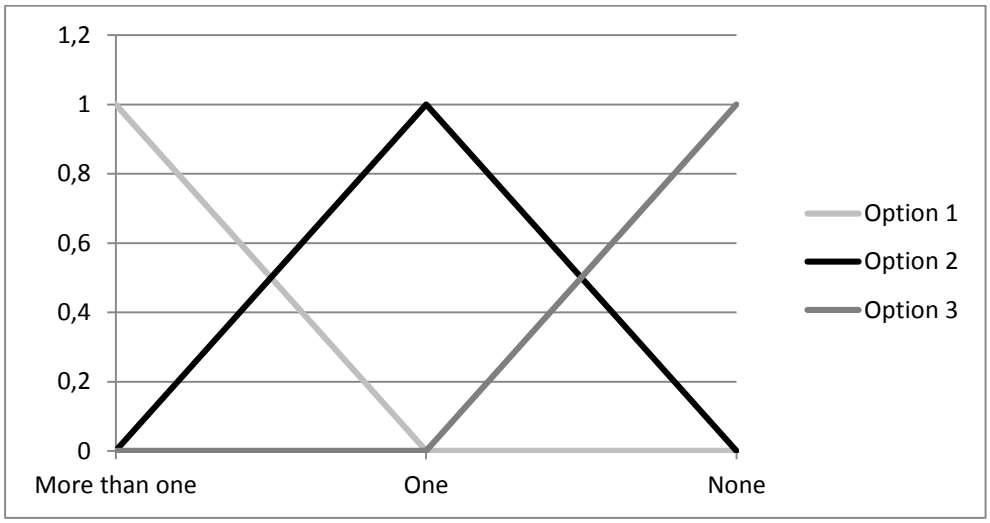

Figure 4.9 : Fuzzy numbers of the linguistic terms for attribute number of patents that the firm has applied for.

4.1.10 Level of customers' collaboration to innovation

The level of customers' contribution to innovation of the firms are retrieved in the 9th question where the firms were asked to specify the methods that they use to evaluate their clients' problems. This query have only the four following options:

- Option 1: Call center
- Option 2: An employee
- Option 3: Intermediaries or sales channels
- Option 4: Directly

The fuzzy values assigned to this options are visualized on the figure below.

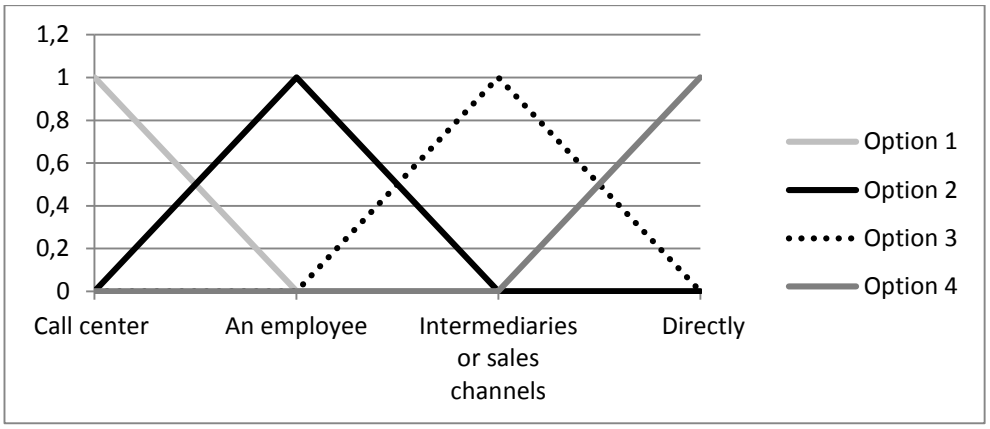

Figure 4.10 : Fuzzy numbers of the linguistic terms for attribute level of customers' collaboration to innovation.

4.1.11 Structure of the sales channels

The structure of the sales channels of the firms are asked in the 10th question where companies are asked to define the sales channels of their companies. This query has only four options:

- Option 1: Direct Sales
- Option 2: Distributors
- Option 3: To one client
- Option 4: Selling promoter

The fuzzy values of these linguistic terms are displayed in Figure 4.11.

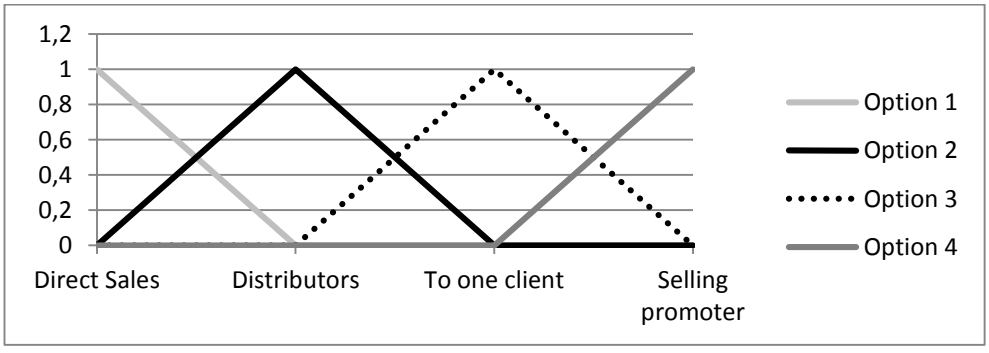

Figure 4.11 : Fuzzy numbers of the linguistic terms for attribute the structure of sales channels of the firm.

4.1.12 Reaction to change

The reaction to change of a company is measured through identifying the nature of the sales channels that a firm has as well as the percentage of digital and traditional sales

channels. In this way, this criterion is retrieved in the 11th question. The following five linguistic terms were taken into account for this factor:

- Only traditional sales channels
- Mostly traditional sales channels
- Both traditional and digital sales channels
- Mostly digital sales channels
- Only digital sales channels

The fuzzy values of these linguistic terms are displayed in Figure 4.12 where the horizontal axis represents the percentage of traditional sales channels from the total sales of a firm, while the vertical axis signifies the membership values.

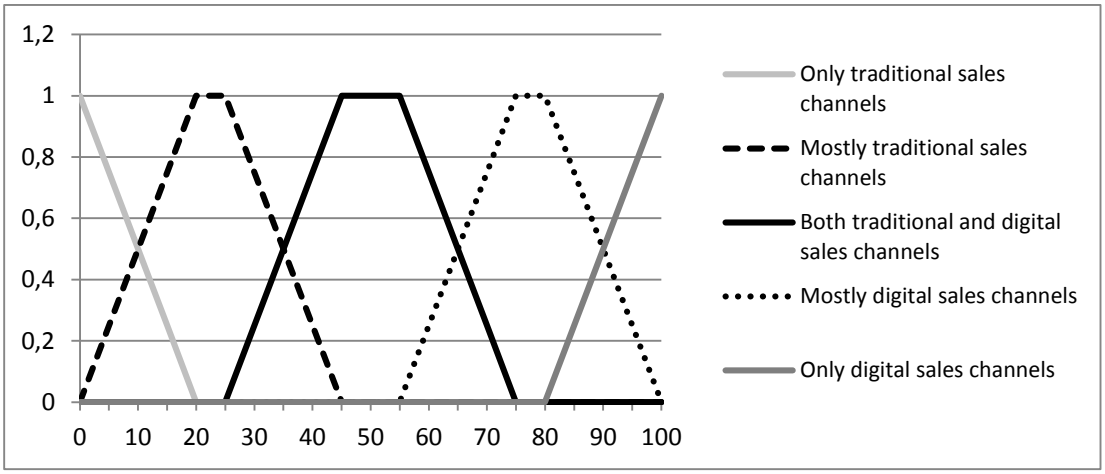

Figure 4.12 : Fuzzy numbers of the linguistic terms for attribute reaction to change of the firm.

4.1.13 Industry trend/ Life cycle stage

The 12th question of the innovation survey with an eleven-point Likert-Scale is asked to retrieve information about the industry trend. The five linguistic terms defined for this question are:

- On the verge of extinction
- Declining in the area
- Likely to be the same in future
- Inclining in the area
- Boosting in the area

The fuzzy values of these linguistic terms are displayed in Figure 4.13

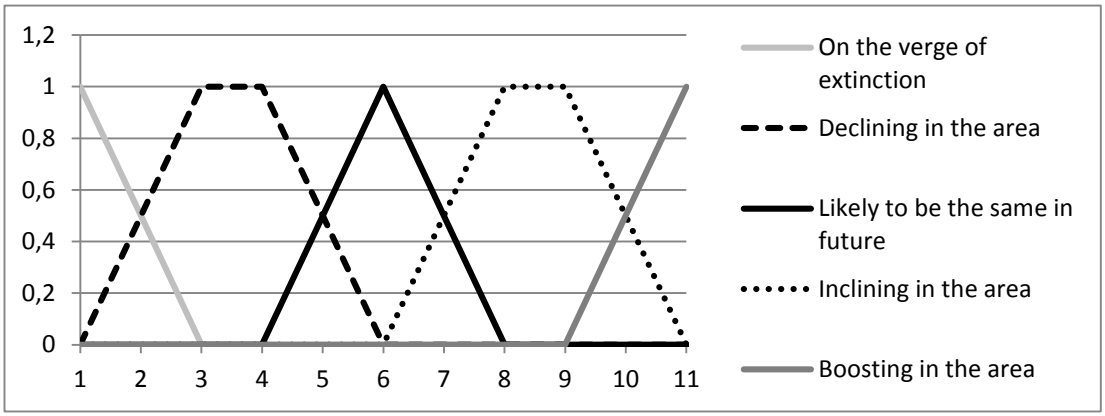

Figure 4.13 : Fuzzy numbers of the linguistic terms for attribute industry trend.

4.1.14 Speed of change

The speed of change of the firms are asked in the 13th question with an eleven-point Likert-Scale. The five linguistic terms defined for this factor are:

- No changing at all
- Almost not changing
- Slowly changing
- Rather fast changing
- Fast changing

The fuzzy values of these linguistic terms are presented in Figure 4.14.

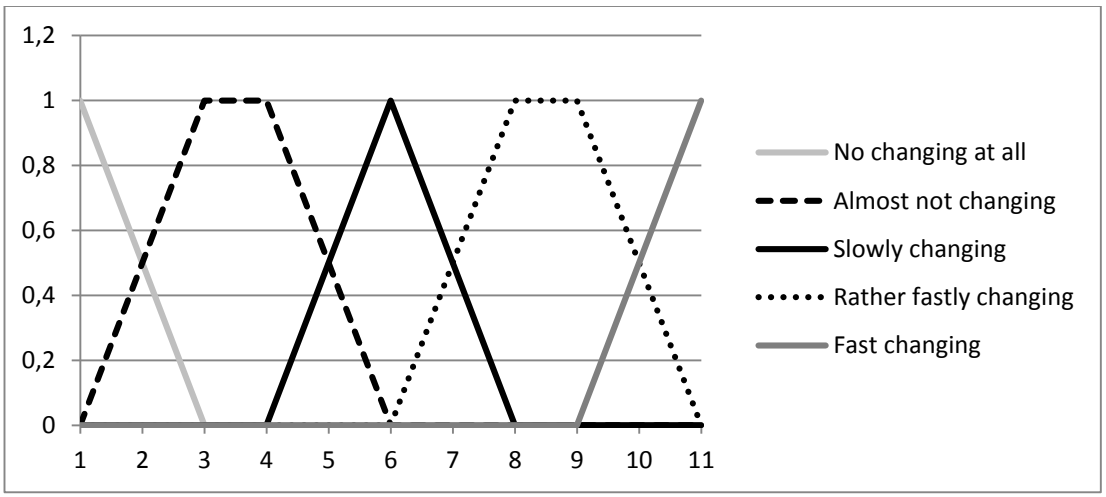

Figure 4.14 : Fuzzy numbers of the linguistic terms for attribute the speed of change of the firm.

4.1.15 Collaborative / competitive industry

The collaborative / competitive industry of firms are obtained in the 14th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Totally collaborative industry
- Tendency to collaborate
- Oblivious to each other
- Tendency to compete
- Totally competitive industry

The fuzzy values of these linguistic terms are displayed in Figure 4.15.

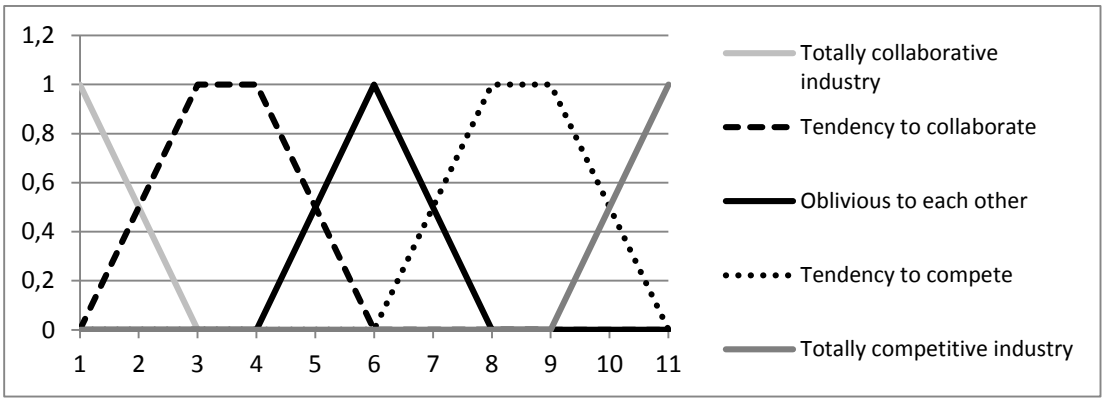

Figure 4.15 : Fuzzy numbers of the linguistic terms for attribute the collaborative / competitive industry of the firm.

4.1.16 R&D structure

The R&D structure of the firm is evaluated in the 15th and 16th questions of the innovation questionnaire. In question 15th firms are inquired to declare if they hold of not R&D activities. Furthermore, in case a firm does hold R&D activities, in question 16th this company is asked to specify its R&D structure. This query has only three options:

- Option 1: R&D Lab
- Option 2: Department / Unit
- Option 3: Outsourced

The fuzzy values of these linguistic terms are displayed in Figure 4.16.

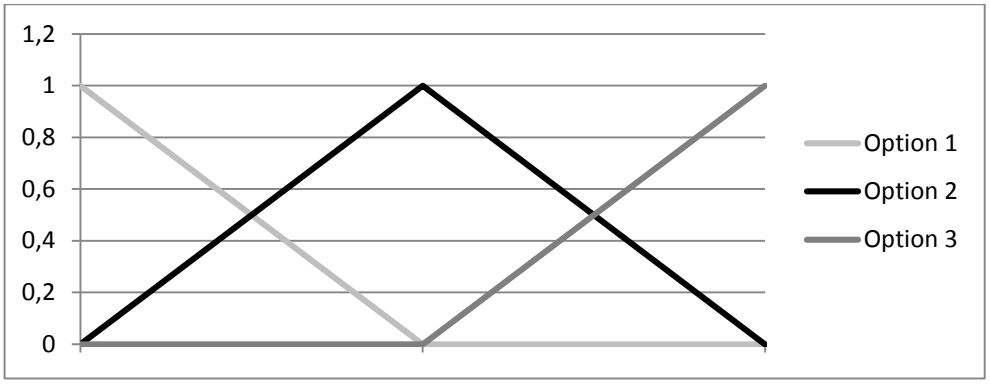

Figure 4.16 : Fuzzy numbers of the linguistic terms for attribute R&D structure of the firm.

4.1.17 Turnover rate

The turnover rate of the firm is retrieved in the 17th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Very low rate
- Low rate
- Medium rate
- High rate
- Very high rate

The fuzzy values of these linguistic terms are presented in Figure 4.17.

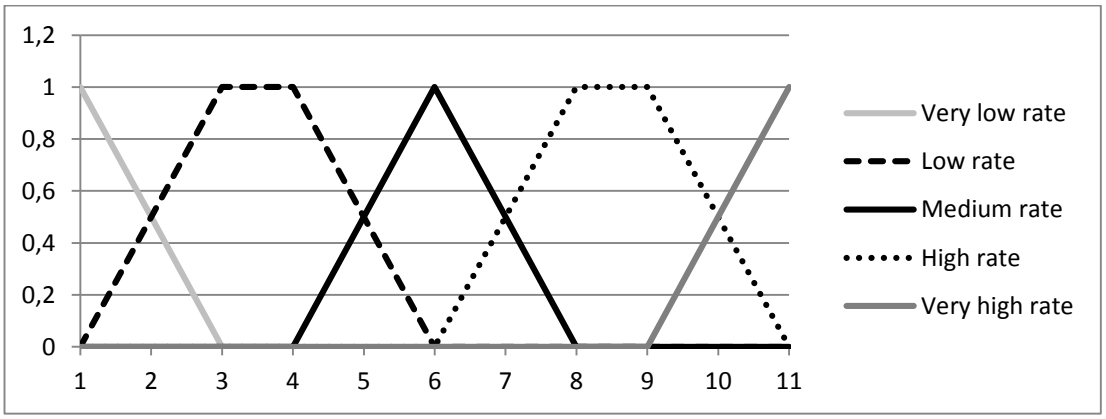

Figure 4.17 : Fuzzy numbers of the linguistic terms for attribute the turnover rate of the firm.

4.1.18 Open innovation ability

In the question 18th firms are inquired to define their companies' innovation approach. This question has only three options:

- Option 1: Openly collaborate
- Option 2: Non-openly cooperate
- Option 3: No innovation

The fuzzy values of these linguistic terms are presented in Figure 4.18.

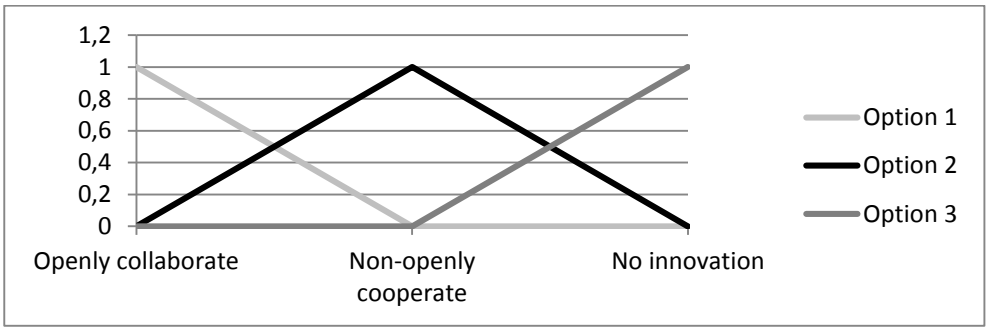

Figure 4.18 : Fuzzy numbers of the linguistic terms for attribute the open innovation ability of the firm.

4.1.19 Learning organization

The learning organization of the firm is asked in the 19th question with a seven-point Likert-Scale. The following five linguistic terms were determined for this criterion:

- Creation and diffusion of new ideas are not supported at all
- Creation and diffusion of new ideas are occasionally supported
- Creation and diffusion of new ideas are totally supported

The fuzzy values of these linguistic terms are presented in Figure 4.19.

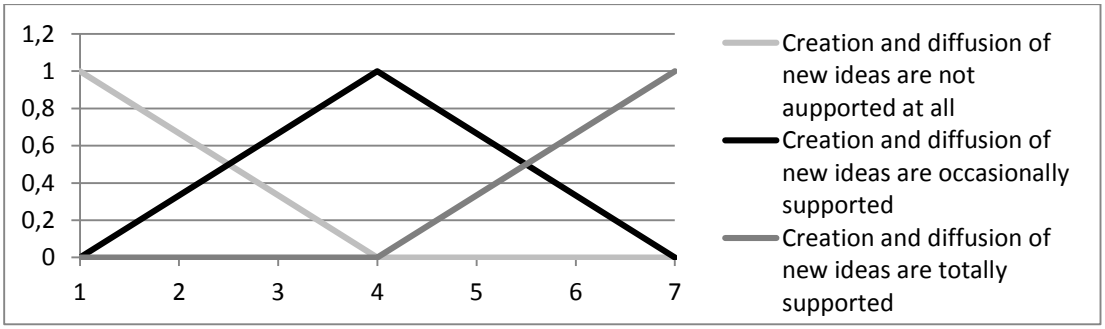

Figure 4.19 : Fuzzy numbers of the linguistic terms for attribute the learning organization of the firm.

4.1.20 Resource allocation policy

The Resource allocation policy of the firm is assessed in the 20th question with an eleven-point Likert-Scale. The first part of this question evaluates the basic resource allocation, whereas in the second part it is asked to retrieve information about the contingency resource allocation system.

The following five linguistic terms were taken into account for the first part of this question:

- Use "save the day" strategy, not planned
- Resource allocation plans are attempted to be made, but it is not possible due to the complicated structure.
- Resource allocation plans are made but changes occur frequently.
- Resource allocation plans are carefully made but changes occur occasionally
- Resource allocation plans are made very thoroughly and the deviations are very small.

The fuzzy values of these linguistic terms are presented in Figure 4.20.

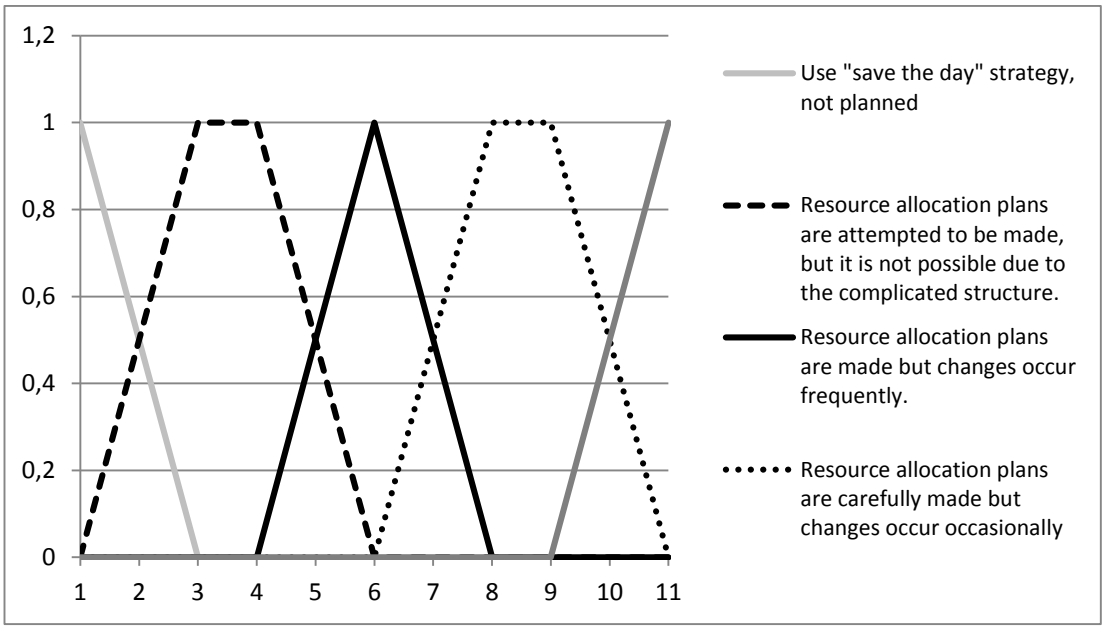

Figure 4.20 : Fuzzy numbers of the linguistic terms for attribute the basic resources allocation of the firm.

For the second part of the resource allocation question, the following five linguistic terms were considered:

- No budget plans are made for emergencies.
- Budget plans are made for emergencies but generally there is no resources left after daily expenses.
- After controlling all costs, some resources are saved for emergencies if the budget allows.
- The budgets allow emergency expenses but preventive plans are not considered.
- Preventive emergency budget plans are made.

The fuzzy values of these linguistic terms are presented in Figure 4.21.

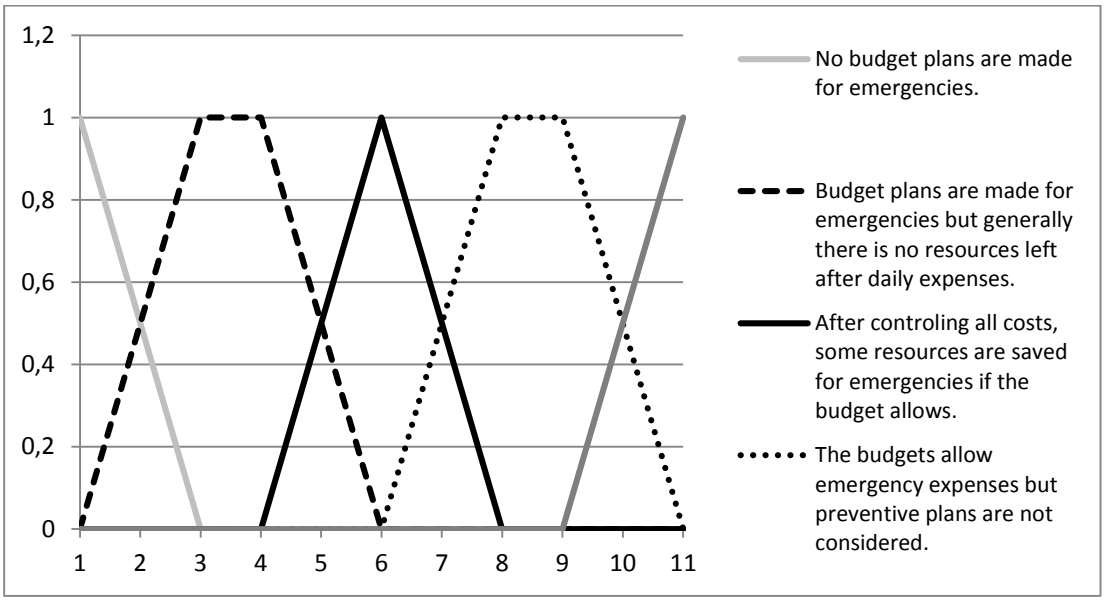

Figure 4.21 : Fuzzy numbers of the linguistic terms for attribute the contingency resouces allocation of the firm.

4.1.21 Relation with other institutes

The relation with other institutes of the firm is evaluated in the 21st question with an eleven-point Likert-Scale. The following five linguistic terms were defined for this factor:

- Very low rate
- Low rate
- Medium rate
- High rate

- Very high rate

The fuzzy values of these linguistic terms are presented in Figure 4.22.

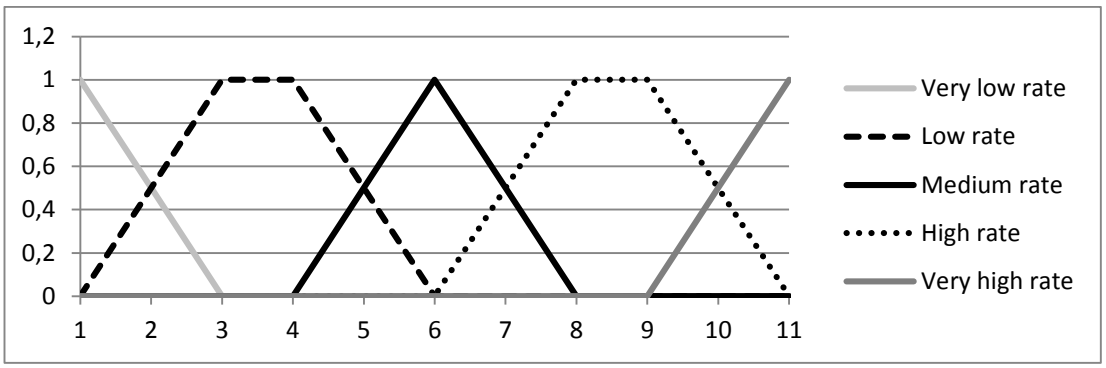

Figure 4.22 : Fuzzy numbers of the linguistic terms for attribute the relation with other institutes.

4.1.22 Relation with universities

The relation with universities of the firm is retrieved in the 22th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Very low rate
- Low rate
- Medium rate
- High rate
- Very high rate

The fuzzy values of these linguistic terms are presented in Figure 4.23.

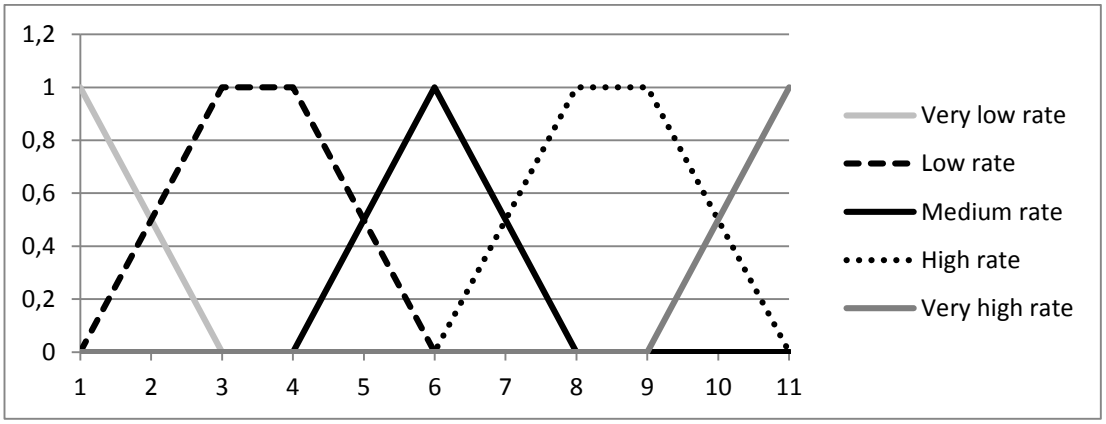

Figure 4.23 : Fuzzy numbers of the linguistic terms for attribute the relation with univerisities.

4.1.23 Competitive relation inside the firm

In question 23rd, the firms are asked to identify their competitive relation inside the firm with an eleven-point Likert-Scale. The following five linguistic terms were defined for this factor:

- Entirely discouraged
- Mostly discouraged but some department managers allow it
- Encouraged if a necessary level of quality and customer satisfaction is caught
- Encouraged in some departments
- Entirely encouraged

The fuzzy values of these linguistic terms are presented in Figure 4.24.

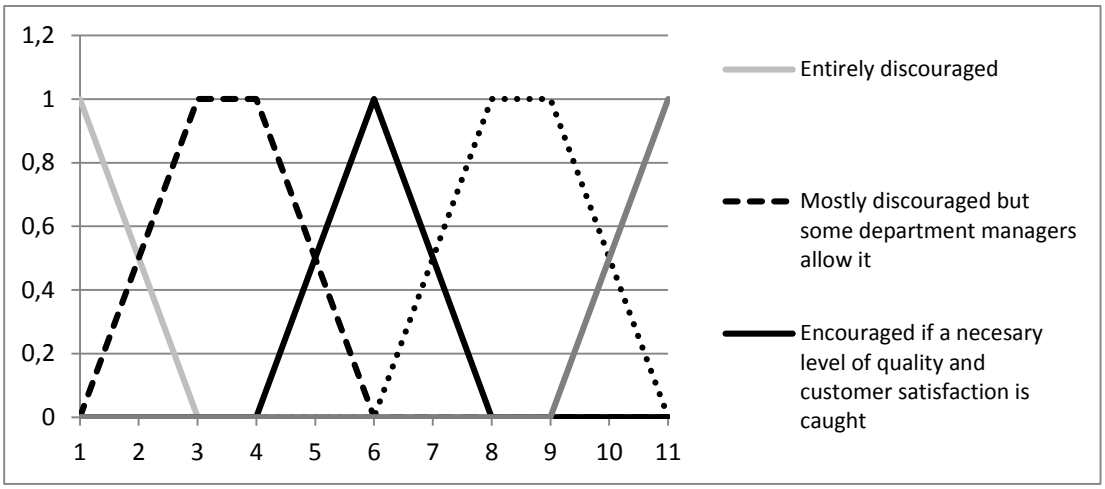

Figure 4.24 : Fuzzy numbers of the linguistic terms for attribute the competitive relation inside the firm of the firm.

4.1.24 Labor productivity

The labor productivity of the firm is assessed in the 24th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Very low
- Low Rate
- Medium Rate
- High Rate

- Very high

The fuzzy values of these linguistic terms are presented in Figure 4.25.

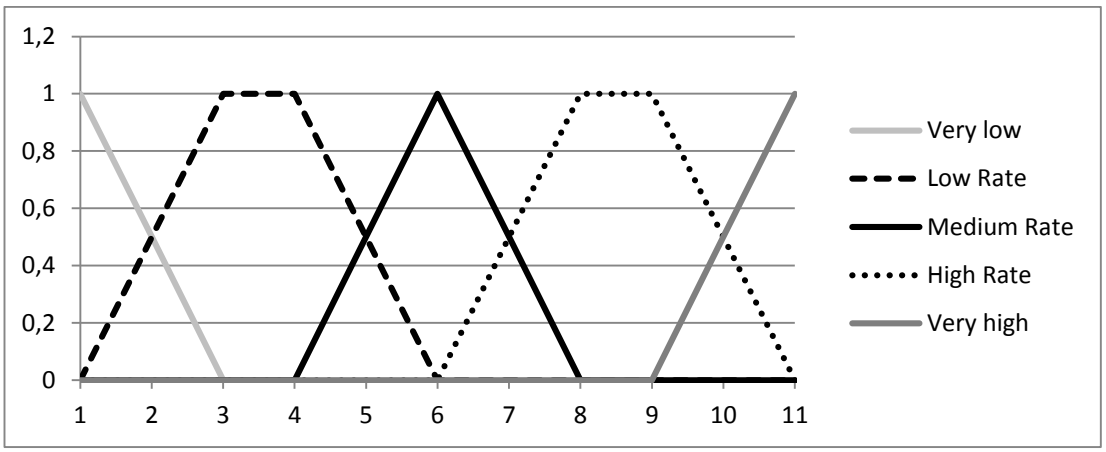

Figure 4.25 : Fuzzy numbers of the linguistic terms for attribute labor productivity of the firm.

4.1.25 Level of customers' contribution to innovation

The level of customers' contribution to innovation of the firm is asked in the 25th question with a seven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Company culture allows to create and diffuse new ideas
- Company culture occasionally allows to create and diffuse new ideas
- Company culture doesn't allow to create and diffuse new ideas

The fuzzy values of these linguistic terms are presented in Figure 4.26.

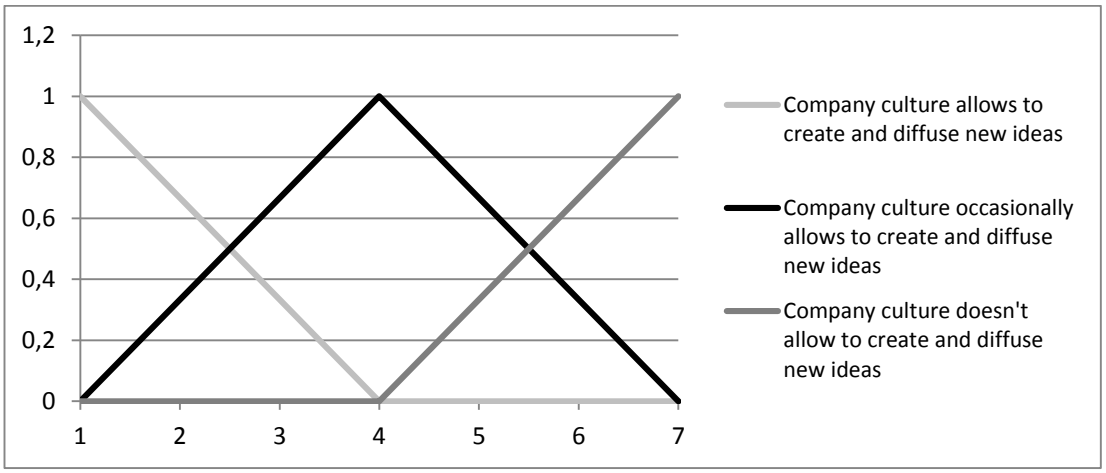

Figure 4.26 : Fuzzy numbers of the linguistic terms for attribute level of customers' contribution to innovation of the firm.

4.1.26 Innovation level of the firm

The innovation level of the firm is retrieved in the 26th question with an eleven-point Likert-Scale. In this question, firms are asked to define its velocity of creation of a new product / process compared to the industry average. The following five linguistic terms were determined for this factor:

- Very slow
- Slow
- Industry Average
- Fast
- Very fast

The fuzzy values of these linguistic terms are presented in Figure 4.15.

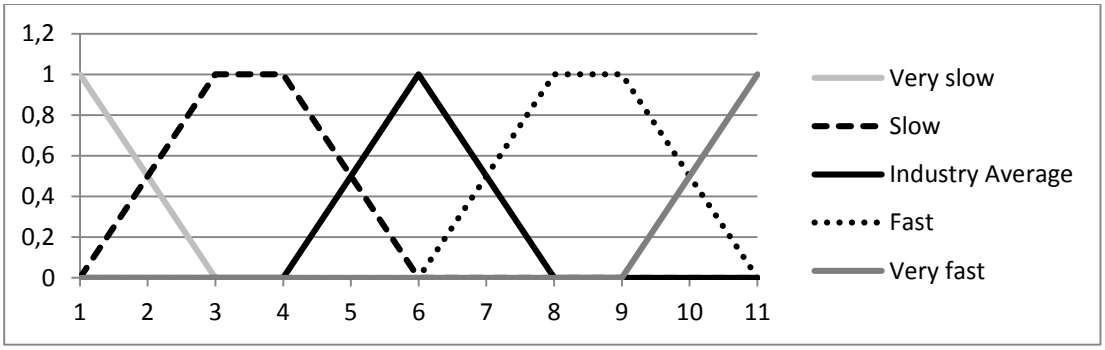

Figure 4.27 : Fuzzy numbers of the linguistic terms for attribute the innovation level of the firm.

4.1.27 Number of qualify workers

In the 27th question, the firms were asked to describe their companies in terms of their qualify workers rate compared with the industry average. The following five linguistic terms were taken into account for this factor:

- None
- Low Rate
- Medium Rate
- High Rate
- All

The fuzzy values of these linguistic terms are presented in Figure 4.28.

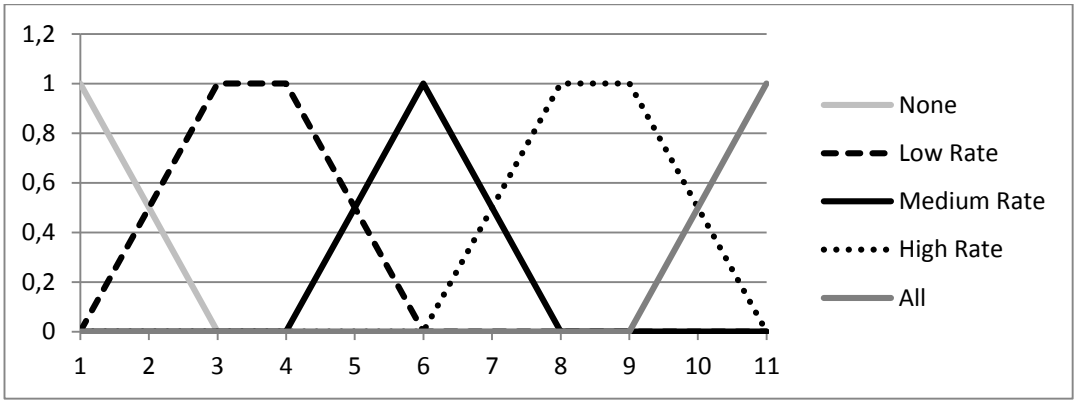

Figure 4.28 : Fuzzy numbers of the linguistic terms for attribute the number of quality workers of the firm.

4.1.28 Annual productivity

The annual productivity of the firm is retrieved in the 28th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Very low rate
- Low rate
- Medium rate
- High rate
- Very high rate

The fuzzy values of these linguistic terms are presented in Figure 4.29.

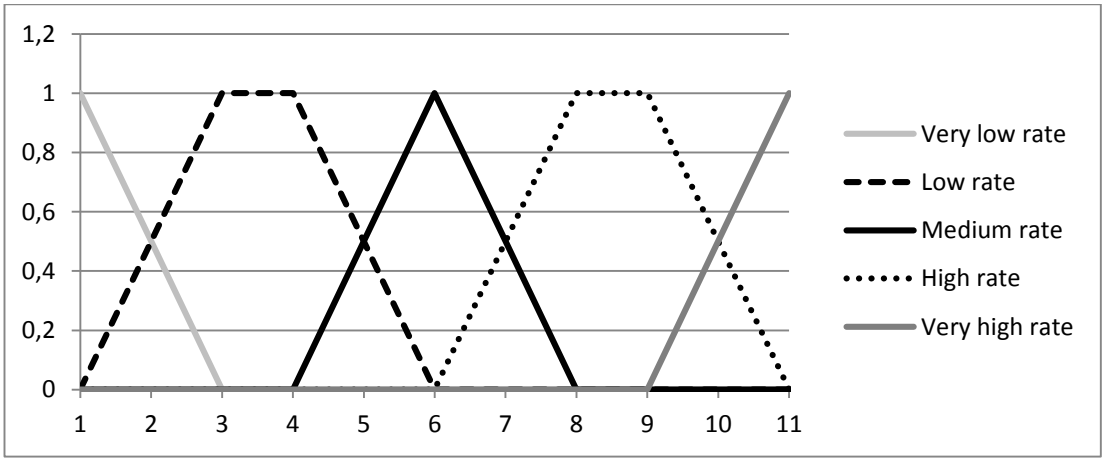

Figure 4.29 : Fuzzy numbers of the linguistic terms for attribute the annual productivity of the firm.

4.1.29 Annual profit

The annual profit of the firm is asked in the 29th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Very low rate
- Low rate
- Medium rate
- High rate
- Very high rate

The fuzzy values of these linguistic terms are presented in Figure 4.30.

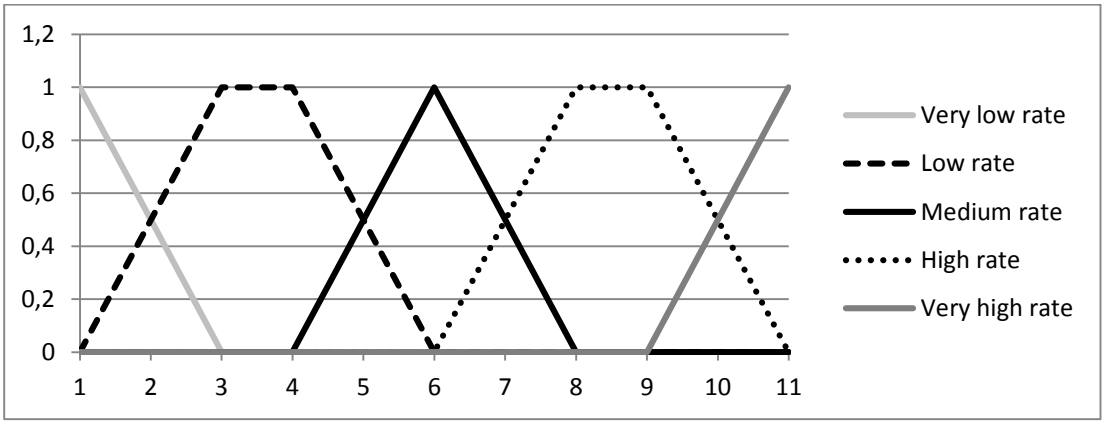

Figure 4.30 : Fuzzy numbers of the linguistic terms for attribute the annual profit of the firm.

4.1.30 Level of suppliers' contribution to innovation

The level of suppliers' contribution to innovation of the firm is evaluated in the 30th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- No contribution
- Offer some new ideas occasionally
- Only contribute with ideas
- Joins activities if requested
- Join R&D activities

The fuzzy values of these linguistic terms are presented in Figure 4.31.

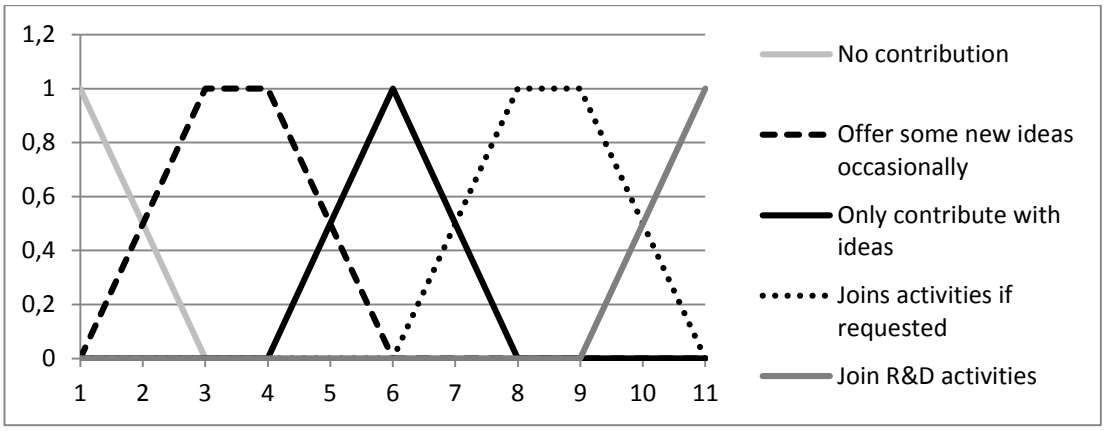

Figure 4.31 : Fuzzy numbers of the linguistic terms for attribute level of suppliers' contribution to innovation of the firm.

4.1.31 Level of sales channels' contribution to innovation

The level of sales channels' contribution to innovation of the firm is estimated through the 31st inquiry with an eleven-point Likert-Scale. The five main linguistic terms contemplated for this factor are:

- No contribution
- Offer some new ideas occasionally
- Only contribute with ideas
- Joins activities if requested
- Join R&D activities

The fuzzy values of these linguistic terms are given in Figure 4.32.

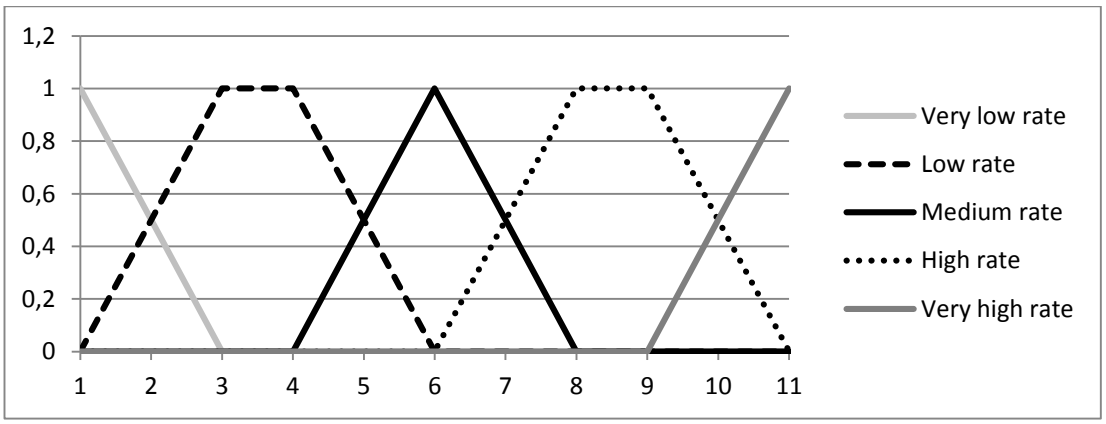

Figure 4.32 : Linguistic terms for attribute level of sales channels' contribution to innovation of the firm.

4.2 Factors that Affect Synergy

According to Altay (2012) the main synergy parameters that affect innovation are listed in four sets as is displayed in Table 4.2.

Table 4.2 : List of factors that affect Synergy in SMEs.

Factors Group	Factors
Organizational and Tangible Factors	• Performance culture • Financial condition • Organizational structure • The clarity of visions, goals and objectives • Type of leadership
Organizational and intangible criteria	• Commitment capabilities to alliance • Inter-organizational communication • Values and company culture • Administrative capacity • Company's pace • Attitude towards alliance • Brand / firm reputation
Alliance and tangible factors	• Scope of the alliance • The compatibility of visions, goals and objectives • Structure of the alliance (clarity of roles) • Dysfunctional conflict • Funding balance • Reward and compensation systems • Organizational resources • Technological capabilities
Alliance and intangible factors	• Communication, coordination and information sharing systems • Inter-organizational trust

4.2.1 Attitude towards alliance

The attitude towards alliance of the firm is evaluated in the 2th question of the synergy survey with a five-point Likert-Scale. In this question firms are asked to indicate if they are interested in being part of a R&D alliance. The following three linguistic terms were taken into account for this factor:

- Unenthusiastic
- Indifferent
- Willing

The fuzzy values of these linguistic terms are presented in Figure 4.33.

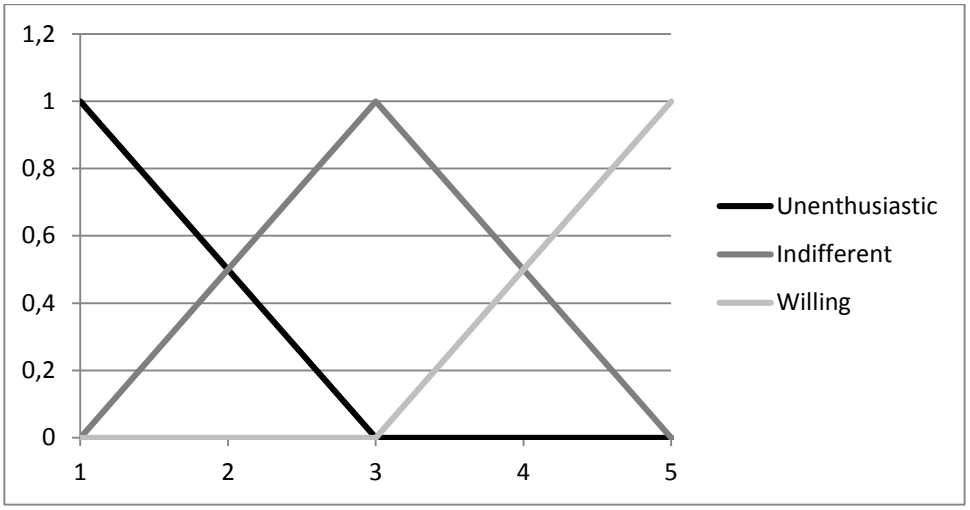

Figure 4.33 : Fuzzy numbers of the linguistic terms for attributes attitude towards alliance of the firm; and inter-organizational communitacion.

4.2.2 Inter-organizational communication

The inter-organizational communication of the firm is evaluated in the 3rd question with a five-point Likert-Scale. In this query, firms are asked to declare if they are or are not opened for communicating with other firms. The following five linguistic terms were taken into account for this criterion:

- Unenthusiastic
- Indifferent
- Willing

The fuzzy values of these linguistic terms are also presented in Figure 4.33.

4.2.3 Organizational structure

The organization structure of the firm is retrieved in the 5th question of the synergy survey with an eleven-point Likert-Scale. This criterion evaluates the hierarchy and the democracy levels of the firm. The following five linguistic terms were defined for this factor:

- Only top management makes the decisions
- Top management and department managers participate in the decision making process

- All managers participate in the decision making process
- A team selected from the employees also participate in the decision making process
- All employers participate in the decision making process

The fuzzy values of these linguistic terms are presented in Figure 4.34.

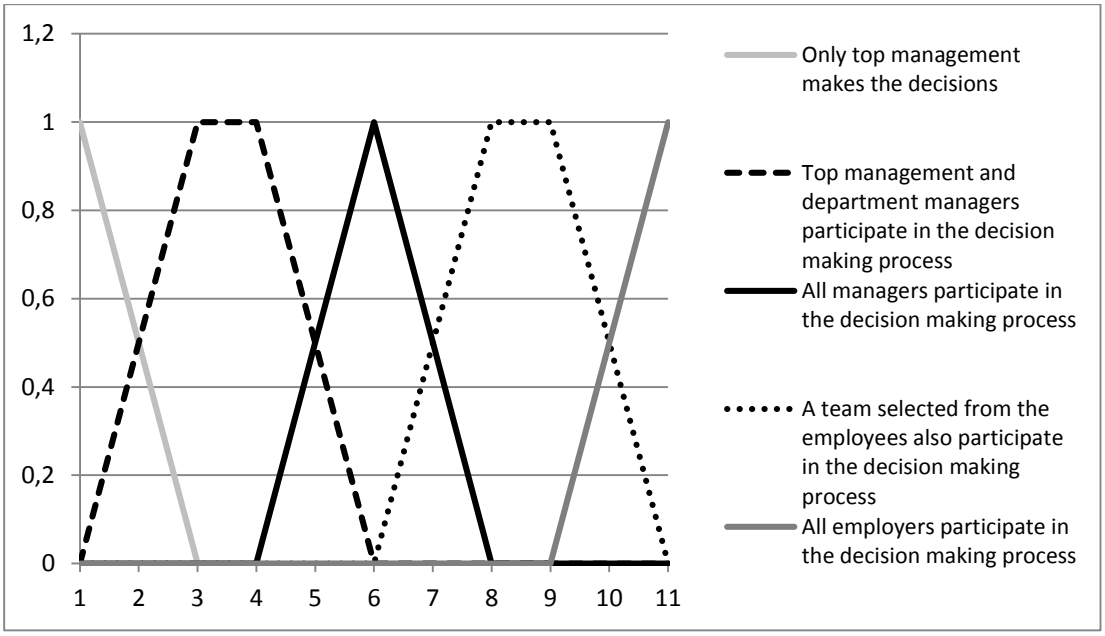

Figure 4.34 : Fuzzy numbers of the linguistic terms for attribute the organizational structure of the firm.

4.2.4 Company's pace

The company's pace of the firm is retrieved in the 6th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this factor:

- Very slow
- Slow
- Industry Average
- Fast
- Very fast

The fuzzy values of these linguistic terms are displayed in Figure 4.35.

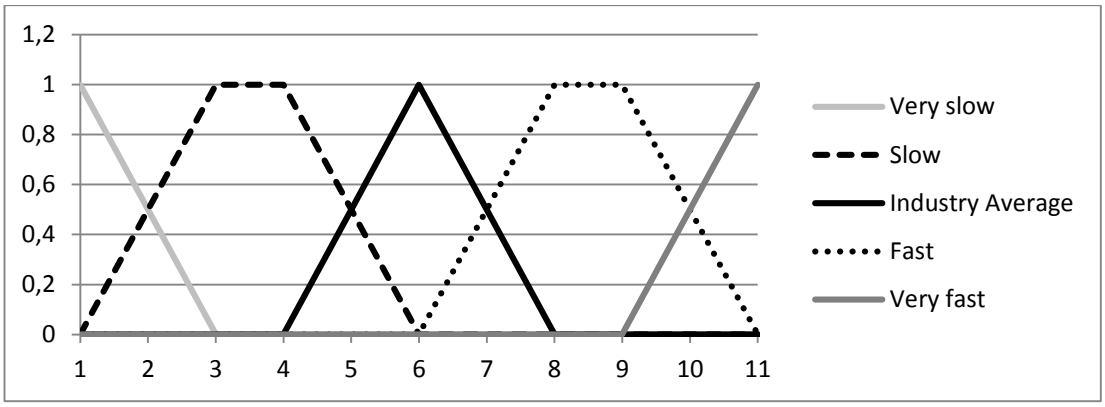

Figure 4.35 : Fuzzy numbers of the linguistic terms for attribute the company's pace of the firm.

4.2.5 Inter-organizational trust

The inter-organizational trust of the firm is assessed in the 8th question of the synergy survey with an eleven-point Likert-Scale. The following five linguistic terms were formulated for this factor:

- Want to participate but with little experience
- Want to participate but with some experience and resources
- Can participate with limited resources
- Can participate with most resources
- Ready to participate

The fuzzy values of these linguistic terms are presented in Figure 4.36.

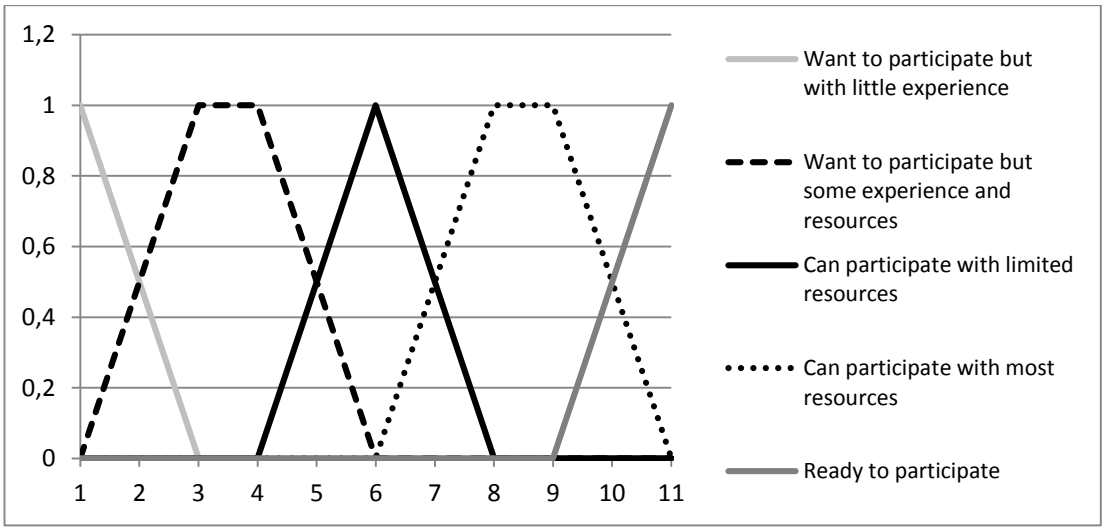

Figure 4.36 : Fuzzy numbers of the linguistic terms for attribute the inter-organizational trust of the firm.

4.2.6 Scope of the alliance

The scope of the alliance of the firm is measured in the 9th question with an eleven-point Likert-Scale. In this question, the firms were asked to state the kind of collaboration that is more suitable for their businesses. The following five linguistic terms were determined for this criterion:

- Not suitable for collaborations
- Suitable for some workshops and activities
- Collaborations for short term
- Term for collaboration depends on the project
- Collaborations for long term

The fuzzy values of these linguistic terms are presented in Figure 4.37.

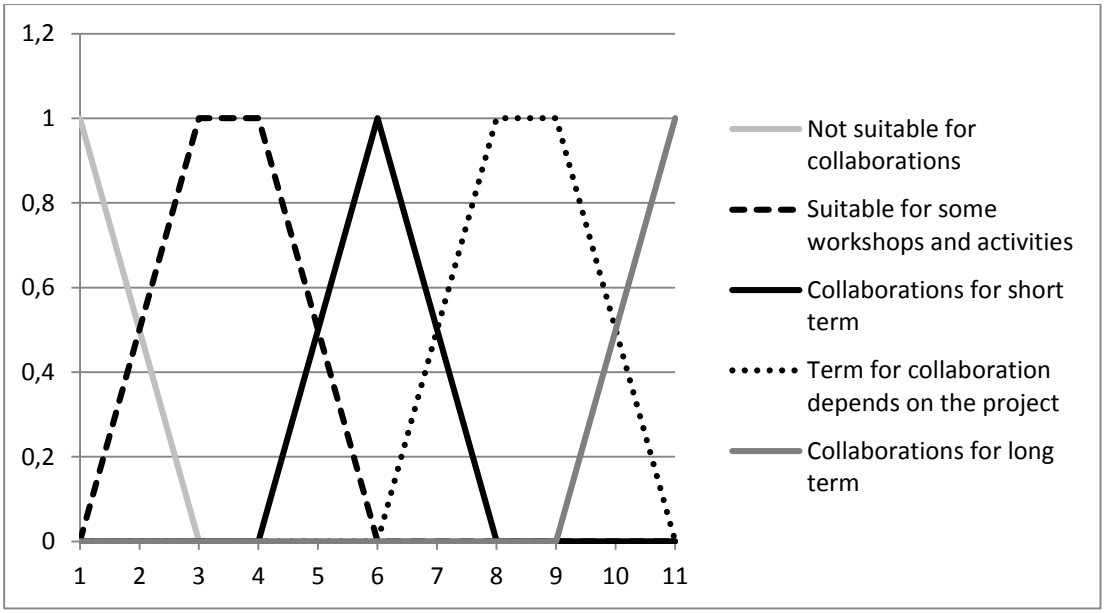

Figure 4.37 : Fuzzy numbers of the linguistic terms for attribute the scope of the alliance of the firm.

4.2.7 Dysfunctional conflict

The dysfunctional conflict of the firm is evaluated through identifying measures required to prevent the generation of problems in a R&D alliance. This criterion is retrieved in the 10th question of the synergy survey with an eleven-point Likert-Scale. The five linguistic terms designed for this factor are:

- All activities should be joint.

- Most activities should be joint.
- Some activities should be joint and others can be individually specified.
- Most activities should be individually specified.
- All activities should be individually specified.

The fuzzy values of these linguistic terms are displayed in Figure 4.38.

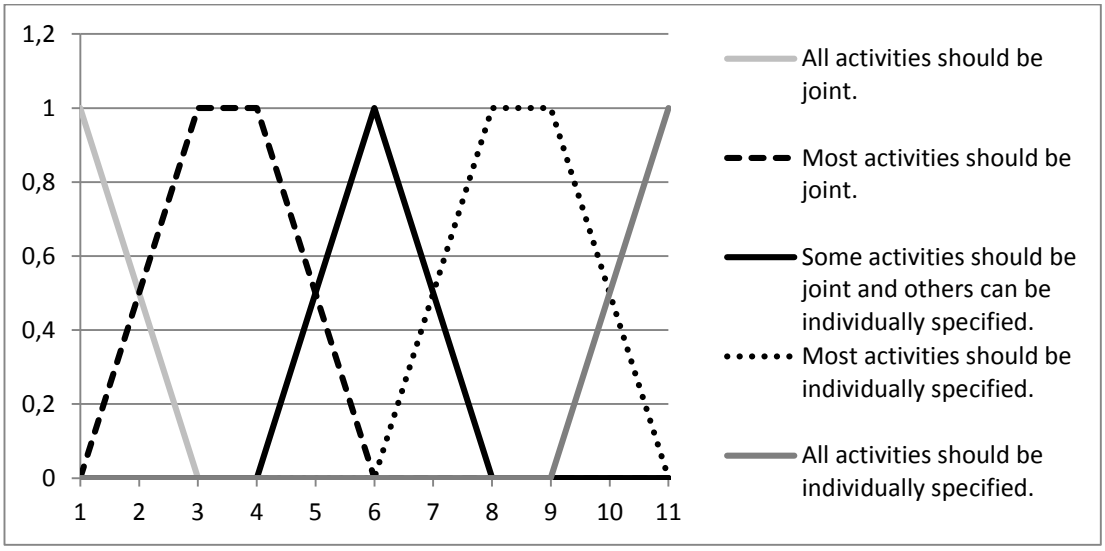

Figure 4.38 : Fuzzy numbers of the linguistic terms for attribute the dysfunctional conflict of the firm.

4.2.8 Commitment capabilities to alliance

The commitment capabilities to alliance of the firm is retrieved in the 11th question of the synergy survey with an eleven-point Likert-Scale. The following five linguistic terms were designed for this factor:

- No commitment
- Intention of occasional commitment
- Partial commitment with a project team
- Willing to commit
- Very willing to commit

The fuzzy values of these linguistic terms are presented in Figure 4.39.

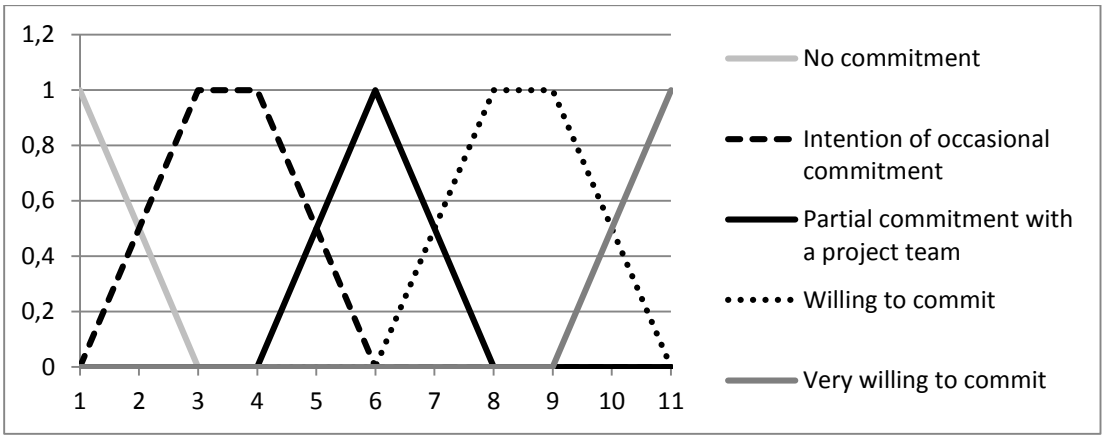

Figure 4.39 : Fuzzy numbers of the linguistic terms for attribute the commitment capabilities to alliance of the firm.

4.2.9 Values and company culture

The values and company culture of the firm is measured through stating how the company's workers would react if the firm becomes part of a R&D alliance. This criterion is retrieved in the 12th question with an eleven-point Likert-Scale. The five linguistic terms formulated for this factor are:

- Negative attitude of workers for collaboration
- Not willing to collaborate but would collaborate if forced
- Indifferent to collaboration
- Willing to occasionally collaborate
- Positive attitude of workers for collaboration

The fuzzy values of these linguistic terms are displayed in Figure 4.40.

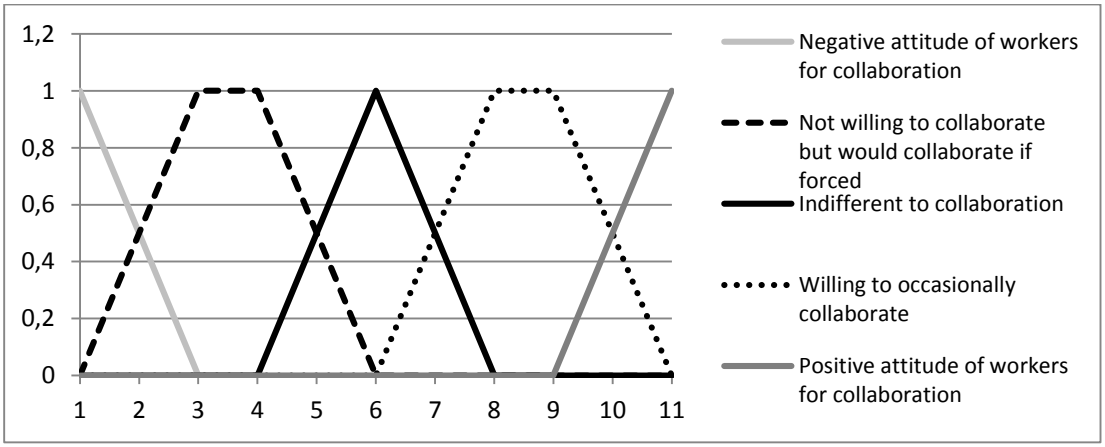

Figure 4.40 : Fuzzy numbers of the linguistic terms for attribute values and company culture of the firm.

4.2.10 Funding balance

This criterion is retrieved in the 13th question of the synergy survey with an eleven-point Likert-Scale. In this question, the firms are requested to indicate how the R&D alliance investments should be shared among member firms. The following five linguistic terms were designed for this factor:

- Defends that the payments should be made according to the wealth of the companies
- Wealthy companies should pay long term investments
- Some companies should undertake the long-term investments and other should undertake the short-term investments.
- Defends that all companies should agree to share the long-term expenses equally, and short term expenses can be shared according to wealth
- Defends that all companies should agree to share the expenses equally

The fuzzy values of these linguistic terms are presented in Figure 4.41.

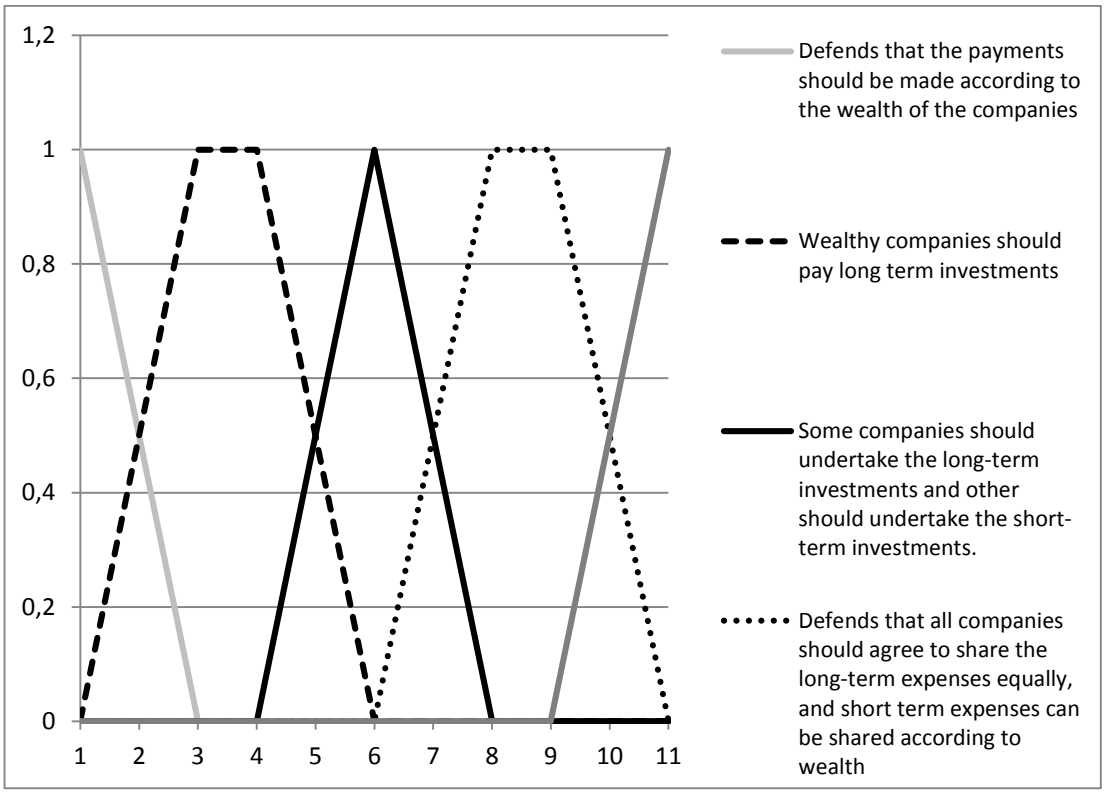

Figure 4.41 : Fuzzy numbers of the linguistic terms for attribute funding balance of the firm.

4.2.11 Structure of the alliance

The structure of the alliance of the firm is assessed in the 14th question with an eleven-point Likert-Scale. The following five linguistic terms were taken into account for this criterion:

- Plans should be made during the execution of the collaboration
- Some basic plans should be ready for each collaboration but major changes will occur during the execution
- Plans should be make specific for each collaboration
- Success stories should be inspired from but they should not constitute the bases of the plans
- Success stories should be benefited from to be successful

The fuzzy values of these linguistic terms are presented in Figure 4.42.

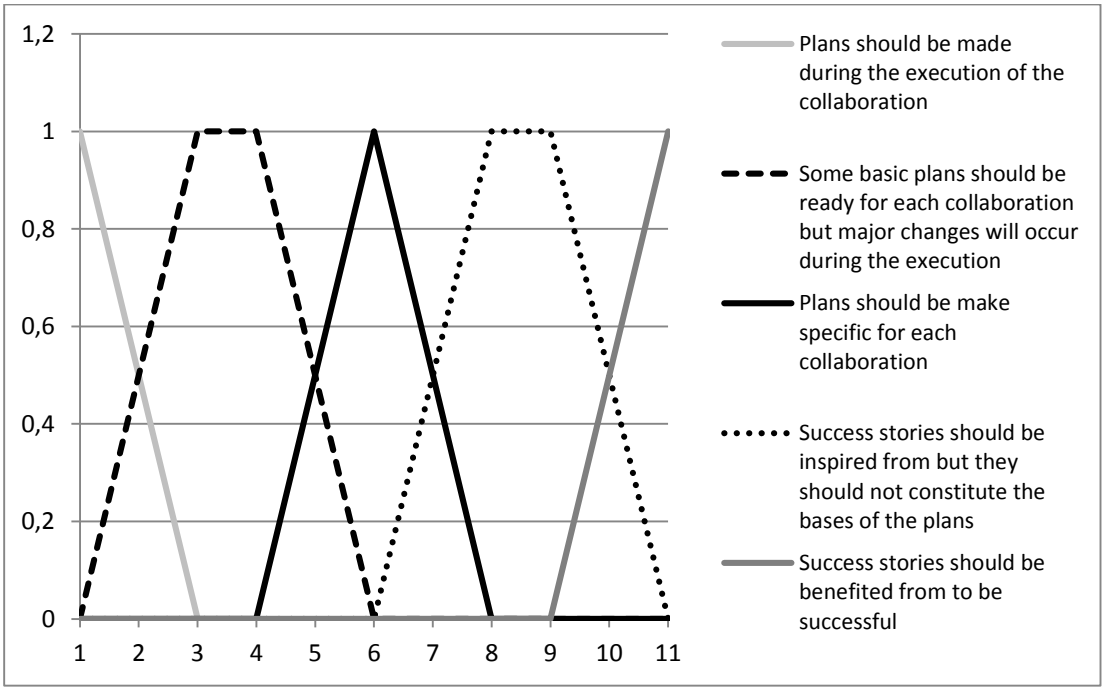

Figure 4.42 : Fuzzy numbers of the linguistic terms for attribute the structure of the alliance of the firm.

4.2.12 Communication, coordination and information sharing systems

The communication, coordination and information sharing systems of the firm are measured in the 15th question with an eleven-point Likert-Scale. The five linguistic terms considered for this criterion are:

- Cultural incompatibility would certainly cause difficulties that may not be overcome.
- Some cultural incompatibility can be tolerated unless the structural difficulties cannot be solved.
- Technical incompatibilities would cause technical difficulties.
- An organized system is not necessary but technical problems should be solved.
- An organized system must be established not to have any problems

The fuzzy values of these linguistic terms are displayed in Figure 4.43.

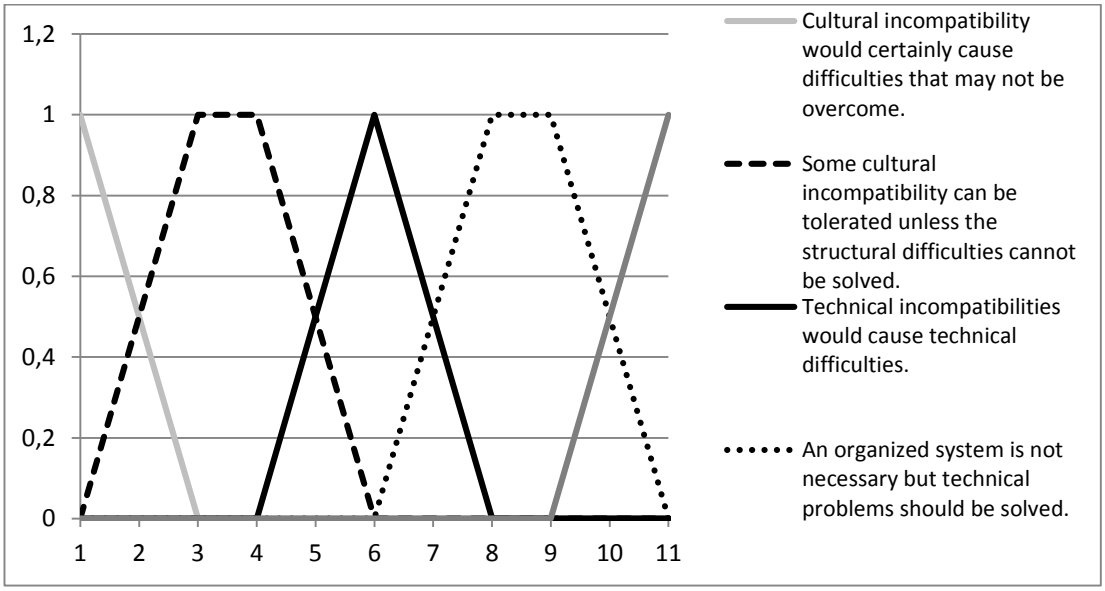

Figure 4.43 : Fuzzy numbers of the linguistic terms for attribute the communication, coordination and information sharing systems of the firm.

4.2.13 Performance culture

In the 16th question firms are inquired to define their companies' performance culture approach. This question has only three options:

- Option 1: Output measure
- Option 2: Input measure
- Option 3: No measure

The fuzzy values of these linguistic terms are presented in Figure 4.44.

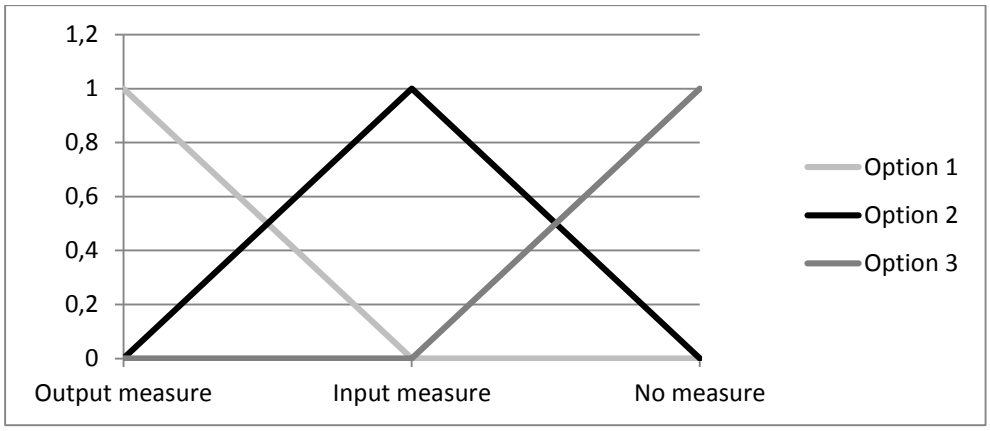

Figure 4.44 : Fuzzy numbers of the linguistic terms for attribute the performance culture of the firm.

4.2.14 Reward and compensation systems

The reward and compensation systems of the firm is evaluated in the 17th question. This query has only three options:

- Option 1: Reward system
- Option 2: Punishment system
- Option 3: No system

The fuzzy values of these linguistic terms are displayed in Figure 4.45.

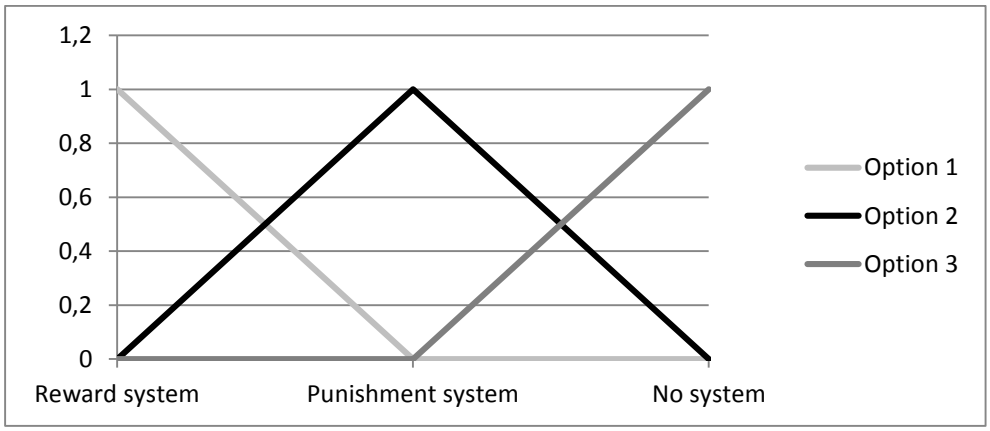

Figure 4.45 : Fuzzy numbers of the linguistic terms for attribute the reward and compensation system of the firm.

4.2.15 The clarity of vision, goals and objectives

The clarity of vision, goals and objectives of the firm is evaluated in the 18th question with a seven-point Likert-Scale. In the first part of this question, which will be the only part considered for the analysis of this criterion, the firms were asked to define at what

level their vision, goals and objectives are realistic and well-adopted by their workers. The following three linguistic terms were designed for this factor:

- Neither realistic nor adopted by the employees
- Not adopted by most workers independent from being realistic
- Realistic and adopted by the employees

The fuzzy values of these linguistic terms are presented in Figure 4.46.

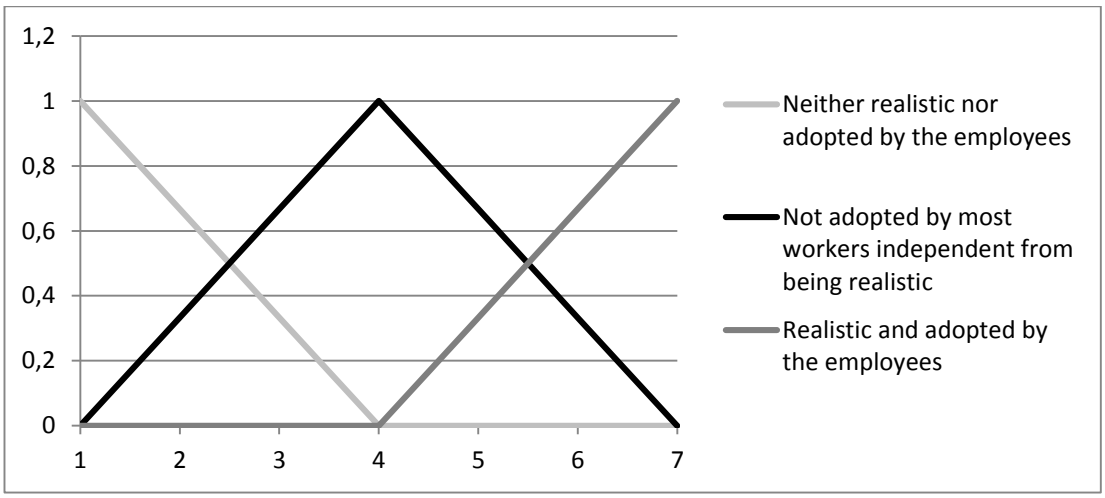

Figure 4.46 : Fuzzy numbers of the linguistic terms for attribute the clarity of vision goals and objectives of the firm.

4.2.16 Type of leadership

The type of leadership of the firm is measured in the 19th question with an eleven-point Likert-Scale. The five linguistic terms designed for this factor are:

- Decisions are made and implemented by one person/committee
- Decisions are made and implemented by one person/committee who gather ideas from the employees
- Decisions are made on a common ground but implementation is made by a person / committee
- A team of employees are also take part in decision making/implementation in case of emergencies.
- All employees are delegated to decide in case of emergencies

The fuzzy values of these linguistic terms are displayed in Figure 4.47.

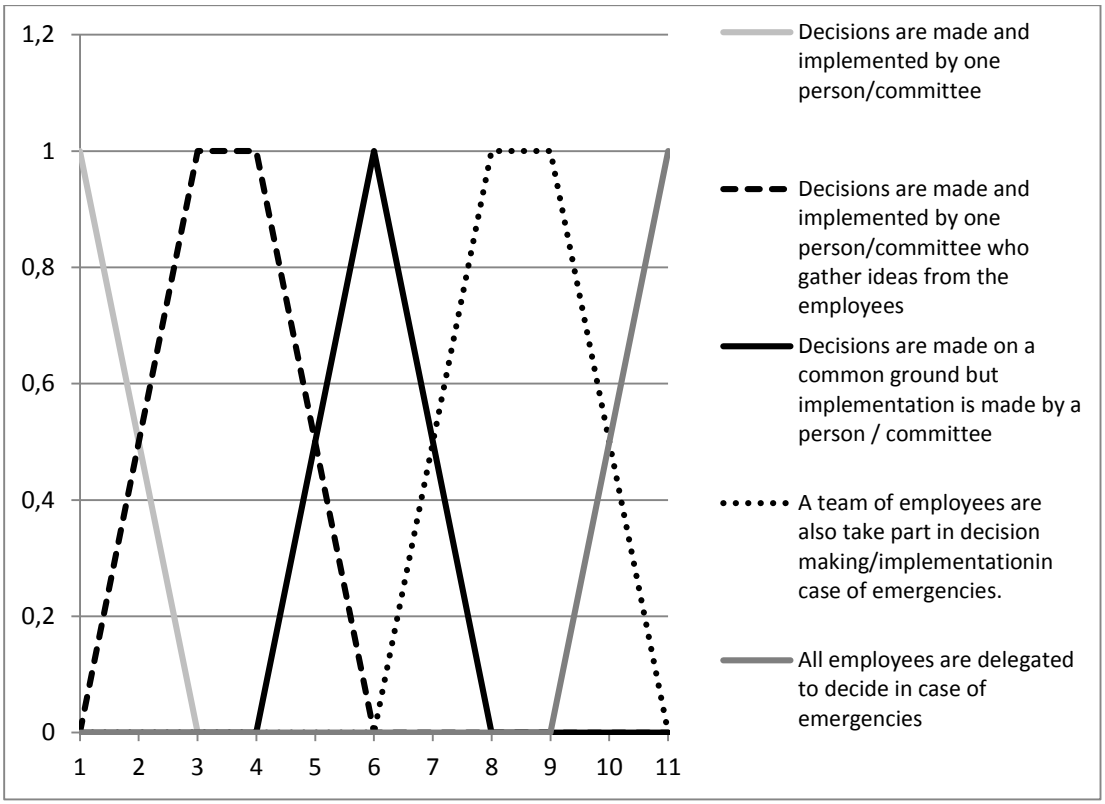

Figure 4.47 : Fuzzy numbers of the linguistic terms for attribute the type of leadership of the firm.

4.2.17 Administrative capacity

The administrative capacity of the firm is retrieved in the 20th question with a seven-point Likert-Scale. In this question, three dimensions of the administrative capacity are assessed. Thereby, the first part of this query evaluates the level in which the current management approach affects the effectiveness of the company, the second the departmental effectiveness, and the third of the employees' one.

The following three linguistic terms were taken into account for each part of this question:

- Decrease efficiency
- Does not affect efficiency
- Increase efficiency

The fuzzy values of these linguistic terms are presented in Figure 4.48.

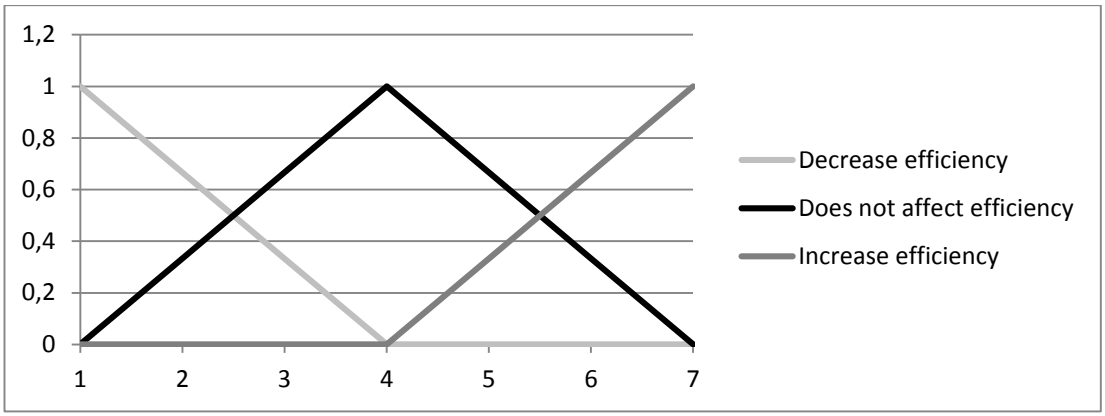

Figure 4.48 : Fuzzy numbers of the linguistic terms for attribute the administrative capacity of the firm.

4.2.18 Brand / firm reputation

This criterion of the firm is retrieved in the 21th question with an eleven-point Likert-Scale. The following five linguistic terms were established for this factor:

- No reputation - infamous
- Limited reputation
- Average reputation
- Good reputation
- Famous

The fuzzy values of these linguistic terms are displayed in Figure 4.49.

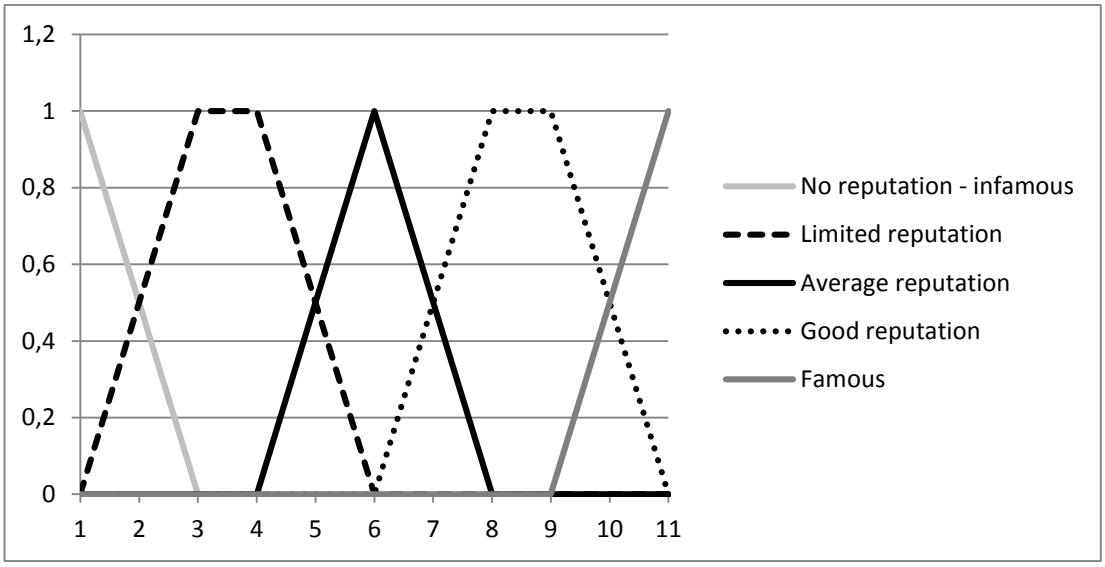

Figure 4.49 : Fuzzy numbers of the linguistic terms for attribute brand/firm reputation of the firm.

4.2.19 Organizational resources

In the 22nd question the firms were asked to indicate at what level they are able to supply their organizational and technological resources if they become part of a R&D alliance. The first five items listed in this query make up the organizational resources of the firm:

- Qualified personnel
- Machinery / equipment
- Commercial agreements
- Capital
- Procedures and processes

The following three linguistic terms were taken into account for this question:

- Can provide none
- Can provide its share
- Can provide for all shares

The fuzzy values of these linguistic terms are presented in Figure 4.50.

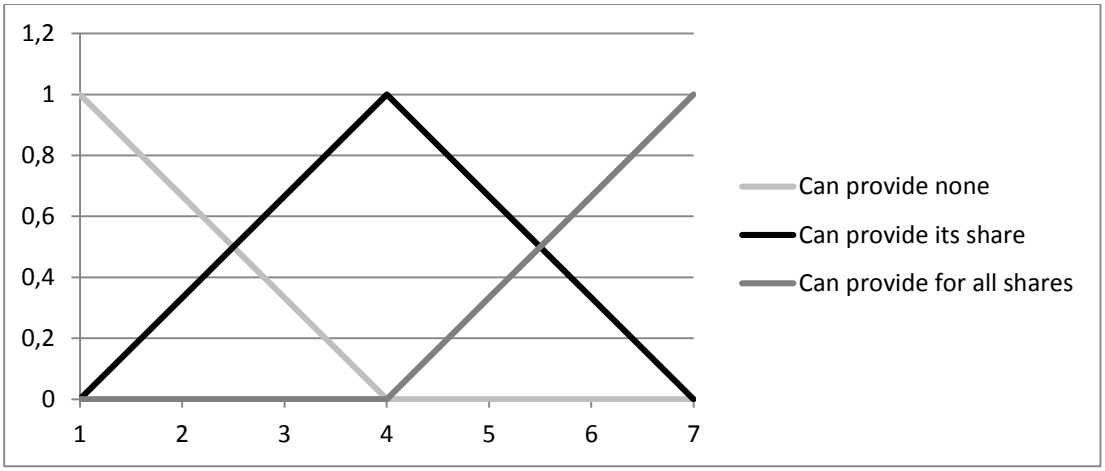

Figure 4.50 : Fuzzy numbers of the linguistic terms for attribute the organizational and technological resources of the firm.

4.2.20 Technological resources

The technological resources of the firm are retrieved in the 22nd question with a seven-point Likert-Scale. The last six items of this question make up the technological resources of the firm:

- Computers
- Communication equipment
- Automated data processing
- Database management systems
- Management information systems
- Related information, equipment, goods and services.

The linguistic terms as well as the fuzzy values for this attribute are displayed in Figure 4.50 since they are the same as the ones defined for organizational resources.

5. APPLICATION AND RESULTS

The results of this study are presented in three parts: (1) a preliminary analysis of the industries, the distribution according to the company size, and the respondents' position; (2) association rules of the most important factors of innovation collaboration comparing the data of Turkish and Bolivian firms, and finally (3) association rules according to the trend, age and size.

5.1 Preliminary Analysis

5.1.1 Sector of the firms

As aforementioned, 27 Bolivian and 51 Turkish SMEs from different industries were applied the questionnaire for this study. In the case of Bolivian SMEs, most of them belong to food (18%), commerce (18%), clothing & textiles (11%) and service sectors (11%); whereas in the case of Turkish SMEs, most of them operate in electronic & machinery (20%), food (18%), clothing & textiles (14%) and service sectors (8%) as it is shown in Figure 5.1 and Figure 5.2 respectively. Hence, the majority of the SMEs in this study operate in food, clothing & textiles, electronic & machineries, commerce and service sectors as reflected in Figure 5.3.

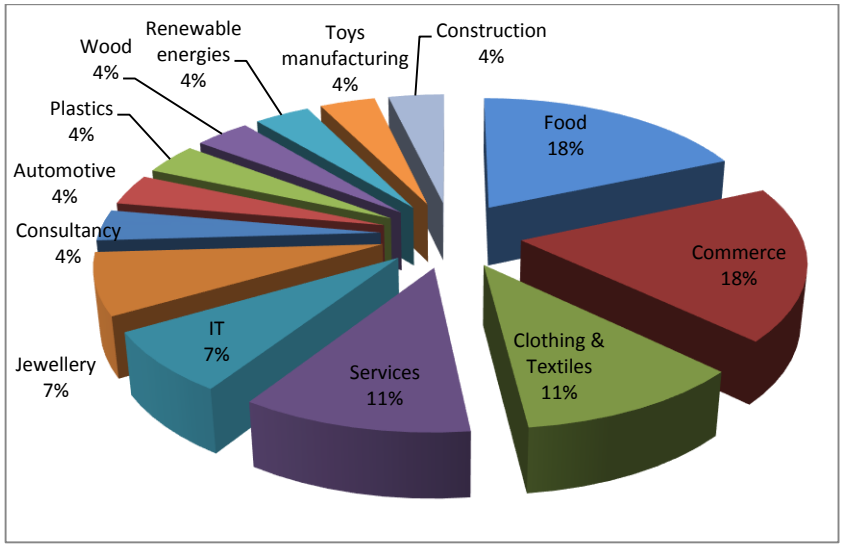

Figure 5.1 : Sector of Bolivian participating firms.

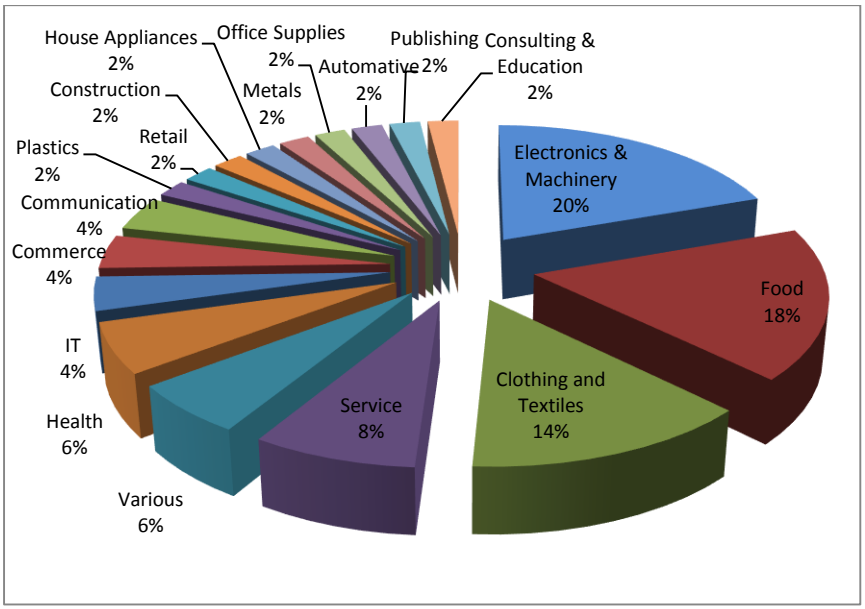

Figure 5.2 : Sector of Turkish participating firms.

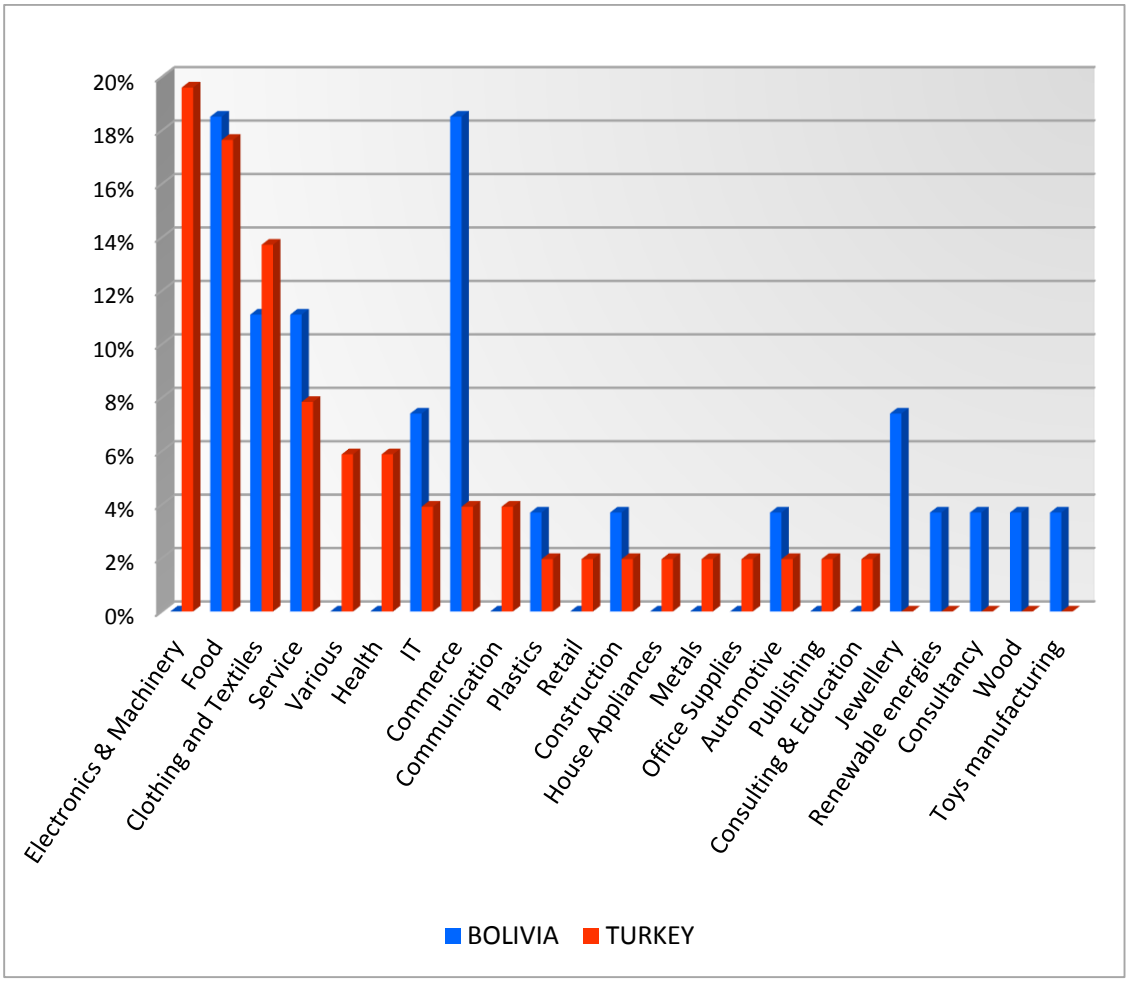

Figure 5.3 : Sector of the total participating firms (Bolivian and Turkish).

5.1.2 Distribution according the firm-size

Table 5.1 : Number of firms accoding to their size.

Size	Bolivia		Turkey	
	Frequency	Percentage	Frequency	Percentage
Micro	15	55,6	34	66,7
Small	10	37,0	11	21,6
Medium	2	7,4	6	11,8
Total	27	100,0	51	100,0

In both countries, most of the respondents correspond to micro companies, then to small and the less percentage to medium size companies.

5.1.3 Respondents position

Table 5.2 : Number and percentage of respondents' position.

Size	Bolivia		Turkey	
	Frequency	Percentage	Frequency	Percentage
Technical Staff	0	0,0	7	13,7
Expert / Engineer	0	0,0	12	23,5
Department Manager / Senior Manager	4	14,8	17	33,3
Top Manager	18	66,7	15	29,4
Owner	2	7,4	0	0,0
Shareholder	3	11,1	0	0,0
Total	27	100,0	51	100,0

In the case of Bolivian firms, most of the respondents were top managers, whereas they were department/senior managers in Turkish firms.

5.2 Association Rules of innovation collaboration factors

5.2.1 Attitude towards alliance

The attitude towards alliance ranges from "unwillingness" to "willingness" to participate in an R&D alliance.

Unwilling SMEs

These firms, both in Bolivia and Turkey, have shown a positive association with the same following factors:

- Not commitment capabilities to alliance considering that they prefer partners that fit with their corporate culture.
- Not willing to collaborate but would collaborate if forced.
- Limited reputation in the market (as for Bolivia) or being an infamous company (in case of Turkey).

In the case of Bolivia, the companies are reluctant to participate in an R&D alliance, if the following factors are satisfied:

- Competitive relations among the firms are entirely discouraged,
- There is a highly hierarchical organizational structure and only the top management and/or department managers make the decisions, and
- The workers incline towards a negative attitude for collaboration.

On the other hand, Turkish SMEs are reluctant to collaborate if the following criteria are supported:

- The basic resource allocation system applies "save the day" strategy; there is no structural plan,
- The contingency resource allocation system is not designed since no budget plans are made for emergencies,
- There is a medium rate annual profit,
- Suppliers contribute to innovation at a very low level,
- Sales channels contribute to innovation at a very low level,
- The members of the organization are unenthusiastic or not willing about communicating with other organizations,
- There is a disposition to participate in a R&D alliance but with some experience and resources,
- There is an intention of occasional commitment,
- The belief that in an R&D alliance, wealthy companies should pay long term investments, and

- There is the conviction that in the structure of the alliance, some basic plans should be ready for each collaboration but major changes would certainly occur during the execution.

Then, these firms are not willing to participate in an R&D alliance.

SMEs that are willing to collaborate

Association rules related to firms that want to take part in an alliance were only retrieved in Turkey. The factors that provide eagerness for the SMEs to collaborate are as follows:

- Micro sized companies have a negative association with the will to collaborate.
- Preventive emergency budget plans are designed for the contingency resource allocation system.
- The members of the organization are willing to communicate with other organizations.
- Collaborations for long term are found more suitable.
- The firm defends that collaboration activities should be individually specified.
- They do not have intention of occasional commitment; they need more than occasional commitment.
- There is also a negative association with not willing to collaborate but would collaborate if forced (This criterion actually shows the results are consistent).
- The workers have a positive attitude towards collaborations.
- They defend that wealthy companies should not be the only that pay long-term investments.
- They defends that all companies should agree to share the expenses equally.

5.2.2 Level of customers' collaboration to innovation

The level of customers' collaboration to innovation spans from having a call center, an employee, intermediaries or sales channels, to a direct interaction with the customer.

SMEs that have a call center

Only one association rule related to firms with a call center was revealed particularly in Turkey, showing an interesting negative relation with the readiness to provide all its management information systems. That is to say, if a firm has a call center, then this company is not enthusiastic at all about sharing its technological capability of management information system.

SMEs that have an employee in charge of evaluation customers' relationships.

For these firms, one interesting association rule was retrieved for each country. In Turkey's case, the rule exposes that if the companies are not willing to share their capital with the R&D alliance, they have an employee for customer interaction; whereas in Bolivia's case, this occurs when they are not enthusiastic about sharing their machinery and/or equipment.

SMEs that use other sources.

In the case of Bolivia, if the firms sustain that:

- Vision, goals and objectives are adopted by most workers independent from being realistic,
- Can share none commercial agreements with the alliance, and
- Cannot share none procedures and processes. That is to say, they might provide procedures and processes to the alliance.

then, the firms obtain information of the customer from other sources such as the sales channels.

On the other hand, Turkish SMEs that support the following criteria:

- Learning organization creation and diffusion of new ideas are not totally supported,
- The corporate approach increases the administrative efficiency of the firm, and
- The corporate approach increases the administrative efficiency of employees.

then, these companies retrieved customers' information from intermediaries or sales channels.

SMEs whose clients directly collaborate with them

Bolivian's SMEs that bolster up the following criteria:

- The company culture does not allow to create and diffuse new ideas,
- Visions, goals and objectives are adopted by most workers independent from being realistic,
- Can provide its share of procedures and processes to the alliance,
- Can neither provide their computers for all shares nor provide none. That is to say, they might provide only their share, and
- Cannot provide for all shares automated data processing.

are the ones that declared to have a direct contact with their clients in order to get information of them.

5.2.3 R&D structure

The R&D structure of the firms ranges from having a R&D laboratory, department / unit, to outsourced R&D activities.

R&D Lab.

In the case of Bolivia, if the companies are ready to provide its share related to capital as an organizational resource, then they own a R&D laboratory.

In Turkey's case SMEs that support the next criteria:

- Vision, goals and objectives are not realistic neither adopted by the employees, and
- In a collaboration, as technological capabilities they can provide for all share computers and database management systems.

then these firms have a R&D laboratory.

The Figure 5.4 displays what kind of resources SMEs of Bolivia and Turkey are willing to provide if being part of an alliance (understanding 0 as "non available information", 1 as "none", 2 as "its share" and 3 as "for all shares").

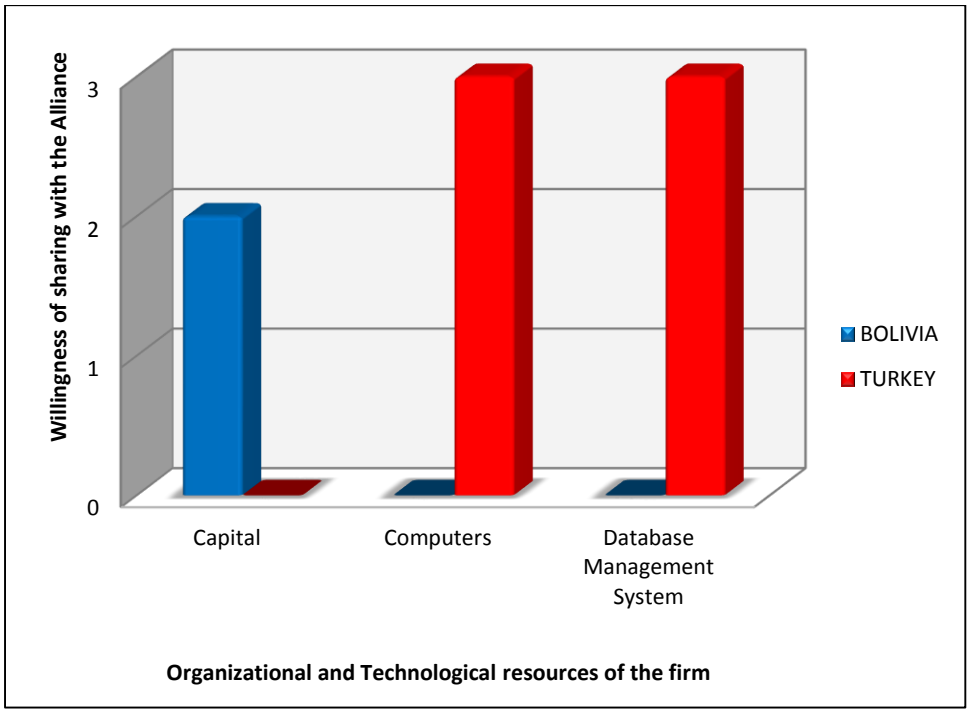

Figure 5.4 : Resources that an SME with a R&D lab is ready to share with an alliance.

R&D Department or Unit

Bolivian's SMEs that supports the following criteria:

- Visions, goals and objectives are not realistic neither adopted by the employees, and
- Can provide none or at maximum its share of commercial agreements. However, they are not enthusiastic to provide its share of communication equipment.

Then, they have a R&D department or unit.

As for Turkey's SMEs, if they can provide capital for all shares, then they do have a R&D department or unit.

The Figure 5.5 displays what kind of resources SMEs of Bolivia and Turkey are willing to provide if being part of an alliance (understanding 0 as "non available information", 1 as "none", 2 as "provide its share" and 3 as "provide for all shares"; positive numbers symbolize a positive association while negatives represents a negative association).

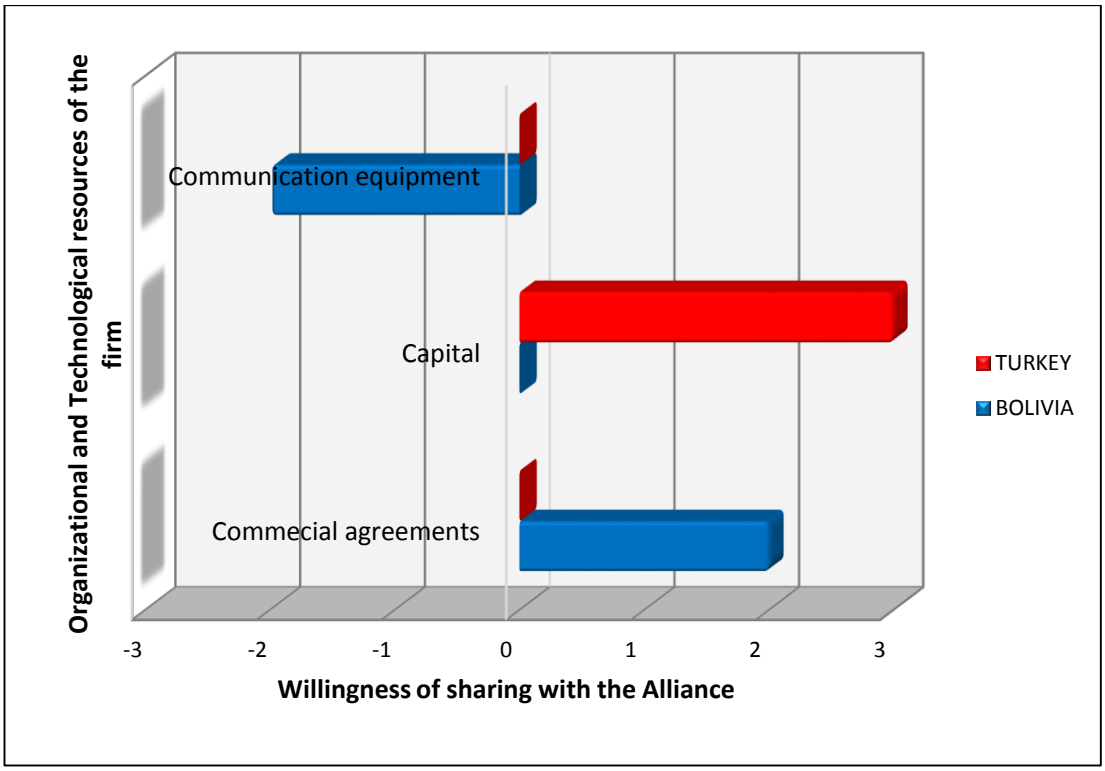

Figure 5.5 : Resources that an SME with a R&D department/unit is ready to share with an alliance.

Outsourced R&D activities.

In the case of Bolivia, if an SME braces the following criteria:

- Corporate approach affects administrative company efficiency, and
- Cannot provide qualified personnel for all shares neither can provide its share of computers,

Then, this firm has been outsourced its R&D activities.

As for Turkish SMEs,

- Corporate approach affects administrative department efficiency, and
- Can provide machinery / equipment for all shares. However, cannot provide its share of capital.

Then, these firms have been outsourced their R&D activities.

The Figure 5.6 shows what kind of resources SMEs of Bolivia and Turkey are willing to provide if being part of an alliance (understanding 0 as “non available information”,

1 as “none”, 2 as “provide its share” and 3 as “provide for all shares”; positive numbers symbolize a positive association while negatives represents a negative association).

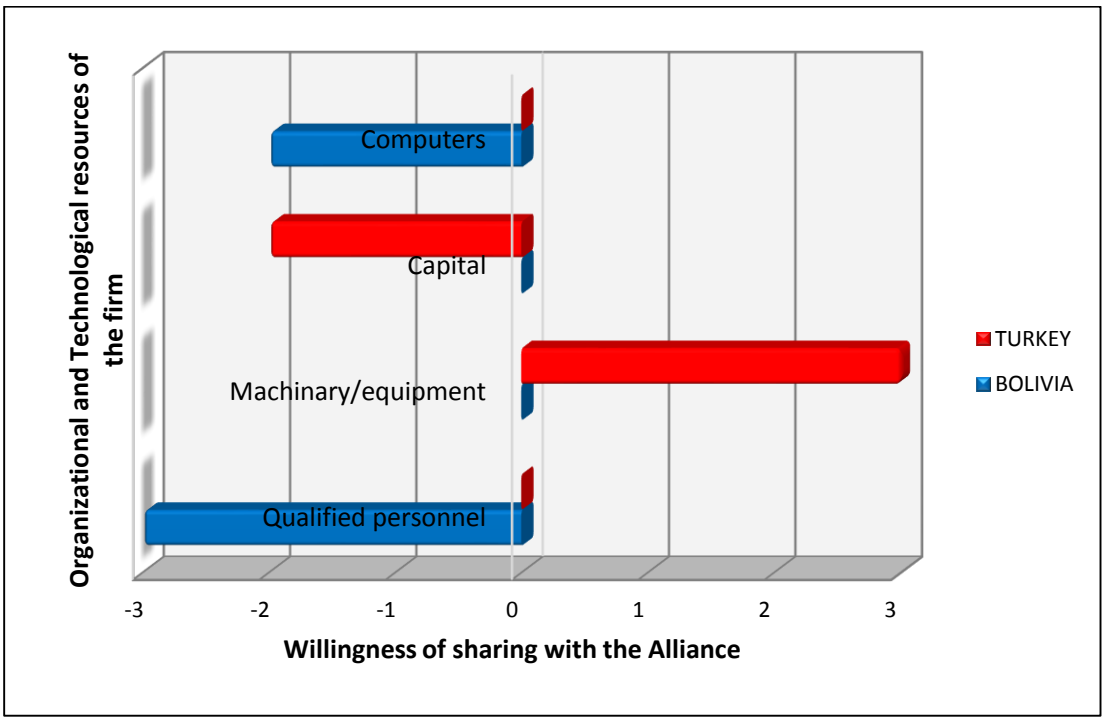

Figure 5.6 : Resources that an SME with outsourced R&D activities is ready to share with an alliance.

5.2.4 Open Innovation Ability

The open innovation ability of the firms ranges from openly collaborate, non-openly cooperate to no having innovation initiatives.

Openly collaborative SMEs

Both in Bolivia and Turkey, if the corporative approach does not affect the administrative efficiency of departments, then the SMEs have an openly collaboration ability.

In the case of Bolivia, the companies have an open collaboration ability, if one of the following factors are satisfied:

- The creation and diffusion of new ideas are occasionally supported
- They cannot provide qualified personnel for all shares
- They can provide automated data processing and database management systems for all shares of. However, they cannot provide related information, equipment, goods and services for all shares.

On the other hand, Turkish SMEs have an open collaboration ability if the vision, goals and objectives are realistic and adopted by the employees.

Closed cooperation

Both in Bolivia and Turkey, if the firms can provide only partial management information system requirements, then the SMEs have a non-open collaboration ability.

Bolivian SMEs are non-open collaboration, if one of the following criteria are satisfied:

- The creation and diffusion of new ideas are not totally supported
- Corporate approach does not increase the administrative company efficiency neither affects the administrative department efficiency.
- Can neither provide their commercial agreements for all shares nor provide none. That is to say, they might provide only their share
- They cannot provide none computers and communication equipment. They might provide only their share.
- They can provide related information, equipment, goods and services for all shares.

As for Turkish SMEs, they are closed to cooperate if the following factors are supported:

- The vision, goals and objectives are adopted by most workers independent from being realistic
- Corporate approaches increase the administrative department efficiency

No innovation

In the case of Turkey, if at least one of the following criteria holds:

- They can provide qualified personnel for all shares, and
- They can provide its share of computers, and for all share communication equipment.

- However, they can provide none of database management systems neither its share of management information systems nor its share of related information, equipment, goods and services.

then, these companies do not have innovation initiatives.

5.2.5 University-firm relations

The interaction of firms with universities spans from a very low rate to a very high rate.

Relations at a very low level

In the case of Bolivia, only one rule was retrieved. If the firms have relations with other institutions at a very low rate, so do the university-firm relations.

On the other hand, as an outstanding result, Turkish SMEs have a very low level of university-firm relations if at least one of the following criteria are supported:

- Competitive relations among the firm are entirely discouraged
- There is a very low rate of labor productivity
- Suppliers contribute to innovation at a very low rate
- Unwilling commitment capabilities to alliance.

Relations at a low level

Bolivian SMEs have a low rate of relation with universities if there is a slow company pace and if there is a possibility of R&D alliance with rich companies who would pay for long-term investments. However, in Turkey if competitive relations among the firms are mostly discouraged but some department managers allow it, and there is a low level of labor productivity, the firms have a low rate of relation with universities.

Relations at a medium level

In the case of Bolivia, the firms possess a medium rate of university-firm relation if their industry is growing in the area. On the other hand, in Turkey, the same level of relations are obtained, if there is the conviction that technical incompatibilities of sharing the communication, coordination and information systems, would cause technical difficulties.

Relations at a high level

Bolivian firms report a high level of university-firm relation if there is a strong digital sales channel.

In the case of Turkey, SMEs satisfy at least one of the following criteria:

- There is a very high turnover rate,
- Competitive relations among the firm are encouraged in some departments,
- There is a high rate of labor productivity,
- They is a defense for having an R&D alliance where most activities should be individually specified,
- The company is willing to commit to the alliance,
- There is also a willingness to occasionally collaborate, and
- There is the conviction that in the alliance structure, success stories should be inspired from but they should not constitute the basis of the plans,

Relations at a very high level

These firms, both in Bolivia and Turkey, have shown a positive association with a very willing commitment capability to alliance.

Bolivian SMEs have a high level of university-firm relation if they satisfy at least one of the following factors:

- The industry does not change at all
- Basic resource allocation plans are made very thoroughly and the deviations are very small.
- There is a very high rate of relation with other institutes
- Very slow velocity of creating a new product/process comparing with the industry average
- The rate of number of qualified workers is very low
- There is a very high rate of annual profit
- There is a very fast company's pace

- They defend that all collaboration activities should be individually specified.
- All employees are delegated to decide in case of emergencies

As for Turkey's SMEs, if they satisfied the following criteria:

- They operate in a manual industry,
- The capital structure depends mostly on borrowed funds,
- The structure of sales channels is mostly digital,
- There is a totally collaborative industry,
- Competitive relations among the firms are entirely encouraged,
- There is a very high rate of labor productivity,
- The company has the ability to create new product/process faster than the industry average,
- There is a very high rate of number of qualified workers,
- The company is very willing to commit to alliance, and
- There is a high rate of labor productivity,

then, these are companies with a high level of university-firm relation.

5.2.6 Relation with other institutes

The companies' relations with other institutes ranges from a very low rate to a very high rate.

Relations at a very low level

In the case of Bolivia, the firms' relations with other institutions have a very low level if at least one of the following factors are satisfied:

- The firm is old
- The shareholder structure does not rely on stock certificates
- The company trend is likely to be the same in future
- Relations with universities are at a very low rate

On the other hand, Turkish SMEs have a very low level of relations with other institutes if at least one of the following criteria are supported:

- Financial resources based mostly on capital
- The basic resource allocation system applies "save the day" strategy; there is no structural plan
- The contingency resource allocation system is not designed since no budget plans are made for emergencies
- There is a very high rate of labor productivity
- Suppliers contribute to innovation at a low or very low level
- Sales channels contribute to innovation at a low or very low level
- There is a highly hierarchical organizational structure and only the top management makes the decisions,
- There is a very slow company's pace
- The firm defends that collaboration activities should be joint.
- The workers incline towards a negative attitude for collaboration.
- There is the conviction that if the communication, coordination and information systems are shared, cultural incompatibility would certainly cause difficulties that may not be overcome.
- The company is known as infamous in the market

Relations at a low level

Bolivian SMEs have a low rate of relation with other institutes if:

- There is a medium turnover rate,
- There is a very low rate labor productivity,
- There is a medium rate number of qualified workers compared to the industry average,
- Limited brand/firm reputation, and

- Can provide none of related information, equipment, goods and services to the alliance.

Whereas in Turkey, the relations are at a low level if:

- They operate in a manual industry
- The financial resources highly rely upon credits
- The turnover rate is very low
- Budget plans are made for emergencies but generally there is no resources left after daily expenses.
- The innovation level of the firm in terms of a new product/process creation's velocity is very fast.

Relations at a medium level

In the case of Bolivia, the firms possess a medium level of relations with other institutes if suppliers contribute to innovation at a medium level. Whereas in Turkey, the relations are at a medium level, if at least one of the following criteria is satisfied:

- The industry is not boosting in the area
- The basic resource allocation plans are made but changes occur frequently.
- The basic resource allocation plans are not made very thoroughly and the deviations are not very small (criterion that evidences the consistency of the previous one).
- After controlling all costs, some resources are saved for emergencies if the budget allows.
- Preventive emergency budget plans are not designed for the contingency resource allocation system.
- There is a medium rate of number of qualified workers
- There is not a very high rate of annual profit
- Sales channels contribute to innovation at a medium level

- There is the conviction that if the communication, coordination and information systems are shared, technical incompatibilities would cause technical difficulties.
- Decisions are made on a common ground but implementation is made by a person / committee
- A team of employees do not take part in decision making/implementation in case of emergencies.
- The company is not famous in the market

Relations at a high level

Bolivian firms report a high level of relations with other institutes if at least one of the following factors are supported:

- The capital structure depends mostly on capital by shareholders
- The basic resource allocation plans are carefully made but changes might occur occasionally
- Competitive relations among the firm are encouraged in some departments
- Suppliers contribute to innovation at a high level
- Sales channels contribute to innovation at a high level
- The industry does not change at all

In the case of Turkey, if the firms' budgets allow emergency expenses without considering preventive plans, then these SMEs have a high rate of relation with other institutes.

Relations at a very high level

These firms, both in Bolivia and Turkey, have shown a positive association with a very high rate of annual profit and with designing very thoroughly basic resource allocation plans with very small deviations.

Bolivian SMEs have a high level of relation with other institutes if they support the following factors:

- There is a totally collaborative industry

- Relations with universities are at a very high rate
- There is an entirely encouraged competitive relations among the firm
- The firm defends that collaboration activities should be individually specified.
- There are very willing commitment capabilities to alliance.
- There is the conviction that in the structure of the alliances success stories should be benefited from to be successful
- In the company all employees are delegated to decide in case of emergencies

As for Turkey's SMEs, the companies with pretty strongly relations with other institutes satisfy the following criteria:

- The company is not a micro sized firm
- The company is a medium sized firm
- The firm is old
- The industry is boosting in the area
- The industry is fast changing
- Resource allocation plans are not made.
- After controlling all costs, non resources are saved for emergencies.
- Preventive emergency budget plans are designed for the contingency resource allocation system.
- There is not a medium rate of number of qualified workers
- There is not a medium rate of annual productivity
- There is a very high rate of annual productivity
- There is not a medium rate of annual profit
- Suppliers do not contribute to innovation to a medium level
- Suppliers contribute to innovation at a very high level
- Sales channels do not contribute to innovation at a medium level
- They cannot participate in an R&D alliance with limited resources.

- They can participate in an R&D alliance with most resources (criterion that exposes the consistency of the results)
- They have willing commitment capabilities to alliance
- There is the conviction that if the communication, coordination and information systems are shared, technical incompatibilities would not cause technical difficulties.
- Decisions are not made on a common ground and implementation is not made by a person / committee
- In the company a team of employees also take part in decision making/implementation in case of emergencies.

5.3 Association rules related to the trend, age and size of the industries

5.3.1 Rules according to the industry trend

Most of the extracted association rules are related to start-up and maturity stage of their business life cycle.

With respect to firms that are boosting in the area, the capital structure of Bolivian SMEs totally depends on borrowed funds. While in contrast, Turkish SMEs are mostly based on capital by shareholders.

In both countries, the structure of sales channels of star-up stage companies are mostly yet not completely traditional ones. In addition, for these SMEs the industry is changing fast.

In Table 4.3 a summary and a comparison of the association rules of Turkish and Bolivian SMEs is displayed according to the trends of the firms.

5.3.2 Rules according to the age

Table 4.4 shows a summary and a comparison of the association rules of Turkish and Bolivian SMEs according to the age of the firms.

Bolivian new firms are in a non-high technology industry since they only require manual works at this stage, as do similar SMEs in Turkey.

On the other hand, the rate of white-collar employees of fairly new Turkish SMEs medium. Unlikely, old companies of Bolivia range from high to very high.

5.3.3 Rules according to the firm size

Table 4.5 shows a summary and a comparison of the association rules of Turkish and Bolivian SMEs according to the size of the firms.

The age of medium-size companies in Bolivia corresponds to the industry average. Whereas, medium-size Turkish companies are old.

In Bolivia, the shareholder structure of medium-size companies relies on government bonds. Similarly, medium-size firms in Turkey are not opened to public offering, yet they partly use government bonds.

Table 5.3 : Comparison of association rules of Bolivia and Turkey according to the business life cycle stage of the SME.

Stage:	Star-up	Growing	Maturity	Declining	Dead
Linguistic term:	Boosting in the area	Inclining in the area	Likely to be the same in future	Declining in the area	On the verge of extinction
Age of the Firm	New		Fairly Old		
Being in a high tech industry	Requires technology in all processes				
Financial resources				Highly relies upon credits Relies on both credits and also has some cash (-)	
Capital structure	Totally depends on borrowed funds Depends mostly on capital by shareholders		Depends on both borrowed funds and capital by shareholders		
Shareholder structure			Relies on government bonds		
Structure of Sales Channels	Mostly traditional sales channels Only traditional sales channels(-)				
Speed of change in industry	Changing fast Rather changing fast (-)				

Table 5.3 (continued): Comparison of association rules of Bolivia and Turkey according to the business life cycle stage of the SME.

Stage:	Star-up	Growing	Maturity	Declining	Dead
Turnover rate	Very high rate		Low rate High rate (-)		
Number of qualified workers	High Rate Medium Rate (-)	High Rate	Medium Rate		
Annual productivity	Medium rate (-)		Medium rate		
Annual profit	Medium rate (-)		Medium rate		
Company's pace	Industry Average(-) Very fast		Industry Average		
Type of leadership	Decisions are made on a common ground but implementation is made by a person / committee (-) All employees are delegated to decide in case of emergencies*		Decisions are made on a common ground but implementation is made by a person / committee		
Brand/firm reputation				Limited reputation	

>|1.96| (97.50%)
(-) negative association

Table 5.4 : Comparison of association rules of Bolivia and Turkey according to the age of the SME.

Age:	New	Fairly New	Industry Average	Fairly Old	Old
Rate of white collar employees		Medium Rate			High Rate All
Being in a high tech industry	Manual industry				
Financial resources				Highly relies upon credits	
Shareholder structure	Open to public offerings				
Speed of change in industry					Slowly changing
Turnover rate	High rate (-)	High rate			
Number of qualified workers	High Rate (-)	High Rate Medium Rate(-)			
Annual profit	Low rate Medium rate(-)	High rate			
Company's pace					Industry Average(-)
Type of leadership					Decisions are made on a common ground but implementation is made by a person / committee (-)
Brand/firm reputation	No reputation - infamous				

>|1.96| (97.50%)
(-) negative association

Table 5.5 : Comparison of association rules of Bolivia and Turkey according to the size of the firm.

Size:	Micro	Small	Medium
Age of the firm	Fairly New Old (-)		Industry Average Old
Rate of white collar employees	High Rate (-)	High Rate	
Being in a high tech industry		Requires technology in all production processes	
Capital structure	Depends mostly on capital by shareholders (-)		
Shareholder structure	Open to public offerings	Relies on stock certificates	Relies on government bonds Partly use government bonds Open to public offerings (-)
Structure of sales channels	Only traditional sales channels(-) Mostly traditional sales channels(-)		
Labor productivity	High Rate		Medium Rate
Speed of change in industry			Changing fast
Number of qualified workers	High Rate		All
Annual productivity			Very high rate
Annual profit	Medium rate		Very high rate
Company's pace			Very fast
Type of leadership			All employees are delegated to decide in case of emergencies
Brand/firm reputation	Average reputation		

>|1.96| (97.50%)
(-) negative association

6. CONCLUSIONS

This final chapter of the study summarizes the most outstanding results and discusses their applicability.

The primary objective of this research was to discover the reasons why SMEs are willing or refusing to collaborate. The survey designed by Altay (2012) is run with Bolivian SMEs, the results allowed to retrieve and compare innovation based collaboration rules of two developing countries.

Turkish firms that own an R&D laboratory or rather a R&D department or unit are able to share their capital in an R&D alliance. Furthermore, Bolivian SMEs have retrieved exactly the same rule.

Bolivian companies that have an R&D department or unit, like the Turkish firms, have stated that their vision, goals and objectives are not considered realistic neither adopted by the employees.

There is a complete consensus that if the companies are not ready to provide qualified workers, they can neither share capital with the alliance, nor they outsource their R&D activities.

The reasons why Turkish SMEs have a very low level of interaction with universities are because the inter-firm competitive relations are completely discouraged and their suppliers contribute poorly to innovation. Even though their labor productivity rate is very low, they are not willing to take part of an alliance.

The motivation of SMEs to collaborate with universities are quite different between Bolivian and Turkish firms. Whereas Bolivian SMEs have a very high level of university-firm relations if the velocity of creating a new product/process comparing with the industry average is “very slow”, in the case of Turkish companies this velocity is “faster” than the industry average. Furthermore, in terms of qualified workers, there is a dissimilarity as well. Whereas Bolivian firms with “very low number” of qualified workers collaborate closely with universities, in the case of Turkish companies with very high university-firm relations have a “very high number” of qualified workers.

The previous paragraph reveals that Bolivian firms are willing to collaborate with universities to fill their gaps in terms of qualified workers and technology in order to survive in the market even though the intensity of local competition is low. By contrast, Turkish firms are enthusiastic to collaborate with universities not with the aim to fill a gap yet in order to get a competitive advantage in the Turkish market since there is a high intensity of local competition. For these reasons, Bolivian SMEs that are part of an R&D collaboration may be more dependent of it and as a result, may be strongly committed to it. However, Turkish SMEs that are part of an R&D collaboration should define specific goals and objectives that boost the synergy and commitment of the firm members since they want to collaborate not to fill a gap but to get more market share in a highly intensive competitive market.

Both Turkish and Bolivian firms has a high level of relation with other institutions if their rate of annual profit is very high and/or they have a very thoroughly designed basic resource allocation plans with small deviations. Nevertheless, for these SMEs, whereas the industry does no change at all in Bolivia, in the case of Turkey the industry is fast changing.

These results can be used for managers to improve the factors that affect the aversion of collaboration with other firms. Therefore, the firms that are enthusiastic to collaborate should benefit these rules since collaboration, a strength of today, may be a threat of tomorrow.

There is a lot of research about SMEs from developing countries. However, few researchers focus on developing countries, less in Latin America. Consequently, more researchers might be encouraged to work in the region.

In this study, one by one interactions are analyzed. Further studies may include multiple interactions and rules at the same time, and the extension of number of samples should be increased.

The results of this study are extracted from SMEs of only two countries: Turkey and Bolivia. Thus, in order to generalize these results about factors that affect collaboration of SMEs in developing countries, further studies that include other developing countries are recommended.

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APPENDICES

APPENDIX A: The Innovation Questionnaire
APPENDIX B: The Synergy Questionnaire

APPENDIX A: The Innovation Questionnaire

Este cuestionario ha sido realizado con el fin de obtener datos sobre "Información de Estructuras de Innovación en PYMES". Le rogamos responder a todas las preguntas del cuestionario. Apreciamos y agradecemos su interés y valiosa contribución a este estudio.

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1. ¿Cuál es el tamaño de su empresa?

a. Mediana (menos de 250 trabajadores)

b. Pequeña (menos de 50 trabajadores)

c. Micro (menos de 10 trabajadores)

NOTA:

Cuando responda a las siguientes preguntas, por favor marque la puntuación más adecuada de la escala presentada de acuerdo a su punto de vista.

Si desea añadir algún comentario fuera de las opciones de respuestas presentadas, puede expresar su respuesta debajo de cada pregunta.

2. ¿Cuál es la proporción de trabajadores administrativos en su empresa?

Menos del 30%					La mitad de los trabajadores					Más del 70%
1	2	3	4	5	6	7	8	9	10	11

3. ¿Como definiría la edad de su empresa?

Somos una empresa nueva					Tenemos casi la misma edad que otras					Somos una empresa antigua y bien establecida
1	2	3	4	5	6	7	8	9	10	11

4. ¿Cómo definiría su empresa en términos de tecnología?

La producción utiliza una baja tecnología o un trabajo manual que no requiere mucho conocimieno					El proceso de producción de nuestra empresa utiliza alta tecnología					Trabajamos en un sector de alta tecnología
1	2	3	4	5	6	7	8	9	10	11

5. ¿Cómo definiría la estructura del capital financiero de su empresa?

1ra Parte

Trabajamos con créditos					Hay una distribución balanceada entre Efectivo y Crédito					Nuestro capital esta conformado por inversiones empresariales
1	2	3	4	5	6	7	8	9	10	11

2da Parte

Todos nuestros recusos financieros son aportados por inversionistas y emprendedores										Todos nuestros recusos financieros estan basados en capital prestado
1	2	3	4	5	6	7	8	9	10	11

6. ¿Cuál es la estructura accionaria de su empresa?

Somos una empresa con capital flotante (que cotiza en la bolsa)					Somos una empresa que manejamos acciones.					Somos una empresa que maneja bonos del estado.
1	2	3	4	5	6	7	8	9	10	11

7. ¿Cuántas patentes tiene su empresa?

Más de una patente 1

Una patente 2

Ninguna patente 3

8. ¿Cuántas patentes ha solicitado o postulado su empresa hasta ahora?

Más de una patente 1

Una patente 2

Ninguna patente 3

9. ¿Cuál de los siguientes métodos utiliza para evaluar los problemas del cliente?

PUEDE MARCAR MAS DE UNA RESPUESTA

Tenemos un centro de llamadas.....1

Tenemos a un empleado encargado de evaluar la relación con el cliente...2

Obtenemos información del cliente de otras fuentes (canales de venta).....3

Otro ***(Especifique)*** ( )

Otro ***(Especifique)*** ( )

10. ¿Cómo definiría los canales de venta de su empresa?

PUEDE MARCAR MAS DE UNA RESPUESTA

Realizamos ventas directas.....1

Realizamos ventas a través de distribuidores.....2

Realizamos ventas a un solo cliente…….3

Otro ***(Especifique)*** ( )

Otro ***(Especifique)*** ( )

11. ¿Cuál de los siguientes canales de venta maneja su empresa?

	Manejamos	No manejamos	**Promedio**
Canales de venta digitales	1	2	……..
Canales de venta tradicionales	1	2	……..
			100

12. Desde su punto de Vista, ¿En que etapa del ciclo de vida esta su empresa?

Nuestro mercado esta disminuyendo					Nuestro mercado se mantiene					Nuestro mercado esta creciendo
1	2	3	4	5	6	7	8	9	10	11

13. ¿Cuál es la velocidad de cambio de su sector?

Nuestro sector no cambia					Trabajamos en un sector con cambios lentos					Trabajamos en un sector con cambios rápidos
1	2	3	4	5	6	7	8	9	10	11

14. ¿Desde su punto vista, cuál es la relación entre las empresas de su sector?

Las empresas muestran una actitud/ comportamiento colaborativo					Las empresas se muestran indiferentes entre ellas, no se sabe información de otras empresas.					Las empresas muestran un comportamiento competitivo
1	2	3	4	5	6	7	8	9	10	11

15. ¿Su empresa sostiene actividades de I+D (Investigación y desarrollo)?

Si, sostiene 1

No, no hay actividades de I+D .....2 ***(PASE A LA PREGUNTA 17)***

16. ¿Cuál de las siguientes opciones describe mejor la estructura de I+D de su empresa?

PUEDE MARCAR MAS DE UNA RESPUESTA

Tenemos un laboratorio de I+D.....1

Tenemos un departamento/unidad de I+D.....2

I+D se ha tercerizado 3

Otro ***(Especificar)*** ( )

17. ¿Cómo describiría la tasa de rotación de personal (retiro y contratación de personal) en su empresa comparado con la competencia?

Alta rotacion de personal					Rotacion de personal igual que la competencia					Poca rotacion de personal
1	2	3	4	5	6	7	8	9	10	11

18. ¿Cómo describiría el enfoque de innovación de su empresa?

PUEDE MARCAR MAS DE UNA RESPUESTA

Estamos dispuestos a cooperar con el fin de incrementar la participación de mercado y los ingresos.....1

Hacemos investigación para nuevos productos pero no compartimos esta información con externos.....2

Otro ***(Especificar)*** ( )

Otro ***(Especificar)*** ( )

No tenemos iniciativas de innovación.....3

19. De las siguientes expresiones indique el nivel más adecuado para su empresa considerando una escala del 1 al 7.

	No para nada			Mas o menos			Si, totalmente
Dentro de nuestra empresa se apoya la creación y difusión de nuevas ideas	1	2	3	4	5	6	7
Nuestra cultura empresarial no es adecuada para la creación y difusión de nuevas ideas	1	2	3	4	5	6	7
Nuestros recursos tecnológicos no son adecuados para la creación y difusión de nuevas ideas	1	2	3	4	5	6	7
Si se realizaran mejoras tanto en nuestra cultura empresarial como en nuestros recursos tecnológicos, se podría apoyar a la creación y difusión de nuevas ideas	1	2	3	4	5	6	7

20. ¿Cómo definiría el sistema de asignación de recuros de su empresa?

1ª Parte

En nuestro rubro, la cantidad de recursos es limitada. Por esta razón, salvamos el día asignando recursos en lo que se necesita con urgencia					Relizamos un plan de asignacion presupuestaria trimestral y anual. Pero nos vemos obligados a cambiar nuestro plan por las necesidades diarias.					Relizamos un plan de asignación presupuestaria trimestral y semestral. A pesar de pequeñas desviaciones el plan no es alterado.
1	2	3	4	5	6	7	8	9	10	11

2ª Parte

No planificamos gastos para situaciones de emergencia.					Después de controlar los gastos, proveemos los recursos y planeamos su uso para situaciones de emergencia					Todos los gastos inclusive los de emergencia son previamente planificados.
1	2	3	4	5	6	7	8	9	10	11

21. ¿Cómo definiría la relación de su empresa con laboratorios, consultores calificados y/o organizaciones científicas internacionales?

Rara vez realizamos colaboraciones e investigaciones con estas organizaciones o personas					Algunas veces realizamos colaboraciones e investigaciones con estas organizaciones o personas					Constantemente realizamos colaboraciones e investigaciones con estas organizaciones o personas
1	2	3	4	5	6	7	8	9	10	11

22. ¿Cuál es la relación de su empresa con universidades?

Rara vez realizamos colaboraciones e investigaciones con universidades					Algunas veces realizamos colaboraciones e investigaciones con universidades					Constantemente realizamos colaboraciones e investigaciones con universidades
1	2	3	4	5	6	7	8	9	10	11

23. ¿Cuál es la situación de su empresa en términos de competencia interna?

En nuestra cultura empresarial creemos que la competencia interna aumenta el riesgo de incomodar a los trabajadores. Por esta razón no fomentamos la competencia interna.					En nuestra empresa antes que la competencia interna esta la calidad y la satisfacción de las necesidades de los clientes					En nuestra empresa diferentes sistemas de evaluación del desempeño y recompensa se aplican con el fin de promover la competencia interna.
1	2	3	4	5	6	7	8	9	10	11

24. ¿Cuál es el nivel de productividad de sus trabajadores de acuerdo a su punto de vista?

Menos del 30% de nuestros empleados trabajan con alta eficiencia					La mitad de nuestros empleados trabajan con alta eficiencia					Más del 70% de nuestros empleados trabajan con alta eficiencia
1	2	3	4	5	6	7	8	9	10	11

25. De las siguientes expresiones indique el nivel más adecuado para su empresa considerando una escala del 1 al 7.

	No para nada			Mas o menos			Si, totalmente
Para mantener la supervivencia de la empresa se requiere reorganizar nuevos productos/ servicios/ procesos de acuerdo a la demanda.	1	2	3	4	5	6	7
La diferenciación de productos / servicios / procesos es difícil y la demanda de los clientes sobre estos es poca / no hay.	1	2	3	4	5	6	7
La diferenciación de productos / servicios / procesos no es posible porque la demanda de los clientes es estándar.	1	2	3	4	5	6	7

26. ¿Cómo definiría la velocidad de creación de un nuevo producto/proceso en su empresa de acuerdo a la siguiente escala?

Más lento que la competencia					La misma que la competencia					Más rápido que la competencia
1	2	3	4	5	6	7	8	9	10	11

27. ¿Cuál es la situación de su empresa en terminos de trabajadores calificados comparada con la competencia?

Menos calificados					Igual de calificados					Más calificados
1	2	3	4	5	6	7	8	9	10	11

28. ¿Cuál es la situación de su empresa en términos de productividad comparada con la competencia?

Menos productiva					La misma productividad					Más productiva
1	2	3	4	5	6	7	8	9	10	11

29. ¿Cuál es la situación de su empresa en términos de rentabilidad comparada con la competencia?

Menos rentable					La misma rentabilidad					Más rentable
1	2	3	4	5	6	7	8	9	10	11

30. ¿A qué nivel contribuyen sus proveedores a la innovación de su empresa?

Los proveedores no participan en todo lo relacionado con la innovación					Los proveedores aportan con ideas a nuestra empresa					Representantes de los proveedores participan en la investigación y desarrollo de innovación
1	2	3	4	5	6	7	8	9	10	11

31. ¿ A qué nivel contribuyen sus canales de venta a la innovación de su empresa?

Los canales de venta no participan en todo lo relacionado con la innovación					Los canales de venta aportan con ideas a nuestra empresa					Representantes de los canales de venta participan en la investigación y desarrollo de innovación
1	2	3	4	5	6	7	8	9	10	11

APPENDIX B: The Synergy Questionnaire

Este cuestionario ha sido elaborado con el fin de obtener datos acerca de **"Información sobre Estructuras de Sinergia de PYMEs".** Le rogamos responder a todas las preguntas del cuestionario. Apreciamos y agradecemos su interés y valiosa contribución a esta investigación.

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Aclarar colaboracion en I+D

1. ¿Cuál es el sector en el que su empresa trabaja?

.....

2. ¿Cómo calificaría la actitud de su empresa respecto a colaborar con la I+D (Investigación y desarrollo)?

No nos interesa		Nos es indiferente		Nos es indispensable
1	2	3	4	5

3. ¿En qué grado su empresa está dispuesta a establecer contacto (ya sea a nivel local, nacional o internacional) con otras empresas (del mismo o de otros rubros)?

No esta dispuesta para nada		Indiferente		Definitivamente dispuesta
1	2	3	4	5

4. Indique la visión de su empresa y los objetivos de innovación. (Si no cuenta con ellos, propóngalos)

.....

.....

.....

.....

.....

.....

5. ¿Cómo calificaría la forma de gestión participativa (en las decisiones sobre innovación) de su empresa utilizando la siguiente escala?

Solo participan el gerente general					Participan los gerentes, subgerentes, y jefes.					Participan todos
1	2	3	4	5	6	7	8	9	10	11

6. De acuerdo con la siguiente escala, ¿como definiría la velocidad de respuesta a cualquier tipo de demanda de sus clientes, comparada con la competencia?

Más lento					El mismo					Más rápido
1	2	3	4	5	6	7	8	9	10	11

7. **<u>¿Como esta constituida su empresa?</u>**

- Unipersonal
- S.R.L. (Sociedad de Responsabilidad Limitada)
- S.A (Sociedad Anonima)
- Sociedad Mixta (capital propio y privado)
- etc

8. ¿Cuál es su actitud respecto a la cooperación en I+D?

Nos gustaría participar en colaboración pero tenemos poca o nada experiencia en este tema					Podríamos contribuir a la colaboración pero los recursos que tenemos son limitados					Estamos listos para trabajar en colaboración sin pertubar nuestro trabajo ni compartir informacion confidencial de la empresa
1	2	3	4	5	6	7	8	9	10	11

9. ¿Cuál es el tipo de colaboración en I+D más adecuado para su negocio?

Nuestro trabajo no es adecuado para las colaboraciones					Las colaboraciones a corto plazo					Las colaboraciones a largo plazo
1	2	3	4	5	6	7	8	9	10	11

10. Desde su punto de vista, ¿qué se debe hacer para evitar que se generen problemas en colaboraciones en I+D?

Todos deben participar en todas las actividades. (Actividades conjuntas)					Algunos socios deben trabajar individualmente y otros grupalmente. (Actividades individuales y conjuntas)					Cada uno de los miembros debe asumir un trabajo individual (Actividades individuales específicas)
1	2	3	4	5	6	7	8	9	10	11

11. ¿Cuál sería su prioridad en una colaboración en I+D?

Preferimos socios que se adapten a nuestra cultura					Tenemos una cultura y trabajo sólidos. Sin embargo, podemos formar un trabajo en equipo					Deseamos crear una base común en la cual nuestro actual negocio y empleados se adapten
1	2	3	4	5	6	7	8	9	10	11

12. Si fuera parte de una colaboración en I+D ¿Cómo reaccionarían sus trabajadores?

Con una actitud adversa al cambio					Les sería indiferente. Continuarían con su trabajo					Con una actitud positiva. Colaborarían
1	2	3	4	5	6	7	8	9	10	11

13. Según usted, ¿Cómo se puede distribuir las inversiones de la colaboración en I+D?

La distribución de inversiones debe ser hecha en proporción a la riqueza. En su mayoría debe ser aportada por los socios mas ricos					Se debe hacer que algunas empresas tengan inversiones a corto plazo, y el resto a largo plazo.					Cada empresa debe hacer sus propias inversiones. Para el trabajo conjunto se debe consensuar un acuerdo.
1	2	3	4	5	6	7	8	9	10	11

14. ¿Cómo puede valorar la posicion de su empresa para tener una colaboracion en I+D con otra(s) empresa(s)?

Pensamos que los planes se deben hacer a medida que sean necesarios durante la ejecución de la colaboración, ya que los roles cambian durante el tiempo.					Sin tomar como referencia casos de éxito, podemos hacer planes para nosotros.					Pensamos que los planes basados en casos de éxito han funcionado bien en el pasado y tienen una alta probabilidad de funcionar bien para nosotros.
1	2	3	4	5	6	7	8	9	10	11

15. En el proceso de una colaboración en I+D qué tipo de problemas pueden surgir en su empresa por el uso de un sistema de comunicación, coordinación y de intercambio de información?

Si hay incompatibilidad cultural con otros socios, pueden surgir dificultades estructurales					Si existe incompatibilidad tecnológica con otros socios, pueden surgir dificultades técnicas					Si todas las empresas de la colaboración establecieran un sistema organizado de comunicación, coordinación e intercambio de información, no surgiria ningún problema por nuestra parte
1	2	3	4	5	6	7	8	9	10	11

16. ¿Cómo describiría el sistema de medición del desempeño?

PUEDE ENCERRAR MAS DE UNA RESPUESTA.

Usamos las salidas del sistema (utilidad, cantidad de producto, etc.).... 1

Usamos el esfuerzo (horas de trabajo, etc) …….2

No tenemos un sistema de medición del desempeño……...3

Otros ***(Especificar)*** ( )

17. ¿Cómo definiría el sistema de recursos humanos de su empresa?

PUEDE ENCERRAR MAS DE UNA RESPUESTA.

Usamos un sistema de recompensas/incentivos**.....**1

Usamos un sistema de sanciones…….2

No tenemos un sistema específico……...3

Otros ***(Especificar)*** ( )

18. De las siguientes expresiones sobre la visión, metas y objetivos de su empresa, indique el nivel más adecuado para su empresa considerando una escala del 1 al 7

La visión, metas y objetivos escritos:	No, para nada			Mas o menos			Si, totalmente
Son realistas y asimilados por los empleados.	1	2	3	4	5	6	7
No son adoptados o asimilados por la mayoría de los empleados.	1	2	3	4	5	6	7
Cambian o varían según el sector y situación del mercado.	1	2	3	4	5	6	7

19. ¿Qué tipo de liderazgo existe en su empresa?

Las decisiones pueden ser tomadas por los accionistas sin embargo la aplicación recae en una única persona o directiva					Las decisiones y la autoridad recaen en una única persona o directiva					La autoridad se distribuye a todos los empleados. En situaciones de emergencia cualquiera de los empleados puede tomar la iniciativa
1	2	3	4	5	6	7	8	9	10	11

20. Indique hasta que punto está de acuerdo con las siguientes expresiones/afirmaciones dándo una puntuación entre 1 y 7.

Gracias al enfoque gerencial hacia los empleados...	Estoy totalmente en desacuerdo			No estoy de acuerdo ni desacuerdo			Totalmente de acuerdo
la eficiencia de la empresa aumenta.	1	2	3	4	5	6	7
la eficiencia departamental aumenta.	1	2	3	4	5	6	7
la eficiencia personal aumenta.	1	2	3	4	5	6	7

21. ¿Cómo definiría la reputación o imagen en el mercado de su empresa?

Como todas la empresas del sector, nuestra reputación es limitada.					No hay información sobre la reputación de las empresas del sector					Generalmente somos aceptados como una empresa con una buena reputación
1	2	3	4	5	6	7	8	9	10	11

22. En una colaboración, ¿cuál de las siguientes fuentes generales/tecnológicas y en qué grado podría suministrar su empresa?

Gracias al enfoque gerencial hacia los empleados...	No podemos proporcionar			Podemos proporcionar lo que incumbe a nuestra empresa			Podemos cubrir todos
Personal calificado	1	2	3	4	5	6	7
Maquinaria/Equipo	1	2	3	4	5	6	7
Acuerdos comerciales	1	2	3	4	5	6	7
Capital	1	2	3	4	5	6	7
Procedimientos y procesos	1	2	3	4	5	6	7
Computadoras	1	2	3	4	5	6	7
Equipos de comunicación	1	2	3	4	5	6	7
Procesamiento automático de datos	1	2	3	4	5	6	7
Sistema de gestión de base de datos	1	2	3	4	5	6	7
Sistemas de gestión de la información	1	2	3	4	5	6	7
Información, equipo y una variedad de servicios	1	2	3	4	5	6	7

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