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Research Report for Taiwan Fellowship Award:

"Participation of small and medium – size enterprises in the implementation of the innovation policy of Taiwan".

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Content

Introduction

Innovation is the dynamic force that changes the economy. It provides new products and processes. It generates productivity growth and leads to increases in the standard of living. It is at heart of entrepreneurship .[1] Innovators differ from non-inovators in that they adopt a purpose stance to final new productsand to adopt new processes.

Considerable of economic research has been devoted to establishing whether small and large firms differ with regard to the rate of innovation or their R&D activity.

The problems and goal of the research

In the strategy „Europe 2020", which was adopted in 2010 by the European Commission paid a lot of attention to joining efforts of the European Union countries for the purposes of formation and practical introduction of innovations that will provide the opportunity to apply new ideas in the production of new ideas, services[2]. EU regional policy, funding focuses on 4 priorities: Research & innovation, Information & communication technologies; Making small and medium-sized businesses more competitive; moving towards a low-carbon economy.

The goal of the presented research is to assess the role of SMEs in the innovation field of Taiwan.

1. The theoretical overview of the problem represented

According to the Global Competitiveness Index (GCI), Taiwan has 15th place in the World (Latvia has 54th place) on the level of business development an11th place in innovation in 2016-2017 (Latvia has 83th place in innovation)[3]. According to the annual report of the European Commission on the successes of EU member-states in the field of innovative activity of the "Innovation Union Scoreboard", Latvia is still lagging behind

[1]John R. Baldwin &Peter Hanel Innovation and Konowledze Creation in an open Economy, Cambridge, 2003, p.1

[2]European private equity and venture capital association, 2011. – Brussels, 2012. – 420 p.

[3]Report of the Global Competitiveness Index in 2017-2018, https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018 (available 03.15.2018)

on innovative development among other EU countries[4]. In Taiwan, small and medium-sized enterprises (SMEs), playing a very important role to the country's economic growth, accounting for almost 99.8 % of overall enterprises and employing almost 78% of all employees [5]. Let's represent the costs of some EU countries for **Research and development** in the form of table 1 (see Annex1):

Table 1. Research and development expenditure, by sectors of performance, % of GDP (developed by the author)[6]

Countries	**2015**	**2016**
EU (28 countries)	2,04	2,03
Euro area (19 countries)	2,14	2,13
Germany	2,92	2,94
France	2,27	2,25
Estonia	**1,49**	**1,28**
Latvia	**0,63**	**0,44**
Lithuania	**1,04**	**0,85**

[4]Maastricht Economic and Social Research Institute on Innovation and Technology – MERIT 2016. European Innovation Scoreboard 2016. Maastricht University, available at: http://www.knowledgetransferireland.com/About_KTI/Reports-Publications/European-Innovation-Scoreboard-2016.pdf (accessed April 20, 2018).

[5] Shu-Jen Chen.THE EFFECTS OF SOCIAL NETWORKS AND A GLOBAL MINDSET ON TAIWANESE MANUFACTURING SMES' ABILITY TO FORM ALLIANCES TO INCREASE INTERNATIONAL AND FINANCIAL PERFORMANCE , A Dissertation by D.B.A Presented to the Graduate Faculty of the School of Management, Alliant International University,US, San Diego, 2013

[6] Eurostat
http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_20&plugin=1

Finland	2,9	2,75
Sweden	3,27	3,25
Denmark	2,96	2,87
Taiwan	**3,1**	

Source : Eurostat[7]

As we can see from the data represented in the table, in 2016 the indicator of costs for R&Din Germany and France made up 2.94% and 2.25%, respectively, however, the average indicator of costs forR&D for EU-28 countries in 2016 made up 2.03% and in euro-zone countries 2.13% this with the existing goal of the program 2020 by 2020 the average indicator for the EU countries, but R&D should be 3%! In the Baltic countries, the situation with the implementation of a plan on the costs for R&D looks deplorable, for example, in Estonia in 2016 costs for R&D made up 1.28%, in Lithuania 0.85% and in Latvia only 0.44 %(!). Here, it should be noted that for Baltic States, costs for according to the program 2020 is Latvia 1.5% of GDP, Lithuania 1.9% and Estonia 3.0% of GDP. However, as we can see from the data, represented in the table 1 only Estonia has approached this indicator, neither Latvia nor Lithuania fulfill the program objectives that makes the research represented relevant. The analysis of the Baltic Sea countries – Sweden, Denmark and Finland showed that they successfully fulfill the R&D indicators set by the Europe 2020 program.Thus, in 2016 costs for R&D in Sweden made up 3.25%, Denmark 2.87% and Finland 2.85% of GDP, respectively. In Latvia the greatest problem of deterrence of innovation activity is the fact that small and medium –sized businesses dominate in the country, covering about 99.8% of all enterprises, which don't have enough funds and skilled staff for the implementation of investments in the innovative projects[8]. According to the statistical data for previous periods in 2014in Latvia 23.4% of

[7] Eurostat
http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_20&plugin=1
(available 03.20.2018)
[8]European Innovation Scoreboard 2017
https://www.rvo.nl/sites/default/files/2017/06/European_Innovation_Scoreboard_2017.pdf EU,2017, p.55
(available 03.20.2018)

enterprises on average were innovative, but this average indicator in the countries of the European Union makes up 52%[9].

In the research of the innovation policy and innovation process in the complex are used such definitions as: innovations, research and development. Since research and development it is seen to have a special and key role in the innovation process. The research we are conducting needs to define these categories. Research is original investigation undertaken on a systematic basis to gain new knowledge. Development is the application of research findings or other scientific knowledge for the creation of new or significantly improved products or processes.[10] So, innovations. European Commission provides definition for innovation: a new or changed product is introduced to the market, or when a new or changed process is used in commercial production.[11]

Can SMEs be included in the innovation process?

There are several reasons why small firms concentrate on the innovation efforts. First, these breakthroughs where small firms may be particularly common for the types of processes in which firm specialize. Second, they may occur because the comparative advantage of large firms lies in the production of the type of knowledge that originates in R&D facilities, since the costs of conducting R&D for large firms are lower because specialization of function means that large firms will enjoy cost advantages in the pure R&D function[12]. A small firm may be just an innovative , but the may innovate in unique ways. Most previous studies have focused on the whether R&D expenditures increase more scale in the R&D function or whether R&D expenditures increase more than proportionally with firm size.[13]

The innovation system is complex: some firms are traditionally R&D laboratories, whereas others develop alliances and joint ventures that allow them to tap into scientific work being done elsewhere. R&D labs are frequently large and costly, and economies of

[9] Centrālā statistikas Pārvalde, available at: http://www.csb.gov.lv/en/statistikas-temas/innovation-d publications-43240.html, (accessed April 27, 2018).

[10] John R. Baldwin &Peter Hanel Innovation and Konowledze Creation in an open Economy, Cambridge, 2003, p.97

[11] European Commission (1997), p.254

[12] John R. Baldwin &Peter Hanel Innovation and Konowledze Creation in an open Economy, Cambridge, 2003, p.169

[13] Soete, L.G. 1979 Firm Size and Inventive Activity: The Avidence Reconsidered, European Economic Review 12:319-40

scale associated there with may prevent small firms from constructing their own facilities very frequently.

A SMEs firm may solve the problem by forming partnerships with other firms. SMEs may offset advantages in terms of flexibility and response time to customer needs.

Table 2. Advantages and disadvantages of SMEs in innovations

Advantages	**Disadvantages**
Smaller firms take decisions faster and implement them more rapidly.	Not to provide the diversification of scientific studies and knowledge, to focus significant resources on one direction and develop capital – intensive innovations.
Small firms focus on technical capability	There is no network for distribution, the marketing department
Small firms exhibit the same flexibility in their R&D that they show in many of their operations	
Small firms also benefit from the R&D done in large firms because a larger proportion of their innovation are the result of liaisons with customers.	
More flexible in creating the alliances with other firms, in developing and changing the strategy	
Size. Their smaller size makes smaller markets attractive to SMEs while these markets would not be attractive for larger firms.	

Kao Jen-Shan[14], one of the researcher at Taiwan Institute of Economic Research (TIER), concluded that small and medium business owners face six difficulties. There are; (1) talent drought and recruiting problems; (2) broken supply chains due to local businesses exodus to China; (3) shortage of entrepreneurship resources of all kinds; (4) high cost for intellectual property rights; (5) the SME's difficulties (compared to larger companies) in joining programs supported by government policies; and (6) tariffs. As the majority of public attention and discussions have been focused on the lack of R&D capacity and

[14]Sarah Anabarja , Working Paper Taiwan Fellowship 2017 – Indonesia, p. 13

innovation-driven, but most SMEs already realized that innovation and R&D were not much of an issue because the companies that declined to invest on research and development.

However, in our opinion, the main advantage of SMEs under conditions of globalization, it is internationalization in small states, such as Latvia, Lithuania, Estonia and etc.

2. **Analysis of the legal regulation of innovation activity in Taiwan and assessment of participation of small and medium – sized business in it.**

To conduct an analysis of the regulation of innovation activity in Taiwan and for the assessment of the participation of small and medium – sized businesses in it, it is necessary to consider the state regulation of activity of SMEs and activity in the field of innovations in Taiwan.

Thus, in the *Strategic Plan for National Spatial Developmentof Taiwan* (2010) clarified that Globalization has intensified competition in the international economy. The 21st century has brought a reordering of the world economy, the accelerating integration of regional economies, and the rapid development of innovation- and knowledge-based economic activity.[15]Thus, the key document on the development of the state also confirms the need for the development of innovations.

Further, in the next document - *Four-Year National Development Plan (2017-2020) and Plan for National Development in 2017* to indicate that one of the development strategies – innovation and Investment in industrial innovation. In the economic policy of Taiwan one of the Six Main Policy Directions also indicates as the priority of innovative economy[16] (figure 1).

In the country successfully function the program *Global Innovation and R&D Partnership Plan,*in which the Ministry of Economic Affairs of Taiwan and the Department of Industrial Technology have developed porgrams for the participation of entrepreneurs in the field of innovations of the country. The main programs are: Business Innovation TDP,

[15]Strategic Plan for National Spatial Developmentof Taiwan (2010), p.5, 29 https://www.ndc.gov.tw/en/cp.aspx?n=7A0D833D43CE09CB&s=7CD14EF812D1B557 available 04.12.2018

[16] Four-Year National Development Plan (2017-2020) and Plan for National Development in 2017 Taiwanfile:///C:/Users/USER/Downloads/National_Development_Plan-0307(new)1060307.pdf available 04.16.2018

A+ Industrial Innovation R&D Program, Industrial Technology Foresight Research Program, Industrial Technology Innovation Center Program, Global R&D Innovation Partner Programand Special Programs[17](figure 1).

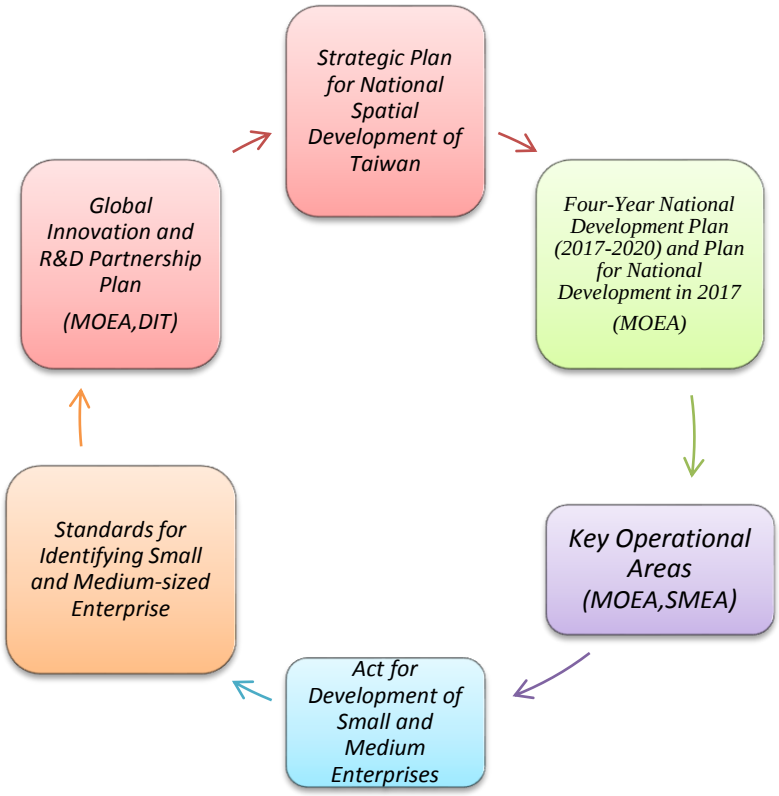


Figure 1. The legal regulation of activity in the field of innovations and SMEs in Taiwan. (Developed by the author)

The Ministry of Economic Affairs of Taiwan together with the Association of Small and Medium – sized Businesses have developed *Key Operational Areas*, in which specified the key areas for SMEs, it is: Creating a Healthy Environment for the Development of SMEs, Optimizing SME's Operational Management Capabilities, C. Building a Platform for Enterprise Start-up and Incubation, D. Enhancing SME's Information Technology Capabilities, E. Promoting Sound Development of SME Finance. On the basis of these documents are developed the vision of the SMEA is to create an environment beneficial to the establishment and growth of SMEs. A significant contribution to the development

[17] Global Innovation and R&D Partnership Plan, http://investtaiwan.nat.gov.tw/showPage?lang=eng&search=10407292 available 04.21.2018

of SMEs in Taiwan made the creation of Taiwan' SME Online University has been recognized as the first e-learning website developed for small and medium enterprises (SME) in Asia. The SME Online University has served over 500,000 SME employers and employees since its launch in 2003.The Taiwan SME Online University is sponsored by the SME Administration under the Ministry of Economic Affairs of Taiwan. [18] Understanding the importance and relevance of innovations in entrepreneurship, the Ministry of Economic Affairs of Taiwan together with the Association of Small and Medium – sized businesses took the lead in fostering the development of incubation centers in Taiwan.

The Ten Key Individual Plans making up the Challenge 2008 National Development Plan included the Global Innovation and R&D Base Plan. One of the elements in this Plan was the establishment of various types of innovation and R&D centers, with a sub-plan for developing Taiwan into an "Asia Entrepreneur Center". The main objective was to build up a high-quality incubation center network that would stimulate start-up and innovation activity, strengthen the competitiveness of Taiwanese industry as a whole, and promote economic growth.[19]

The activities of small and medium-sized businesses in Taiwan regulate *Act forDevelopment of Small and Medium Enterprises* which consists of four main parts:Chapter 1- General Principles, Chapter 2 - Financing Facilities and Guaranty, Chapter 3 - Operation Management, Market and Product Development, Chapter 4 -Tax Remittance (figure 1).

The basic rules for the formation of SMEs are described in the *Standards for Identifying Small and Medium-sized Enterprise*(picture 1): SMEs paid-in capital of NT$80 million or less, or less than 200 regular employees. Sales revenue of NT$100 million or less in the previous year, or has less than 100 regular employeesor less than NT$80 million, which

[18]Small and Medium Size Administration Ministry of Economic Affairs https://www.moeasmea.gov.tw/ct.asp?xItem=12852&CtNode=468&mp=2 available 04.26.2018

[19] Small and Medium Size Administration Ministry of Economic Affairs https://www.moeasmea.gov.tw/ct.asp?xItem=3397&ctNode=469&mp=2 available 02.05..2018

equals 2.42 million U.S. dollars for manufacturing, construction, mining, and quarrying industries. This means that if either criterion is met, the business qualifies as an SME. In 13 service and commerce sectors, micro enterprises are defined by having fewer than 5 employees while SMEs must have fewer than 50 employees, and a preceding year sales revenue of less than NT$100 million, which equals 3.03 million U.S. dollars (Ministry of Economic Affairs, 2012).In the low introduces the definition "small-scale enterprise" - small-scale enterprise - less than 5 regular employees. For comparison, we will mention the requirements for the classification of SMEs in the European Union countries (Table 3).

Table 3. The classification of micro, small and medium –sized enterprises in EU *recommendation 2003/361*

Company category	**Staff headcount**	**Turnover**	or	**Balance sheet total**
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Source: European Commission [20]

As we can see from the represented analysis the requirements for the creation of SMEs in the EU countries are somewhat higher, it concerns the number of employees up to 250 people, in Taiwan 200 people. In the EU the requirements for the turnover for SMEs are set (See. Table 3) or to Balance sheet total, in Taiwan as the criterion serves revenue.

In the low are described benefits for SMEs in the tax area: 1. Tax credit up to 15% of the research and development expenses, applied to the current year profit-seeking enterprise income tax payable. 2.Tax credit up to 10% of the research and development expenses, applied to the annual profit-seeking enterprise income tax payable for three years, starting from the current year.

In Latvia, from January 1, 2018 for small enterprises, engaged in the development of innovations "startup" exists privileged regime, which includes:

[20]Eurostat
http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_20&plugin=1
available 03. 28.2018

- "flat" tax rate of €252 per person with a monthly salary of up to €4050 for a minimum coverage of social benefits. If an employee earns more, an additional "solidarity tax" is applied or
- A tax regime, wherein all social benefits and taxes of employee are covered by the state with the provision of a full amount of social benefits. Such option can be applied in relation to highly qualified employees with a science degree or work experience of more than 5 years.

  In order to qualify for participation in the preferential program of Latvia, a startup should:

  - To create an innovative product or service;
  - To exist less than 5 years;
  - To earn no more than €200 thousand within the first two years after registration;
  - Not to pay dividends.

  In addition, each such startup must attract funding in the amount of not less than **€30 thousand** — a requirement that guarantees the efficiency of the idea and ability of the founders to promote the product.

  The state reimburses to startups of Latvia a part of costs for participation in exhibitions, conferences, for business trips to find potential partners, customers, etc. Assistance to startups will be available up to 70% of exhibition and business trip expenses.

3. Analysis of the influence of socio – economic indicators on the development of small and medium –sized businesses in Taiwan.

Thus, in order to fulfil the goal set in the paper, we need to select the statistical base for the assessment of an influence on the number of SMEs of Taiwan and employed in the field of innovations, which are represented by us in table 4.

Table 4. The dynamics of economic and social indicators, influencing on innovations from 2008 to 2015 (developed by the author)

Indic/year		**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Per Capita GDP,	USD	18 131	16 988	19278	20939	21308	21916	22648	22384
R&D Expenditure as % of GDP	Person-years	2.78	2.83	2.80	2.89	2.94	2.99	3.00	3,05
Unemploy-ment Rate	%	4,1	5,9	5,2	4,4	4,2	4,2	4,0	3,8
Higher Education amount	NT$ million	3,441	3,683	3,797	3,918	3.965	3,912	3,844	3,718
Number of Researchers (Full time equivalent)	Person-years	110,089	119,185	127,768	134,048	139,215	140,124	142,983	145,381
Annual Papers in Science Citation Index (SCI)	Papers	22,756	23,778	24,921	27,283	27,639	27,699	27,430	26,715
Annual Papers in Engineering Index (EI)	Papers	17,483	18,869	20,302	22,819	20,729	24,415	22,706	19,822
Patents Granted in U.S.	Cases	6,339	6,642	8,238	8,781	10,646	11,071	11,332	11,690
Number of Students	Higher Educat. Bach.pr	1 ,006,102	1 ,010,952	1 ,021,682	1 ,033,035	1 ,038,136	1 ,035,654	1,037,178	1 ,035,356
Number of Students	Gradut School	213,700	217,152	219,252	217,890	215,930	208,908	203,564	1 99,815
Number of SMEs		1234749	1232025	1247998	1,279784	1,306,729	1,331,182	1,353,049	1,383,981
Total Sales Value of SMEs	Million NT$;	10,462,696	9,189,463	10,709,005	100,770	11,381.8	11,321,842	11,839,868	11,803,100
Total Employment SMEs	Thous. persons	7.966	8,066	8,191	8,337	8,484	8,588	8,669	8,759
Total Sales Value of Large enter.	Million NT$;	24,776,441	689,448	756,519	806,127	26,267,306	27,139,052	28,400,638	27,072,200
Total employment large comp	Thous. persons	1,479	1,173	1,253	1,334	1,349	1,359	1,387	1,024

Source: Taiwan Statistical Data Book[21], White Paper on Small and Medium Enterprises in Taiwan[22]

[21] Taiwan Statistical Data Book, 2016

Thus, the selection of indicators for the assessment of the dynamics of SMEs is implemented by us in 3approaches - it is the choice of dynamic and social indicators. So, the first group of indicators is related to the macroeconomic indicators of the country. Undoubtedly, innovation activity is influenced by the indicator of the costs for research and development, which assesses the international organizations such as the World Economic Forum, the level of gross domestic product per inhabitant is the basic indicator – for both all external assessments and internal assessments of the state -International Monetary Found, Word trade organizationand others.

Since the subject of our research is an innovative sphere, undoubtedly, in the opinion of the author such a group of indicators as:

- Number of Researchers (Full time equivalent)
- Annual Papers in Science Citation Index (SCI)
- Annual Papers in Engineering Index (EI)
- Patents Granted in U.S.and we also include in the research the
- Number of Students

It is necessary to include in the research for the assessment of influence on the innovation sector and the third group of indicators is directly related to SMEs:

- Number of SMEs
- Total Employment SMEs
- Total Sales Value ofSMEs

Data on which are included in studies due to the Ministry of Economic Affairs of Taiwan (MOEA) - White Paper on Small and Medium Enterprises in Taiwan, 2009 – 2017.

In figure 2 the author represents a diagram of growth dynamics of researchers and their publications.

[22] White Paper on Small and Medium Enterprises in Taiwan 2009 - 2015

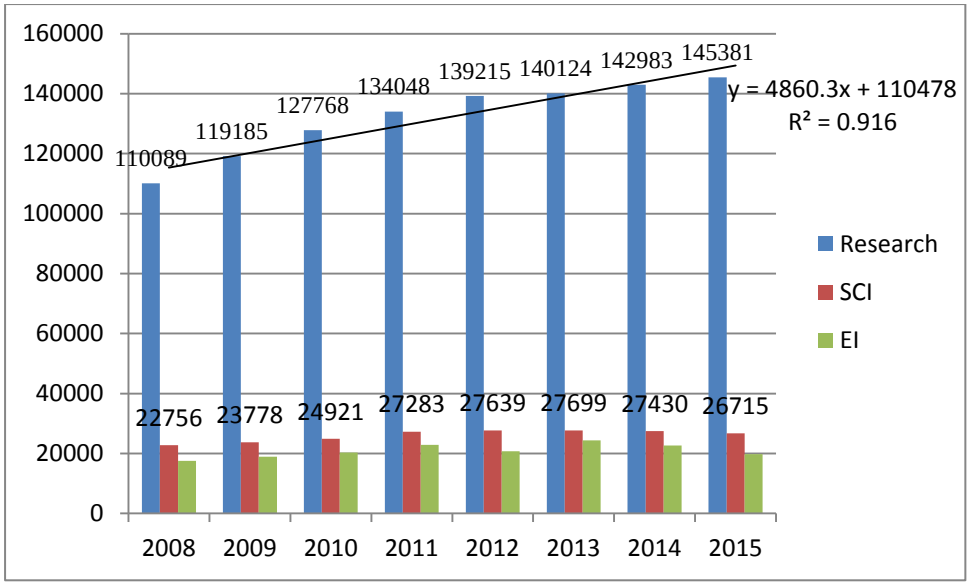


Figure 2.The dynamics of change of researchers and publications in cited databases SCI and EI in Taiwan 2008-2015. Developed by the author

The calculated coefficient of determination by us (R^2 = 0,916) shows a high level of dependence between the quantities represented. Further, let's represent in figure 3 the dynamics of the change of the number of researchers and growth in the number of SMEs and employed in the field of SMEs in Taiwan.

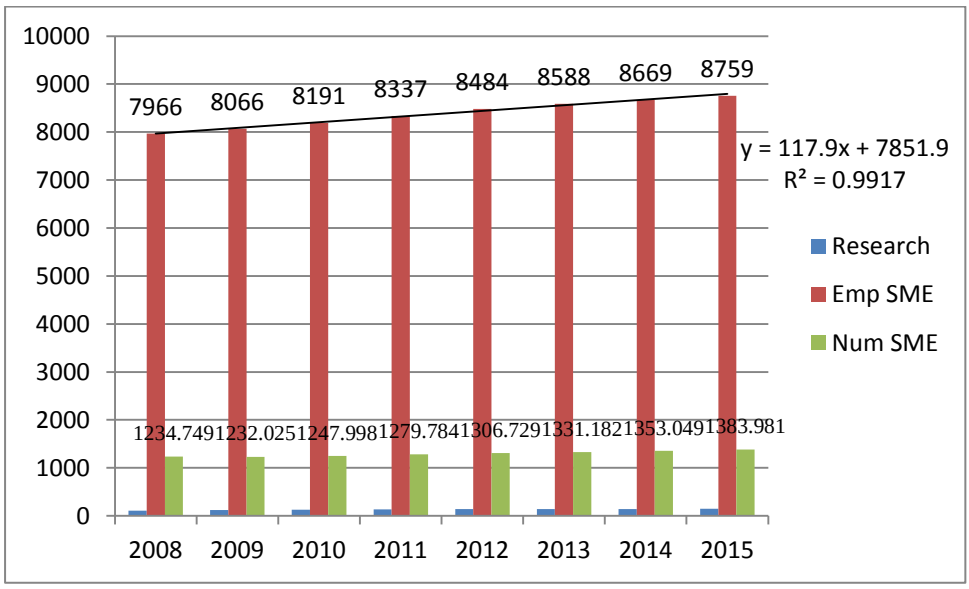


Figure 3 The dynamics of change of the number of researchers, the number of employed in SMEs and the number of SMEs in Taiwan in 2008-2014.Developed by the author

The calculated coefficient of determination by us (R^2 = 0,991) shows a high level of dependence between the quantities represented. It is interesting, in our opinion to examine the number of enterprises and the number of patents, figure 4.

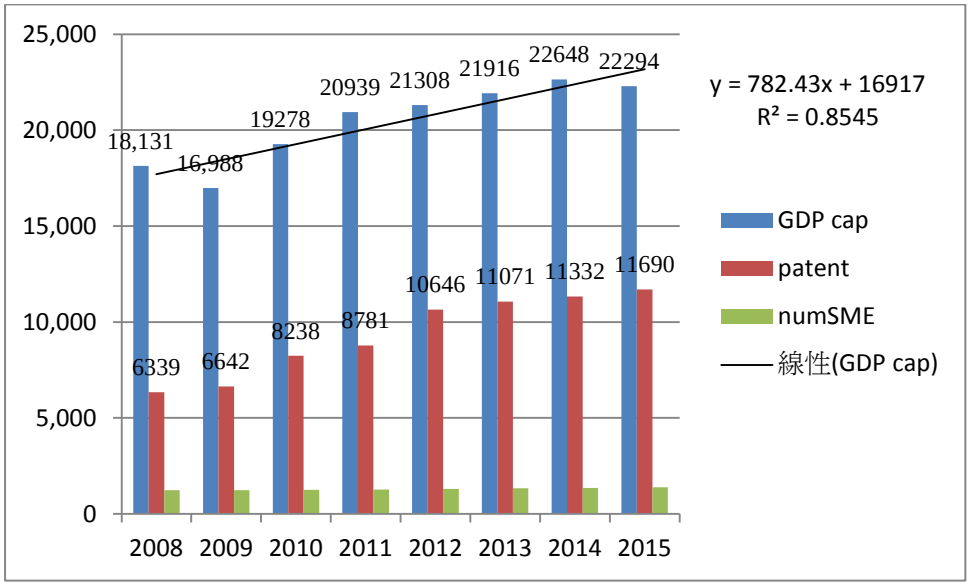


Figure 4. Dynamics of changes of GDP per capita, the number of SMEs and the number of patents, registered in the USA

The graph shows a linear variation of the number of patents, the level of GDP per capita and the number of registered SMEs. The calculated coefficient of determination by us (R^2 = 0,854) shows a high level of dependence between the quantities represented. However, undoubtedly, not all registered SMEs in Taiwan are engaged in innovation activity. According to a survey conducted by the MOEA in 2014.

Table 5. Analysis of enterprises of Taiwan, which invested funds inR&D in 2013

About 52 % of all registered enterprises invested finances in R&D. 32% of small and medium –sized enterprises spent financial resources for R&D, at medium – sized businesses – 68% spent on R&Dand almost 85% of large business enterprises invested funds in R&D.

In table 6, we will represent how the financial resources are distributed in enterprises of Taiwan in the period from 2011-2015, depending on the number of employees of enterprises.

Table 6. **Business Sector R&D Expenditure by Enterprise Size, 2011-2015, mlln NT$**[23]

	0-99 employment	**100-199 employment**	**200-499 employment**	**500< employment**
2011	23,431	20,434	40,889	215,604
2012	24,725	20,488	45,561	229,132
2013	24,701	22,66	46,593	249,501
2014	24,701	22,66	50,21	270,1
2015	27,574	24,299	49,984	295,306
Total	**125,132**	**110,541**	**233,237**	**1259,643**

Thus, the MOEA analysis shows that enterprises spend significant funds in R&D. Along

	2013	**Small-sized enterprise**	**Medium-sized enterprise**	**Large enterprises**
Without R&D sector	44.88	68.24	31.47	15.55
With R&D sector	55,12	31,76	68,53	84,45

[23]2014 White Paper on SMEs in Taiwan, 2017, p.50

with this in small firms (up to 99 people) more money is spent on R&D, obviously, it is because of a large number of enterprises in Taiwan. Leadership in R&D, undoubtedly for large companies – in diagram 5 it is clearly visible.

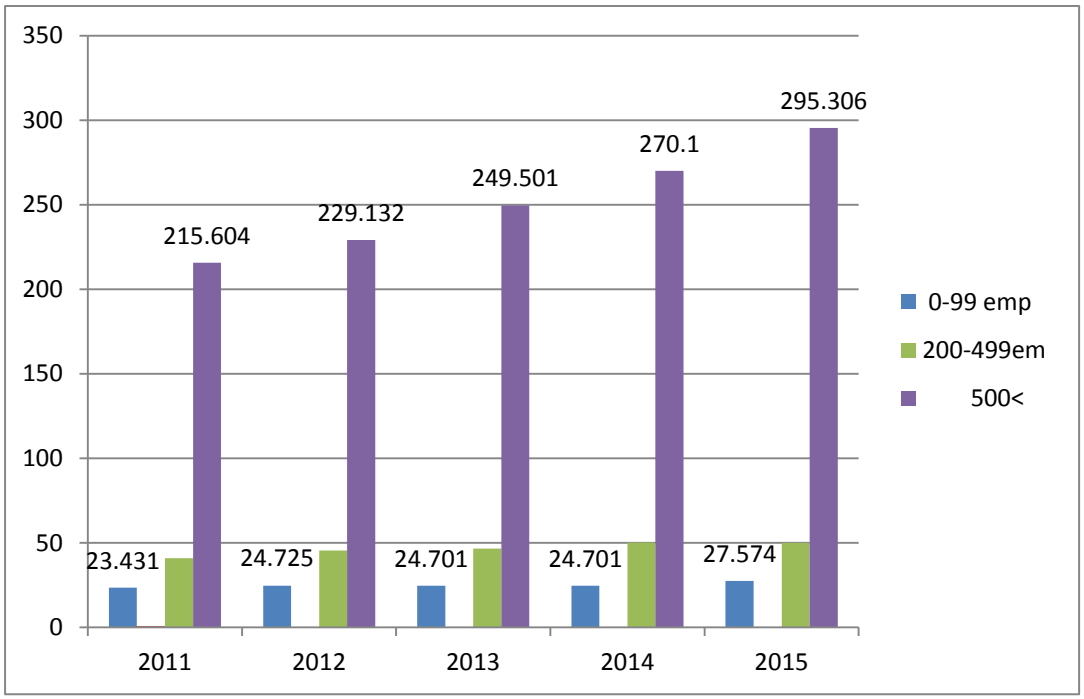


Figure 5. Business Sector R&D Expenditure by Enterprise Size, 2011-2015, mlln NT$ (developed by the author)

Further, let's calculate how companies of Taiwan for 5 years spent funds on R&Dand the obtained calculations, we will represent in the form of diagram 6.

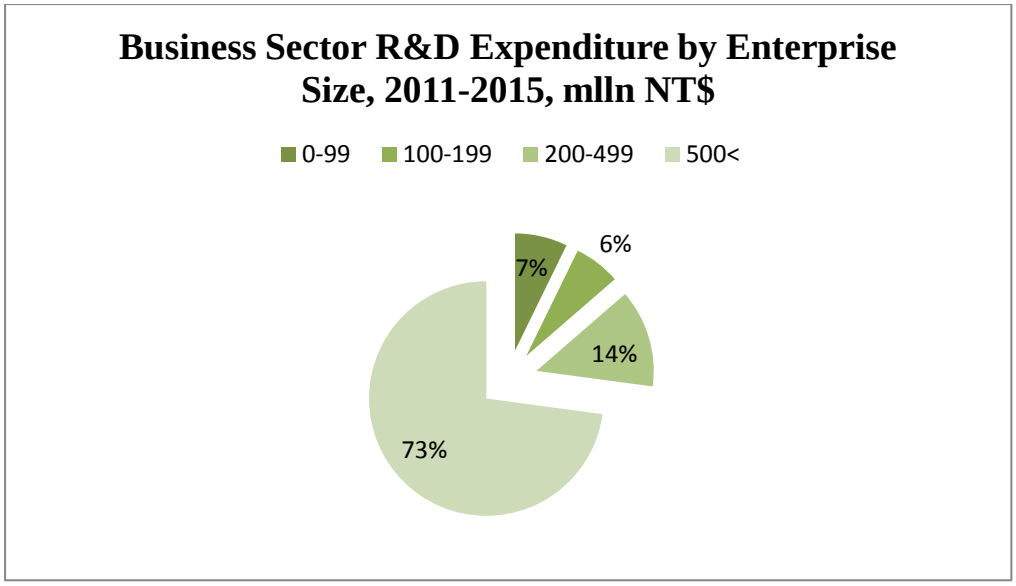


Figure 6. R&D Expenditure by Enterprise Size, 2011-2015, mlln NT$, calculated by the author.

The calculations carried out by the author from 2011 to 2015 show that firms with up to 99 people spent 7 % of total investments by Taiwan enterprises in R&D, firms from 100 to 199 people invested 6 % in total costs in R&D, on companies from 200 to 499 employees account for almost one third of all investments – 14% and companies with more than 500 employees account for 73 % of costs for R&D. Thus, in aggregate to the large business of Taiwan – more than 200 people, working account for 13 % of investments in R&D, but SMEs account for 73% that makes up almost one third. Undoubtedly, this is significant financial investments in the economy of the state.

Further, to find the relationship between the coefficients, using the correlation analysis, let's make a calculation between the represented values. Thus, the correlation analysis is carried out by 3 methods: correlation of Pearson, Spearman and Tau Kendall (Annex 2).

The value of correlation coefficient ranges from - 1 to 1. In the table is represented the possible correlation coefficient and corresponding characteristics of force and direction of dependence.

Table 6

The possible value of correlation coefficient[24]

Values of correlation coefficient	Linear dependence
-1	Functional and negative
0	Does not exist
1	Functional and positive
$\|r\| < 0.5$	Weak
$0.5 \leq \|r\| \leq 0.8$	Average
$\|r\| \geq 0.8$	Strong

Using the EXCEL, let's make the calculation of Pearson correlation, taking into account the lack of scatters between the variables, which are shown in the form of regression analysis carried out by the author, figure 1,2,3between GDPper capita and the number of registered patents. The level of correlation was – 0.952913, but the level of correlation (Table 7).

Table7 Calculation of the Pearson correlation betweenGDP per capita, Patents Granted in U.S and Number of SMEs in Taiwan, 2008-2014 (calculated by the author)

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
GDP per capita in USD	18 131	16 988	19278	20939	21308	21916	22648	22294
Patents Granted in U.S.	6,339	6,642	8,238	8,781	10,646	11,071	11,332	11690
Number of SME	1234749	1232025	1247998	1279784	1306729	1331182	1353049	1383981
Correl: 0,956656; Corel : 0,953389.								

[24]Orekhov A.M. Methods of economic research, M .: 2009, c. 287-288

Between the number of registered patents and the number of registered enterprises also showed a high level of correlation: **0,953389** (!) this means that innovations have a direct influence on the level of such important economic indicators as – GDP per capita (Between the number of registered patents and GDP per capita the correlation is **0,956656)** and employment of the population. Further, let's calculate the correlation coefficients of Pearson, Spearman and Tau Kendall, using the SPSS program (*Statistical Package for the Social Sciences*) for the rest of the coefficients chosen by us (Annex 2). The obtained data will be formed in the form of table 8.

Table8 Calculation of Pearson's correlation coefficients (Calculated by the author)

Pearson Correlation										
Pearson Correlation		R&D %GDP	Numb Reserc	Papers SCI	Papers EI	Number of Students	Number SME	Sales SME	Emp SME	Patents
R&D %GDP		1	,906**	,891**	,836*	,145	,971**	-,076	,968**	,940
Numb reser		,906**	1	,972**	,880**	,056	,906**	-,230	,969**	,964**
papers SCI		,891**	,972**	1	,895**	,154	,874*	-,388	,934**	,930**
papers EI		,836*	,880**	,895**	1	,390	,818*	-,076	,868*	,833
Number of Students		,145	,056	,154	,390	1	-,044	-,114	,013	-,071
Number SME		,971**	,906**	,874*	,818*	-,044	1	,000	,981**	,965**
Sales SME		-,076	-,230	-,388	-,076	-,114	,000	1	-,082	-,110
Emp SME		,968**	,969**	,934**	,868*	,013	,981**	-,082	1	,988**
**. Correlation is significant at the 0.01 level (2-tailed).										
*. Correlation is significant at the 0.05 level (2-tailed).										

Thus, made economic calculations, using SPSS program showed that the number of students, studying at universities of Taiwan doesn't influence on the indicators related

to the number of SMEs and doesn't influence on the number of employed in the field of SMEs. The level of sales of SMEs also has a negative correlation for all the indicators mentioned by us! Obviously, on these parameters should look for other dependencies.

Let's make the table with indicators which, according to the results of the carried out correlation analysis have showed a high level of the Pearson correlation coefficient (Table 9). However, the other indicators chosen by us, such as the level of costs for R&D showed a high impact on the number of SMEs and the level of employed in SMEs of Taiwan that is confirmed by the indicators of correlation – 0,971, 0,968, respectively!

Table 9. Calculation of Pearson correlation – influence on the number of SMEs and employed in SMEs in Taiwan, calculated by the author

Pearson Correlation		**R&D %GDP**	**Numb reserc**	**Papers SCI**	**Papers EI**	**Number SME**	**Emp SME**	**Patents**
R&D %GDP		1	,906**	,891**	,836*	**,971****	,940	,940
numb res		,906**	1	,972**	,880**	**,906****	,964**	,964**
papers SCI		,891**	,972**	1	,895**	**,874***	,930**	,930**
papers EI		,836*	,880**	,895**	1	**,818***	,833	,833
Number SME		,971**	,906**	,874*	,818*	1	**,981****	,965**
Emp SME		,968**	,969**	,934**	,868*	,981**	1	**,988****
Patents		,940**	,964**	,930**	,833*	,965**	,988**	1

The number of researchers and their publications also has a high impact on the number of enterprises in SMEs and employed employees in it and this is confirmed by the Pearson correlation coefficients which make up more than 0, 9 in all mentioned indicators.

It should be noted that the calculated correlation coefficients of Spearman and Tau Kendall confirm the calculations obtained by the author. In calculating the correlation of Tau Kendall

is shown not high – 0.619,but the dependence of the influence of number of students on the level of publications. Perhaps, this reflects the participation of students in scientific work in the form of provision of publications. Other calculations obtained by the author on the correlation coefficients by the methods of Spearman and Tau Kendall haven't revealed significant deviations in the presented calculations of the Pearson correlation.

4. Conducting a survey of experts of Taiwan in the field of small and medium –sized businesses

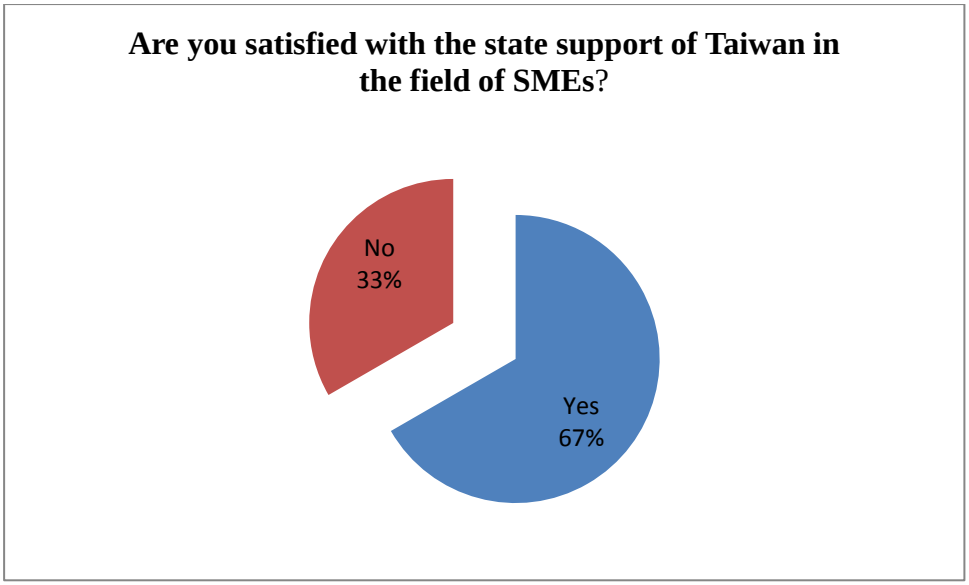
Thus, for promotion of SMEsof Taiwan on foreign markets and participation in trade with the EU countries, a questionnaire was developed by the author (See. Annex 3) and a survey of 12 experts in the field of SMEs is conducted.

The first questions (1-4) assess the competence of the expert: work experience in the work of SMEs, the number of employees in the enterprise and participation in investments in R&Dof small and medium –sized businesses. Thus, the survey showed that:

- The interviewed experts have work experience in the management of SMEs on average 16 years;
- The average number of employees of SMEs, interviewed by experts is 115 people;
- The amount of investments for the last 10 years made up NT$ 5.25 Mln .

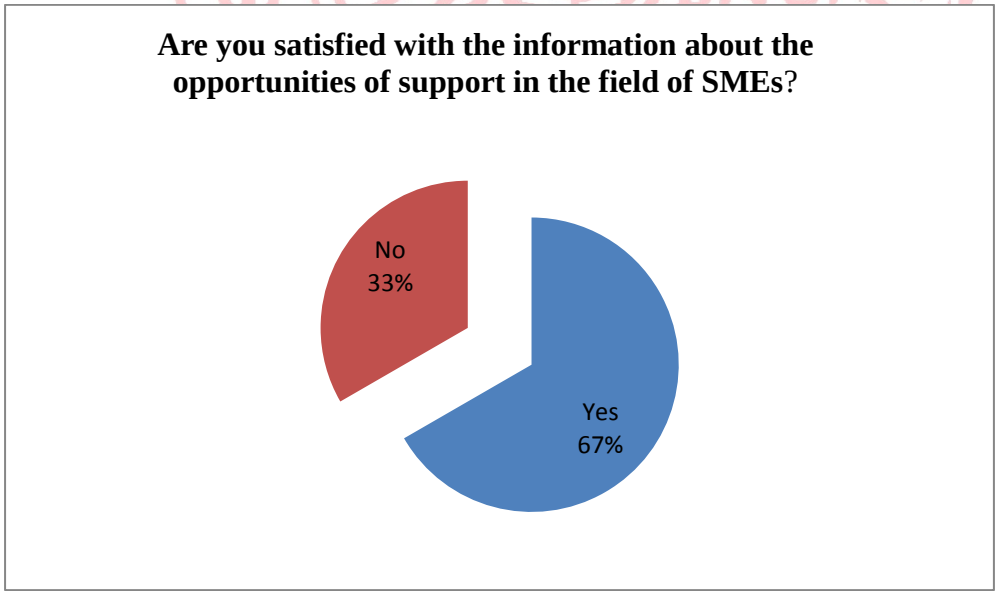
Let's represent the results of a survey in the form of diagrams (calculated by the author):

1. Are you satisfied with the state support of Taiwan in the field of SMEs?



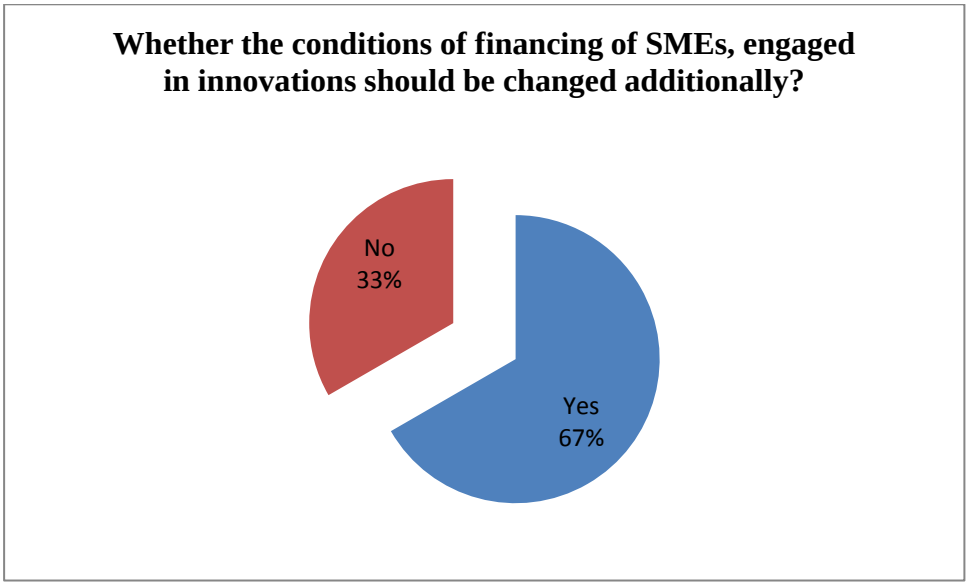
As you can see from the obtained data, 67% are satisfied with the support of SMEs, 33% of experts answered negatively this question.

2. Are you satisfied with the information about the opportunities of support in the field of SMEs?



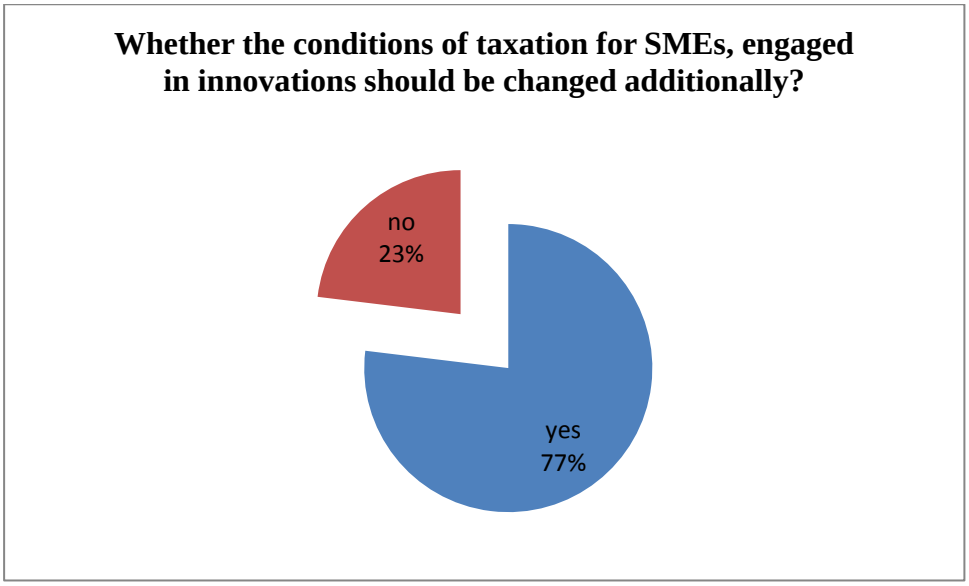
67% of experts satisfied with the information about the opportunities of support in the field of SMEs.

3. Whether the conditions of financing of SMEs, engaged in innovations should be changed additionally?



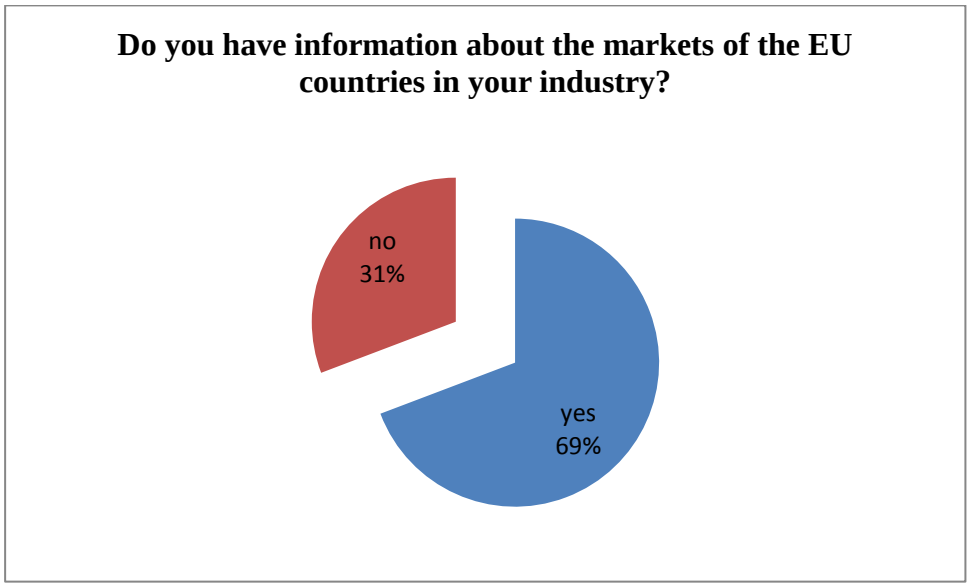
Most of the experts - 67% believe that the financing conditions of SMEs involved in innovations should be additionally changed

4. Whether the conditions of taxation for SMEs, engaged in innovations should be changed additionally?



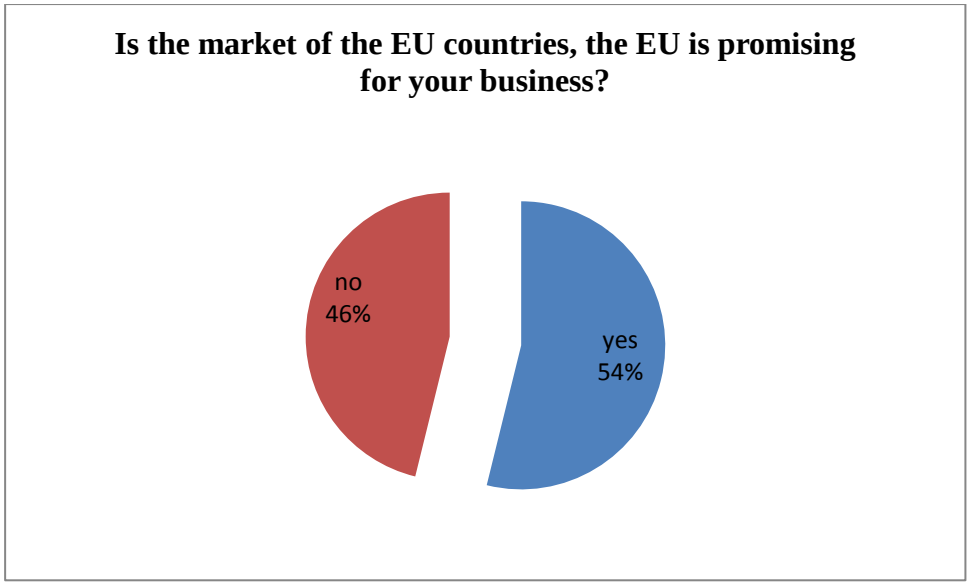
Changes are necessary in taxation for SMEsengaged in innovations, consider –77% of experts.

6. Do you have information about the markets of the EU countries in your industry?



At the same time, the most part of experts are familiar with the market of the EU countries in their industry – 69% and 31% of experts don't know the market of the EU countries.

7. Is the market of the EU countries, the EU is promising for your business?



Experts also believe that for SMEsof Taiwan, the EU market is promising (54%), however, 46% of respondents don't see prospects in cooperation with the EU countries.

The fifth question of the questionnaire of experts ofSMEs of Taiwan this is a description of the reasons, which complicate entry into the market of the EU countries for SMEs entrepreneurs.

Here, it should be noted that in the author's opinion, the reasons can be divided into 3 groups:

The first group: the macroeconomic situation – the decline in the economy of the EU countries, unemployment, the public debt of the EU countries, the situation with Brexit, the influence of PRC and corporate expansion;

The second group: bureaucratic reasons - the laws and regulations of the EU countries in the field of the environment and customs taxes and duties;

The third group: different – for example–racial prejudice.

Further, using the alpha – Cronbach model, we will carry out an analysis of agreement and reliability of the conducted survey of experts in the field of SMEs of Taiwan. (Annex 4).

An assessment of confidence and reliability of the survey conducted by the author of experts in the field of small and medium –sized businesses of Taiwan will be conducted with the help of SPSS program.

Thus, in the questionnaire (see Annex 4) the author formulated 6 questions and the results of the answers are represented in the form of a table. Answers YES – denoted as **1**, answers NO as**0**. Using the Cronbach alpha coefficient, let's carry out an analysis of obtained data. Thus, the **Cronbach alpha coefficient** (α) is a measure of internal consistency or uniformity of the measuring scale.

As a rule, α lies in the range from 0 to 1, but, it also can take negative values. They indicate that some of the elements or points of the scale measures the opposite values.

The closer the coefficient α to 1, the higher the internal consistency of the system of tasks.

On the basis of the questionnaire, let's calculate the degree of agreement of questions by experts.

Thus, for the assessment of small and medium –sized businesses in Taiwan, as well as possibilities for cooperation with the EU countries – twelve experts of SMEs were interviewed.

The calculated data were carried out, using SPSS[25]program and calculated by the author in tables from 10 to 15.

Table 10. Case Processing Summary

[25]George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon.

		N	%
Cases	Valid	12	100,0
	Excluded[a]	0	,0
	Total	12	100,0

a. Listwise deletion based on all variables in the procedure.

Thus, all 12 questionnaires were recognized as valid and took part in the survey.

Table 11. Reliability Statistics

Cronbach's Alpha	N of Items
,737	6

The mentioned calculation of the Cronbach alpha coefficient shows a good consistency of the questions represented in the questionnaire – 0,737.

Further, we estimate the reliability of the suggested questionnaire and formulated questions of Table 12:

Table 12. Reliability Statistics

Cronbach's Alpha	Part 1	Value	,705
		N of Items	3[a]
	Part 2	Value	,670
		N of Items	3[b]
	Total N of Items		6
Correlation Between Forms			,402
Spearman-Brown Coefficient	Equal Length		,573
	Unequal Length		,573
Guttman Split-Half Coefficient			,573

a. The items are: gover_support, informat, state finan.

b. The items are: taxation, info about EU, market EU.

In the represented table, the author used the following methods for the calculation of reliability:

- Split-half method (Half splitting on *Spearman-Brown*) — the program splits the variables into 2 groups in order of their enumeration (the number of variables in the groups is the same, if the total number of variables is even; otherwise, the first group contains more than one variable) and compares these groups among themselves.

As you can see from the calculation the correlation between the variables of 6 questions) of the questionnaire is high – 0.705.

The *Guttman* method is based on the operation of calculation of lower bounds of fitness (Table 13).

Table 13. Reliability Statistics

Lambda	1	,614
	2	,785
	3	,737
	4	,573
	5	,755
	6	,955
N of Items		6

The Strict parallel method is an analysis of the maximum likelihood of test suitability on the condition that all variables have equal average values and equal variances.

Table 14. Test for Model Goodness of Fit

Chi-Square	Value	-38,183
	df	19
	Sig	,006
Log of Determinant of	Unconstrained Matrix	-13,471
	Constrained Matrix	-9,072

Under the parallel model assumption

The calculation of the coefficient Chi-Square = -38.183p$_{Value}$< 0,01 means that found difference has a random nature, the number of degrees of freedom (df) equals to 19.

Table 15. Reliability Statistics

Common Variance	,259
True Variance	,082
Error Variance	,177
Common Inter-Item Correlation	,318
Reliability of Scale	,737
Reliability of Scale (Unbiased)	,785

Assessment of the reliability of the questionnaire makes up 0.737 and unbiased indicator of reliability equals to 0.785.

Conclusions:

Based on the results of the conducted research on the topic "*Participation of small and medium – size enterprises in the implementation of the innovation policy of Taiwan*", the author came to the following conclusions:

1. The analysis of costs for R&Din the countries of the EU is not uniform, based on the recommendation of the EU, the Europe 2020 program, the EU countries on average for the EU-28 for 2016 spent 2.03% with the set goal of 3% of GDP. Thus, the Baltic States plan by 2020 to increase costs for R&Dup to 1.5% of GDP, however, only Estonia managed to break the barrier in 1% by 2016 and made up 1.28%, Lithuania spent only 0.85%, for R&Din 2016, but the costs of Latvia in the same year made up 0.44%.
2. For the fulfillment of set priority tasks of Europe 2020, the EU countries also need to follow recommendations. The share of early school leavers should be under 10% and at least 40% of 30-34 years old should have completed a tertiary or equivalent education.It should be noted that with an average indicator in Europe 39.1% in 2016 and in euro- zone countries 39.2%in the Baltic countries, it is also at a high level: in Estonia - 45.4%, in Lithuania - 58.7%, but in Latvia 42.8%.
3. The research of theoretical works of the authors in the field of SMEs participation in the innovation field of such authors as John R. Baldwin &Peter Hanel, Sarah Anabarja,

Yves L. Doz & Keeley Wilson, Shu-Jen Chen, Jahja Hamdania, Christina Wirawanb allowed the author formulating the main advantages and disadvantages of SMEs in the innovation field. Among which the author as an advantage emphasized smaller firms take decisions faster and implement them more rapidly; more flexible in creating the alliances with other firms, in developing and changing the strategy; small firms exhibit thesame flexibility in their R&D that they show in many of their operations; their smaller size makes smaller markets attractive to SMEs while these markets would not be attractive for larger firms. As disadvantages: don't provide diversification of scientific studies and knowledge; focus significant resources on one direction and develop capital –intensive innovations; there is no network for distribution – department of marketing.

4. For the analysis of participation of SMEs of Taiwan in innovation activity, the analysis of legal environment is carried out by the author, regulating the activity of SMEs in the country. The author came to the conclusion that program documents of the state, such as*Global Innovation and R&D Partnership Plan; Strategic Plan for National Spatial Development of Taiwan;Four-Year National Development Plan (2017-2020) and Plan for National Development in 2017; and the laws itself*: *Key Operational Areas*, in which key areas for SMEs are specified; The activities of small and medium-sized businesses in Taiwan regulate *Act for Development of Small and Medium Enterprises;* The basic rules for the formation of SMEs are described in the *Standards for Identifying Small and Medium-sized Enterprises*create fruitful ground for active participation of SMEs in the innovation field.

5. The analysis of the main economic and social indicators is carried out by the author, characterizing the activity of SMEs in the innovation field for 2008-2015 among indicators: using the regression analysis the author showed the linear relationship between groups of coefficients.

6. The establishment of a linear relationship and the use of the correlation analysis of Pearson, Spearman and Tau Kendall, using SPSS program allowed the author to find the relationship between the indicators. Thus, between GDP per capita and the number of registered patents there is a high interrelation–the level of correlation made up 0. 9533, but the level of correlation between the number of registered patents of SMEs also showed a high level–0.9566(!). This means that innovations have direct influence on the level of such important economic indicators as GDPper capita and employment of the population.

The number of researchers of Taiwan and the number of their publications also have a direct impact on the number of SMEs and employed employees in it and this is confirmed by the coefficients of Pearson correlation, which make up more than 0.9 of all mentioned indicators. However, made econometric calculations, using the SPSS program showed that the number of students, studying at the universities of Taiwan doesn't influence on the indicators related to the number of firms of SMEs and doesn't influence on the number of employed in the field of SMEs. The level of sales of SMEs also has a negative correlation for all of the indicators provided by us. Obviously, on these parameters should look for other dependencies.

7. The author conducted a survey among heads of SMEs, the number of experts made up 13 people. The interviewed experts have work experience in the management of SMEson average is 16 years; The average number of employees of SMEs, interviewed by experts is 115 people; The amount of investments for the last 10 years made up NT$ 5,25 Mln .

8. The questions of the questionnaire have good consistency and reliability among themselves that is confirmed by the coefficientsof Cronbach's Alpha – 0.737, Reliability of Scale -0.737 , Reliability of Scale (Unbiased) – 0.785 calculated by the author, using the program.

9. 67% of interviewed experts are satisfied with the support of SMEs, 33% of experts answered negatively this question. 67% of experts are satisfied with the information about the opportunities of support in the field of SMEs. Most of the experts - 67% consider that the conditions of financing of SMEs, involved in innovations should be additionally changed. Changes are needed in taxation for SMEsof Taiwan, engaged in innovations consider 77% of experts. At the same time, the main part of experts is familiar with the market of the EU countries in their industry - 69% and one third of experts don't know the market of the EU countries. Experts also consider that for SMEs of Taiwan, the EU market is promising (54%), however, 46% of respondents don't see a prospect in cooperation with the EU countries.

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Annex 1

Gross domestic expenditure on R&D (GERD), % of GDP										
Geo /time	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**TARGET**
EU (28 countries)	1,84	1,93	1,93	1,97	2,01	2,02	2,03	2,04	2,03	3
Euro area (19 countries)	1,89	1,99	1,99	2,04	2,1	2,1	2,13	2,14	2,13	:
Belgium	1,92	1,99	2,05	2,16	2,27	2,33	2,39	2,47	2,49	3
Bulgaria	0,45	0,49	0,56	0,53	0,6	0,63	0,79	0,96	0,78	1,5
Czech Republic	1,24	1,29	1,34	1,56	1,78	1,9	1,97	1,93	1,68	1
Denmark	2,77	3,06	2,92	2,94	2,98	2,97	2,91	2,96	2,87	3
Germany	2,6	2,72	2,71	2,8	2,87	2,82	2,87	2,92	2,94	3
Estonia	**1,26**	**1,4**	**1,58**	**2,31**	**2,12**	**1,72**	**1,45**	**1,49**	**1,28**	**3**
Ireland	1,39	1,61	1,59	1,55	1,56	1,56	1,5	1,2	1,18	2
Greece	0,66	0,63	0,6	0,67	0,7	0,81	0,83	0,97	1,01	1,2
Spain	1,32	1,35	1,35	1,33	1,29	1,27	1,24	1,22	1,19	2
France	2,06	2,21	2,18	2,19	2,23	2,24	2,23	2,27	2,25	3
Croatia	0,88	0,84	0,74	0,75	0,75	0,81	0,78	0,84	0,85	1,4
Italy	1,16	1,22	1,22	1,21	1,27	1,31	1,34	1,34	1,29	1,53
Cyprus	0,39	0,44	0,45	0,46	0,44	0,48	0,51	0,48	0,5	0,5
Latvia	**0,58**	**0,45**	**0,61**	**0,7**	**0,66**	**0,61**	**0,69**	**0,63**	**0,44**	**1,5**
Lithuania	**0,79**	**0,83**	**0,78**	**0,9**	**0,89**	**0,95**	**1,03**	**1,04**	**0,85**	**1,9**
Luxembourg	1,62	1,68	1,5	1,46	1,27	1,3	1,26	1,27	1,24	2,3
Hungary	0,98	1,13	1,14	1,19	1,26	1,39	1,35	1,36	1,21	1,8
Malta	0,53	0,52	0,61	0,67	0,83	0,77	0,72	0,77	0,61	2
Netherlands	1,64	1,69	1,72	1,9	1,94	1,95	2	2	2,03	2,5
Austria	2,57	2,6	2,73	2,67	2,91	2,95	3,07	3,05	3,09	3,76
Poland	0,6	0,66	0,72	0,75	0,88	0,87	0,94	1	0,97	1,7
Portugal	1,45	1,58	1,53	1,46	1,38	1,33	1,29	1,24	1,27	2,7
Romania	0,55	0,45	0,46	0,5	0,48	0,39	0,38	0,49	0,48	2
Slovenia	1,63	1,82	2,06	2,42	2,57	2,58	2,37	2,2	2	3
Slovakia	0,46	0,47	0,62	0,66	0,8	0,82	0,88	1,18	0,79	1,2
Finland	3,55	3,75	3,73	3,64	3,42	3,29	3,17	2,9	2,75	4
Sweden	3,5	3,45	3,22	3,25	3,28	3,31	3,15	3,27	3,25	4
United Kingdom	1,63	1,69	1,67	1,67	1,6	1,65	1,67	1,67	1,69	:
Iceland	2,52	2,64	:	2,48	:	1,76	2	2,17	2,08	:
Norway	1,55	1,72	1,65	1,63	1,62	1,65	1,71	1,93	2,03	:
Switzerland	2,71	:	:	:	3,19	:	:	3,37	:	:
Montenegro	:	:	:	0,31	:	0,37	0,36	0,37	:	:
Former Yugoslav Republic of Macedonia,	:	:	:	:	:	:	:	0,44	0,43	:
Serbia	:	0,87	0,74	0,72	0,91	0,73	0,77	0,87	0,89	:
Turkey	0,69	0,81	0,8	0,8	0,83	0,82	0,86	0,88	:	:
Bosnia and Herzegovina	:	:	:	:	0,27	0,32	0,26	:	:	:
Russia	0,98	1,17	1,06	1,02	1,05	1,06	1,07	1,1	:	:
United States	2,77	2,82	2,74	2,77	2,7	2,73	2,75	2,79	:	:
Japan	3,34	3,23	3,14	3,24	3,21	3,32	3,4	3,29	:	:
South Korea	3,12	3,29	3,47	3,74	4,03	4,15	4,29	4,23	:	:
EU (27 countries)	:	:	:	:	:	:	:	:	:	3

Annex 2

Pearson correlation The correlation analysis were used by us as, namely this method allows evaluating: whether there is a connection between the examined variables? In this case, we can use *a correlation analysis.*

Usually the dependent variable is called *effective sign*; it denotes Y and its specific numerical values - $y_1, y_2, \ldots, y_n$.

Factorial signs or *simply factors* are called values, determining the change of effective sign. Factorial sign denotes X, its specific numerical values - $x_1, x_2, \ldots, x_n$. If there are several factorial signs, then they denote $X_1, X_2, \ldots, X_m$, and their numerical values - $x_{11}, x_{12}, \ldots, x_{1n}; x_{21}, x_{22}, \ldots, x_{2n}; \ldots; x_{m1}, x_{m2}, \ldots, x_{mn}$.

The division of signs into independent and dependent is relative. What value to choose as effective and what to choose as factor depends on concrete objective and requires a prior understanding and logical analysis.

The *goal of the correlation analysis* is to determine the degree of dependence between factorial and resultant signs.

If the dependence between the examined signs is linear, i.e., if simultaneously with the changes of factorial signs occurs equal proportional change of resultant signs, then in front of us is *linear correlation*. If the dependence is nonlinear then the nature of its change describes the *nonlinear correlation.* Depending on the influence of how many factors is considered, distinguish *pair* and *multifactorial correlation.*

Pair correlation characterizes the nature of dependence between two signs: effective (dependent) and factorial (independent). Pair correlation depends on the nature and intensity of influence of all considered values.

The *correlation diagram (scatter diagram)* is used in order visually determine the type of dependence and constraint force between effective and factorial signs. In correlation diagram on the axis Ox is placed the values of factorial sign (independent variable) and on the axis Oy - the corresponding values of resultant sign (dependent variable). The spread of obtained points around an imaginary line (or curve) passing between the obtained points, characterizes the closeness of connection of two signs.

The value of linear connection of two signs characterizes the *coefficient of linear correlation* which is denoted *r.*

The value of correlation coefficient can be calculated by the following formula (*Pearson correlation coefficient):*[26]

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}} = \frac{n\sum_{i=1}^{n} x_i y_i - \left(\sum_{i=1}^{n} x_i\right)\left(\sum_{i=1}^{n} y_i\right)}{\sqrt{n\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2}\sqrt{n\sum_{i=1}^{n} y_i^2 - \left(\sum_{i=1}^{n} y_i\right)^2}}$$

Where, $\bar{x}$ and $\bar{y}$ mean values of X and Y: $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$, $\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$.

[26] George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon.

n - sample number;
i - number of observation.
The value of correlation coefficient ranges from -1 to 1. In the table is represented the possible correlation coefficient and corresponding characteristics of force and direction of dependence.

Table 1. The possible value of correlation coefficient[27]

Values of correlation coefficient	Linear dependence
-1	Functional and negative
0	Does not exist
1	Functional and positive
$\|r\| < 0.5$	Weak
$0.5 \leq \|r\| \leq 0.8$	Average
$\|r\| \geq 0.8$	Strong

Spearman's rank correlation coefficient or **Spearman's rho**, named after Charles Spearman and often denoted by the Greek letter (rho) is a nonparametric measure of rank correlation (statistical dependence between the rankings of two variables). It assesses how well the relationship between two variables can be described using a monotonic function.

The **Spearman correlation** between two variables is equal to the Pearson correlation between the rank values of those two variables; while Pearson's correlation assesses linear relationships, Spearman's correlation assesses monotonic relationships (whether linear or not). If there are no repeated data values, a perfect Spearman correlation of +1 or −1 occurs when each of the variables is a perfect monotone function of the other.

Intuitively, the Spearman correlation between two variables will be high when observations have a similar (or identical for a correlation of 1) rank (i.e. relative position label of the observations within the variable: 1st, 2nd, 3rd, etc.) between the two variables, and low when observations have a dissimilar (or fully opposed for a correlation of −1) rank between the two variables.

Spearman's coefficient is appropriate for both continuous and discrete ordinal variables.

Spearman's rank correlation coefficient is the more widely used rank correlation coefficient.
Symbolically, Spearman's rank correlation coefficient is denoted by r_s . It is given by the following formula:
$r_s = 1- (6\sum d_i^2)/ (n (n^2-1))$

[27] George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon.

**Here* d_i *represents the difference in the ranks given to the values of the variable for each item of the particular data*

This formula is applied in cases when there are no tied ranks. However, in the case of fewer numbers of tied ranks, this approximation of Spearman's rank correlation coefficient provides sufficiently good approximations.

The **Kendall rank correlation coefficient**, commonly referred to as **Kendall's tau coefficient** (after the Greek letter τ), is a statistic used to measure the ordinal association between two measured quantities. A **tau test** is a non-parametric hypothesis test for statistical dependence based on the tau coefficient.

It is a measure of rank correlation: the similarity of the orderings of the data when ranked by each of the quantities. It is named after Maurice Kendall, who developed it in 1938,[1] though Gustav Fechner had proposed a similar measure in the context of time series in 1897.[2]

Intuitively, the Kendall correlation between two variables will be high when observations have a similar (or identical for a correlation of 1) rank (i.e. relative position label of the observations within the variable: 1st, 2nd, 3rd, etc.) between the two variables, and low when observations have a dissimilar (or fully different for a correlation of -1) rank between the two variables.

Kendall rank correlation is a non-parametric test that measures the strength of dependence between two variables. If we consider two samples, a and b, where each sample size is *n*, we know that the total number of pairings with a b is *n*(*n*-1)/2. The following formula is used to calculate the value of Kendall rank correlation:

$$\tau = \frac{n_c - n_d}{\frac{1}{2}n(n-1)}$$

Nc= number of concordant
Nd= Number of discordant

The main advantages of using Kendall's tau are as follows:

- The distribution of Kendall's tau has better statistical properties.
- The interpretation of Kendall's tau in terms of the probabilities of observing the agreeable (concordant) and non-agreeable (discordant) pairs is very direct.
- In most of the situations, the interpretations of Kendall's tau and Spearman's rank correlation coefficient are very similar and thus invariably lead to the same inferences.

		R&D %GDP	numb res	papers SCI	papers EI	Number of Students	Number SME	Emp SME	Patents
R&D %GDP	Pearson Correlation	1	,906**	,891**	,836*	,145	,971**	,968**	,940**
	Sig. (2-tailed)		,005	,007	,019	,756	,000	,000	,002
	N	7	7	7	7	7	7	7	7
numb res	Pearson Correlation	,906**	1	,972**	,880**	,056	,906**	,969**	,964**
	Sig. (2-tailed)	,005		,000	,009	,906	,005	,000	,000
	N	7	7	7	7	7	7	7	7
papers SCI	Pearson Correlation	,891**	,972**	1	,895**	,154	,874*	,934**	,930**
	Sig. (2-tailed)	,007	,000		,006	,741	,010	,002	,002
	N	7	7	7	7	7	7	7	7
papers EI	Pearson Correlation	,836*	,880**	,895**	1	,390	,818*	,868*	,833*
	Sig. (2-tailed)	,019	,009	,006		,387	,025	,011	,020
	N	7	7	7	7	7	7	7	7
Number SME	Pearson Correlation	,971**	,906**	,874*	,818*	-,044	1	,981**	,965**
	Sig. (2-tailed)	,000	,005	,010	,025	,926		,000	,000
	N	7	7	7	7	7	7	7	7
Emp SME	Pearson Correlation	,968**	,969**	,934**	,868*	,013	,981**	1	,988**
	Sig. (2-tailed)	,000	,000	,002	,011	,978	,000		,000
	N	7	7	7	7	7	7	7	7
Patents	Pearson Correlation	,940**	,964**	,930**	,833*	-,071	,965**	,988**	1
	Sig. (2-tailed)	,002	,000	,002	,020	,879	,000	,000	
	N	7	7	7	7	7	7	7	7

			R&D %GDP	numb res	papers SCI	papers EI	Number of Students	Number SME	Sales SME	Emp SME
Kendall's tau_b	R&D %GDP	Correlation Coefficient	1,000	,905**	,714*	,619	,429	,810*	,905**	,905**
	numb res	Correlation Coefficient	,905**	1,000	,810*	,714*	,333	,905**	1,000**	1,000**
	papers SCI	Correlation Coefficient	,714*	,810*	1,000	,714*	,524	,714*	,810*	,810*
	papers EI	Correlation Coefficient	,619	,714*	,714*	1,000	,619	,619	,714*	,714*
	Number of Students	Correlation Coefficient	,429	,333	,524	,619	1,000	,238	,333	,333
	Number SME	Correlation Coefficient	,810*	,905**	,714*	,619	,238	1,000	,905**	,905**
	Sales SME	Correlation Coefficient	,143	,238	,048	,143	-,048	,333	,238	,238
	Emp SME	Correlation Coefficient	,905**	1,000**	,810*	,714*	,333	,905**	1,000**	1,000
	Patents	Correlation Coefficient	,905**	1,000**	,810*	,714*	,333	,905**	1,000	1,000**
Spearman's rho	R&D %GDP	Correlation Coefficient	1,000	,964**	,857*	,786*	,536	,893**	,964**	,964**
	numb res	Correlation Coefficient	,964**	1,000	,893**	,821*	,429	,964**	1,000**	1,000**
	papers SCI	Correlation Coefficient	,857*	,893**	1,000	,857*	,607	,857*	,893**	,893**
	papers EI	Correlation Coefficient	,786*	,821*	,857*	1,000	,750	,786*	,821*	,821*
	Number of Students	Correlation Coefficient	,536	,429	,607	,750	1,000	,286	,429	,429
	Number SME	Correlation Coefficient	,893**	,964**	,857*	,786*	,286	1,000	,964**	,964**
	Sales SME	Correlation Coefficient	,321	,393	,143	,214	-,143	,429	,393	,393
	Emp SME	Correlation Coefficient	,964**	1,000**	,893**	,821*	,429	,964**	1,000**	1,000
	Patents	Correlation Coefficient	,964**	1,000**	,893**	,821*	,429	,964**	1,000	1,000**

Annex 3

Questionnaire of experts in the field of small and medium –sized businesses 中小企業專家問卷

Dear expert, for conducting a survey, we ask you to provide information about your professional activity in the field of SMEs **尊敬的專家，為了進行問卷調**查，請您提供您在中小企業從事專業活動的信息

Questions/問題:	Answer/回答
How many years is your experience in the field of small and medium –sized businesses please specify? 請問，您有多少年在中小企業工作的經驗？	
How many employees at your enterprise (people)? 您的企業有多少員工（人員)？	
Whether there have been investments in innovations or in R&D over the past 10 years? 過去十年，您的企業是否有創新投資或 **R&D**？	
Specify the amount of investments/**請選擇投資金額**: From NTD 1 million – NTD 5 million/**100 万 NT$—500 万 NT$** From NTD 5 million – NTD 10 million/**500 万 NT$—1000 万 NT$** Over NTD 10 million/**1000 万 NT$以上**	

№	Questions /問題	Yes/是	No/否
1	Are you satisfied with the state support of Taiwan in the field of SMEs? **您是否滿意政府對中小企業的扶持？**		
2	Are you satisfied with the information about the opportunities of support in the field of SMEs? **您對中小企業扶持信息的獲取渠道是否滿意？**		
3	Whether the conditions of financing of SMEs, engaged in innovations should be changed additionally? **是否應該進一步改變創新型中小企業的融資環境？**		
4	Whether the conditions of taxation for SMEs, engaged in innovations should be changed additionally? **是否應該進一步改變創新型中小企業的稅收？**		
5	What reasons make it difficult for you to access the foreign market of the EU countries (name 2-3 main reasons)? **您認為什麼原因導致歐盟市場復雜化（列出 2-3 種主要原因）？**	1. 2. 3.	

6	Do you have information about the markets of the EU countries in your industry? **您是否有所在領域歐盟國家市場的信息？**		
7	Is the market of the EU countries, the EU is promising for your business? **歐洲國家、歐盟市場對您的業務是否具有吸引力？**		

Annex 4

I. Cronbach's alpha model

Cronbach's alpha is a measure used to assess the reliability, or internal consistency, of a set of scale or test items. In other words, the reliability of any given measurement refers to the extent to which it is a consistent measure of a concept, and Cronbach's alpha is one way of measuring the strength of that consistency.

Cronbach's alpha is computed by correlating the score for each scale item with the total score for each observation (usually individual survey respondents or test takers), and then comparing that to the variance for all individual item scores:

$$\alpha=(kk–1)(1–\sum ki=1\sigma 2yi\sigma 2x)\alpha=(kk–1)(1–\sum i=1k\sigma yi2\sigma x2)$$

where: kk refers to the number of scale items

σ2yiσyi2 refers to the variance associated with item i

σ2xσx2 refers to the variance associated with the observed total scores

Alternatively, Cronbach's alpha can also be defined as:

$$\alpha=k\times\bar{c}\bar{v}+(k–1)\bar{c}\alpha=k\times\bar{c}\bar{v}+(k–1)\bar{c}$$

…where: kk refers to the number of scale items

$\bar{c}\bar{c}$ refers to the average of all covariances between items

$\bar{v}\bar{v}$ refers to the average variance of each item

Cronbach's alpha is thus a function of the number of items in a test, the average covariance between pairs of items, and the variance of the total score.

How do interpret Cronbach's alpha?

The resulting αα coefficient of reliability ranges from 0 to 1 in providing this overall assessment of a measure's reliability. If all of the scale items are entirely independent from one another (i.e., are not correlated or share no covariance), then αα = 0; and, if all

of the items have high covariances, then αα will approach 1 as the number of items in the scale approaches infinity. In other words, the higher the αα coefficient, the more the items have shared covariance and probably measure the same underlying concept.

Although the standards for what makes a "good" αα coefficient are entirely arbitrary and depend on your theoretical knowledge of the scale in question, many methodologists recommend a minimum αα coefficient between 0.65 and 0.8 (or higher in many cases); αα coefficients that are less than 0.5 are usually unacceptable, especially for scales purporting to be unidimensional (but see Section III for more on dimensionality).

For example, let's consider the six scale items from the American National Election Study (ANES) that purport to measure "equalitarianism"—or an individual's predisposition toward egalitarianism—all of which were measured using a five-point scale ranging from 'agree strongly' to 'disagree strongly':

In interpreting a scale's αα coefficient, remember that a high αα is both a function of the covariances among items and the number of items in the analysis, so a high αα coefficient isn't in and of itself the mark of a "good" or reliable set of items; you can often increase the αα coefficient simply by increasing the number of items in the analysis. In fact, because highly correlated items will also produce a high αα coefficient, if it's very high (i.e., > 0.95), you may be risking redundancy in your scale items.

A reliable measure is one that contains zero or very little random measurement error—i.