Analyzing a Knowledge Country
How is Sweden Managing its Innovation Process?

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Abstract: In a scenario where knowledge is considered an essential tool for firms and organizations, the paper presented an analysis about how Sweden, considered as a knowledge country, manages its innovation process. First, the paper presents the measures that Sweden government are doing, exposing the essential points in its innovation strategy. Then, the behaviour of Swedish enterprises related to innovation is analysed. Using an ANOVA technique, the paper shows that there are not differences between Swedish regions managing innovation, but there are differences between industries. After that, a comparison between industries in order to analyse which are the differences has been realized. Results show that machinery and retail industries are the most innovative, and fabricated metal industry is considered the least innovative. Although there are differences between industries, results show that in general Swedish enterprises are innovative because only a 9 per cent of enterprises have not realized something related to innovation process.

1 INTRODUCTION

At the present time, knowledge is considered an essential tool for organizations to achieve a competitive advantage. (Nonaka and Takeuchi, 1995; Von Krogh, 2012), to such an extent that it has been claimed that we live in a *Knowledge Society* (Sakaiya, 1991). But not all organizations and enterprises manage their knowledge in the same way leading to differing business outcomes.

This paper examines how a country like Sweden, considered as a knowledge country (Sarabia *et al.,* 2012), manages its innovation activity. This includes both the actions of the Government and also, how enterprises manage this activity. This case is of particular interest because according to Sarabia *et al.* (2012) Sweden represents an example for other countries to follow. Therefore, the main question is: how does Sweden (both the government and at business level) manage innovation activity?

In order to answer this question, the paper is structured as follows: First, a theoretical framework is presented highlighting innovation activity. Then, the Swedish case is presented, analyzing in the first place the government´s own program and then the behaviour of individual Swedish companies; in order to analyze the last point, an empirical analysis is presented using ANOVA to determine if there are differences between industries and/or regions (region 1: Stockholm-Solna, region 2: Boras, Goteborg, Jonkoping, Trollhattan-Vanersborg, region 3: Malmo-Lund and region 4: Linkoping, Orebro, Karlstad, Vasteras). Finally, the conclusions of the study are presented along with the principal findings, implications, limitations and future research possibilities.

2 INNOVATION

Innovation is defined as “the implementation of a new or significantly improved product (goods or services), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” (Oslo Manual, 2005: 46). That is to say, innovation is related to the idea of change or something new (Formichella, 2005) and it is considered a knowledge process with the aim of create new knowledge and developing solutions (Herkema, 2003).

Innovation is essential for both survival and

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competitiveness, whether for individual enterprises or for countries (OECD, 2010). This process contributes towards economic growth (Schumpeter, 1934) and plays an essential role in regional development (Schiuma and Lerro, 2008), with governments playing a role in stimulating innovative activity in individual enterprises (Gondora *et al.,* 2010). Therefore research on this topic is of great importance for present-day society because it helps to create an environment of sustainability (Luengo and Obeso, 2012).

The innovation process is also linked to research and development activity. Regarding the previous paragraph, within innovative enterprises there are R&D workers, and these workers are important for establishing knowledge networks and the business outcomes of the firm (Huber, 2013). Following Humerlinna-Laukkanen *et al.,* (2012), R&D is linked to innovation performance and innovation networks and, R&D is itself influenced by capability and network stability. In other words there is a direct relationship between innovation and the performance of the firm in question (Liao *et al.,* 2010).

Innovation management is defined as *"a process of change, incremental or substantial, in products, processes, organization and/or marketing that includes all the enterprise and involves interaction with environment"* (Camio *et al.,* 2014: 31). Additionally, innovation management includes the relationships within the organization that influences the innovation process, whether between employees between the organization and the environment (Arango Londono, 2012).

3 THE CASE OF SWEDEN

3.1 Government´s Programme

The importance of innovation for the Swedish government is demonstrated by the fact that they have devised a plan for innovation, proposing an innovation strategy for the entire country. This plan has been made universally available in order to promote innovation. The plan is entitled *The Swedish innovation strategy* and its stated purpose is *"to contribute to a climate with the best possible conditions for innovation in Sweden with year 2020 in sight"* (Government Offices of Sweden, 2015: 5). The main information contained in this document is summarized in this section.

In more detail, the Swedish government has three aims: (1) that Sweden contributes to innovative solutions to global challenges, (2) that Sweden increases its competitiveness in a global world where knowledge is an essential activity, and (3) that public services in Sweden achieve greater efficiency.

In order to achieve these aims, the strategy has three pillars: (1) providing the best possible conditions for innovation, (2) the people, businesses and organisations that work systematically with innovation and (3) implementation of the strategy based on a holistic view. Subsections 3.1.1 to 3.1.3 discuss there in greater detail.

3.1.1 The Best Possible Conditions for Innovation

This pillar is based on the personal skills and infrastructure necessary to promote knowledge and innovation. In this way, Swedish citizens must have the necessary knowledge and skills needed in order to contribute to the innovation process and, the willingness to do so. The climate should also promote innovation. In order to achieve this goal, Swedish government has developed various proposals.

With respect to individuals and their skills and levels of willingness, Sweden should continue investment in its educational system, which is seen as essential in imparting knowledge and promoting willingness, creativity, innovation and entrepreneurship without gender or racial stereotypes. These developments should be implemented in close partnership with the business world to adapt the learning process to the requirements of business.

Inside the educational system, higher education plays a fundamental role because universities are the cradle of knowledge. The Swedish government wants the quality of education and research in Sweden to reach the highest international quality standards and measures have been implemented to achieve this goal.

On the one hand, the government wishes to promote excellence in university level research by developing an environment where both Swedish and foreign researchers can carry out innovative work**.** To achieve this, a law has been passed supporting knowledge-based research conducted by students and researchers. In addition, incentives to encourage cooperation between universities and wider society are already in place in Swedish universities.

On the other hand, research institutes are also important in innovation activity, therefore collaboration between these institutes, universities, industries and public administration should be

promoted. The activities of the Industrial Research Institute, created with the aim of supporting small and medium businesses in their innovation process, is of particular note in this area.

Knowledge sharing is related to mobility. In this sense, the Swedish proposal aims to facilitate mobility between business, organizations, industries, regions and even countries to share different knowledge. In addition, a diverse and innovative workplace will be attractive to foreign workers, the European Union being useful in this respect because it opens Sweden up to a wider labor market.

Finally the government should develop an ideal framework where positive attitudes to entrepreneurship and innovation in society become reality. In this framework inventions and intellectual property are protected and taxes and lend capital is equity**.**

3.1.2 People, Businesses and Organisations that Work Systematically with Innovation

Swedish organizations must have the knowledge necessary to achieve a world-class capacity for innovation. Therefore Sweden needs to develop internationally competitive conditions to promote cooperation and competition, facilitating the growth of small and medium-sized businesses that are primarily related to the process of innovation.

Linked to this goal, cooperation is considered an essential condition for sharing knowledge and innovation. This includes not only Swedish agencies like universities, public administration, institutes and small, medium and large enterprises, but also foreign businesses. In this sense, internationalization is presented as a convenient tool for enterprises, because learning related to other cultures and languages opens a door for the future.

The Swedish government will promote innovative businesses and create collaboration between agencies and the new information and communication technologies (ICTs), a key resource for increasing national and international potential in small and medium firms.

The challenge for the government is to communicate the idea that knowledge and entrepreneurship are the key to producing and developing new goods, services, systems and business models and, therefore necessary for raising competitiveness.

In addition, public services play an essential role because they should be innovative, collaborative and efficient, with a high level of quality and availability. In this way, public services will promote opportunities for innovation by developing initiatives that support this process. Public administration is essential for collaborate with agencies and increasing innovation and competitiveness.

3.1.3 Implementation of the Strategy based on a Holistic View

Planning is very important, but implementation is also fundamental. The starting point is the existing interrelationship between Swedish agencies that have an influence on the strategy and with foreign agencies, or in other words: Swedish strategy should take a holistic view where the result is the sum of the parts.

The Swedish Government is faced with the challenge of creating and promoting an innovative environment while paying attention to the different areas and social actors. Success therefore is dependent on, an implementation strategy that includes a bilateral relationship between government and other players with the government keeping up to date about the evolution of this situation

The aim is that Sweden will be a source of global inspiration for other countries because of its strong innovative climate.

3.2 What Swedish Companies do?

3.2.1 Data Collection and Methodology

Data has been collected in Sweden by the World Bank, covering the period between January 2014 and November 2014. A total of 600 businesses were successfully interviewed about their activities during the previous year (2013). In the information provided on data collection, it is stated that, the sample for Sweden was selected using stratified random sampling in order to make sure that the final, complete sample included establishments from all different sectors and that unbiased estimates for different subdivisions of the whole population were obtained. The data included questionnaire-based responses to questions in the following areas: general information, infrastructure and services, sales and supplies, degree of competition, innovation, capacity, land and permits, crime, finance, business-government relations, labor, business environment and performance.

The database was obtained from the Microdata Library, a service established by Enterprise Surveys (World Bank) to provide information about people

living in mainly developing countries (World Bank, 2016), but information has also been collected on certain developed countries such as Sweden.

The companies surveyed belonged to the following industries: fabricated metals, machinery and equipment, other manufacturing, automotive services, other services and retail (six categories). The authors of the present study had access to the database in April 2016, when the last available data for Sweden dated from 2013.

For the analysis, an Analysis of Variance (ANOVA) has been used. ANOVA is a statistical method used with the aim of comparing different groups with respect to one or more quantitative variables. In this way the method is used to analyze whether or not differences exist between groups (Hair et al., 1995).

3.2.2 Analysis about Swedish Enterprises

The starting point was to analyze the differences between Swedish companies managing innovation in different industries in Sweden The following variables related to innovation activity were selected: whether the company had recently introduced new or significantly improved products or services (h1), the introduction or otherwise of any new or significantly improved methods of manufacturing products or offering services (h3), the introduction of any new or significantly improved logistics, delivery, or distribution methods for inputs, products or services (h4a), the introduction of any new or significantly improved systems or activities to support their main operations, such as maintenance systems or operations for purchasing, accounting or computing (h4b), the introduction of any new or significantly improved organizational structures or management practices (h5), the introduction of new or significantly improved marketing methods (h6), and money spent on formal research and development (R&D) activities, either in-house or contracted out to other companies (h7). In all cases, using Levene´s test, the null hypothesis was rejected if a significance of less than 0.05 was obtained, indicating that variances between variables are different (see Table 1). Potential differences in innovative activity between the 6 industrial sectors were also tested. .

Then a post-hoc comparison was carried out using T2 from Tamhane´s test (see Table 2). Significant differences of less than 0,05 were found between industrial sectors for all variables except for h3, h4a, h4b and h5, thus confirming significant differences in variance between industries linked to the following variables: h1, h6 and h7.

Table 1: Levene´s test linked to industries in Sweden.

Variable	Levene´s test	d.f1	d.f2	Sig.
h1	13,156	5	559	0,000
h3	3,808	5	559	0,002
h4a	3,489	5	559	0,004
h4b	5,499	5	559	0,000
h5	3,370	5	559	0,005
h6	4,532	5	559	0,000
h7	45,376	5	559	0,000

Moreover, the same Analysis of Variance technique (ANOVA) was repeated in order to discover if there were possible differences in how companies managed innovation between the four regions in Sweden From this starting point, the same variables were selected (h1, h3, h4a, h4b, h5, h6 and h7) as in the previous analysis. However, in this case applying Levene´s test to the results gave a value of more than 0.05 in all cases except for h4a and h4b, and therefore the null hypothesis could not be rejected in h1, h3, h5, h6 and h7. That is to say, there were no differences between variances in these variables.

To confirm the obtained results post-hoc comparison was performed using T2 from Tamhane´s test (see Table). Results show that the significance was greater than 0,05 in all cases, and that, therefore, geographical location (as defined by the region variable) did not influence the results.

It was additionally considered useful to examine exactly what innovation activities occurred within each industry Subsections 3.2.3 to 3.2.7 deal with the different kinds of industry. Section 3.2.8 presents a comparison between them.

3.2.3 Fabricated Metals (Ind1)

There were 117 businesses (n) included in the fabricated metal industry (ind1) with an average age of around 39 years (b5) and their market was predominantly national (64,15 per cent of sales were national) (d3a). The majority of businesses were small to medium size (almost 75 per cent) (see Figure 1) and the average growth, measured using differences in the number of employees between the year of the survey and three years previously was around 2,86 per cent (L2) (see Table 5).

This industry was characterized by low levels of innovative behaviour. Only 68,4 per cent of businesses, the lowest figure for any industry, had introduced new products or services in the previous three years. And only 53 per cent of firms had

introduced new products or services to the market (h2), again the lowest figure. Similarly, only 36 per cent of firms had introduced new logistics in the previous three years, with around 56 per cent introducing new maintenance systems and around 36 per cent introducing new marketing methods. With respect to investment in R&D, the percentage of businesses making an investment was also lower, at only 35,9 per cent and investment in formal training for employees was also the lowest (62.4 per cent).

Table 2: ANOVA results by industries in Sweden.

Variable		Sum of squares	df	Mean square	F	Sig.
h1	Between group	2,304	5	0,461	2,552	0,027
	Within group	100,959	559	0,181		
	Tota	103,264	564			
h3	Between group	1,138	5	0,228	0,952	0,447
	Within group	133,633	559	0,239		
	Tota	134,772	564			
h4a	Between group	1,598	5	0,320	1,348	0,242
	Within group	132,515	559	0,237		
	Tota	134,113	564			
h4b	Between group	2,178	5	0,436	1,873	0,097
	Within group	130,024	559	0,233		
	Tota	132,202	564			
h5	Between group	1,174	5	0,235	1,057	0,384
	Within group	124,270	559	0,222		
	Tota	125,444	564			
h6	Between group	8,716	5	1,743	7,353	0,000
	Within group	132,513	559	0,237		
	Tota	141,228	564			
h7	Between group	13,734	5	2,747	12,85	0,000
	Within group	119,452	559	0,214		
	Tota	133,186	564			

3.2.4 Machinery (Ind2)

There were 112 businesses included in the machinery industry (ind2) with an average age of around 45 years with sales mainly proceeding from direct exports (d3c) (44,19 per cent) follow very closely by national sales (43,79 per cent). The majority of businesses were classified as medium or large (see Figure 1) and the average growth was 5,23 per cent (see Table 5).

The machinery industry was characterized by its proactive approach to innovative activities. More than 87 per cent of businesses had introduced new products or services in the previous three years and, of these, almost 78 per cent were also new to the market. In addition, 67 per cent of businesses had introduced new process in the previous three years, with 36,6 per cent introducing new distribution methods, more than 62 per cent introducing new maintenance systems and 72,3 per cent of enterprises introducing new structures (the highest figure of any industry). In addition, investment in R&D was also the highest (almost 60 per cent of businesses having invested in research and development) (see Table 5).

Table 3: Levene´s test by regions in Sweden.

Variable	Levene´s test	d.f1	d.f2	Sig.
h1	1,736	3	561	0,159
h3	1,502	3	561	0,213
h4a	5,902	3	561	0,001
h4b	3,116	3	561	0,026
h5	1,520	3	561	0,208
h6	0,023	3	561	0,995
h7	1,627	3	561	0,182

Table 4: ANOVA test linked to regions in Sweden.

Variable		Sum of squares	df	Mean square	F	Sig.
h1	Between groups	0,226	3	0,075	0,411	0,745
	Within groups	103,038	561	0,184		
	Total	103,264	564			
h3	Between groups	0,415	3	0,138	0,578	0,630
	Within groups	134,357	561	0,239		
	Total	134,772	564			
h4a	Between groups	1,285	3	0,428	1,810	0,144
	Within groups	132,828	561	0,237		
	Total	134,113	564			
h4b	Between groups	0,842	3	0,281	1,198	0,310
	Within groups	131,360	561	0,234		
	Total	132,202	564			
h5	Between groups	0,224	3	0,075	0,334	0,801
	Within groups	125,221	561	0,223		
	Total	125,444	564			
h6	Between groups	0,217	3	0,072	0,287	0,835
	Within groups	141,012	561	0,251		
	Total	141,228	564			
h7	Between groups	0,346	3	0,115	0,487	0,692
	Within groups	132,840	561	0,237		
	Total	133,186	564			

3.2.5 Other Manufacturing (Ind3)

There were 115 businesses included in the other manufacturing industry category (ind3) with an average age of around 52 years (the highest average) and their sales mainly proceeded from national activity (almost 66 per cent). The majority of were classified as medium or large (see Figure 1) and the

average growth was the lowest at 2,23per cent (see Table 5). It seems that this industry is largely composed of mature enterprises**.**

Table 5: Comparison between industries.

	Ind1	Ind2	Ind3	Ind4	Ind5	Ind6
n	117	112	115	73	83	65
b5	39,48	45,04	51,5	35,21	26,46	18,57
b7	21,68	20,7	22,7	26,71	24,08	24,25
d3a	64,15	43,79	65,9	95,89	90,69	96,55
d3b	17,35	11,13	10,23	1,01	1,58	0,08
d3c	18,5	44,19	23,86	3,1	7,73	3,37
L2	2,86	5,23	2,23	9,38	5,25	6,13
L9a	10,9	10,98	11,14	11,5	12,2	-
h1	68,4	87,5	75,7	72,6	73,5	76,9
h3	65	67	55,7	58,9	56,6	58,5
h4a	36,8	36,6	32,2	39,7	44,6	49,2
h4b	56,4	62,5	68,7	68,5	53	69,2
h5	64,1	72,3	68,7	67,1	57,8	69,2
h6	36,8	47,3	37,4	68,5	55,4	67,7
h7	35,9	59,8	48,7	11	32,5	23,1
L10	62,4	66,1	73	79,5	69,9	80
h2	53,8	77,6	71,3	77,4	78,7	64

Figures for innovative activity were as follows: 75,7 per cent of enterprises had introduced new products or services, and of these, more than 71 per cent were also new to the market. Figures linked to new processes and logistics were the lowest (at 55,7 and 32,2 per cent respectively). Around 68 per cent of businesses had introduced new maintenance systems and structures, and the figures concerning the introduction of new logistics and new marketing methods were 32,2 and 37,4 respectively. Finally investment in R&D was in the middle (around 49 per cent) and investment in formal training was high (73 per cent) (see Table 5).

3.2.6 Automotive Services (Ind4)

There were 73 businesses included in the Automotive services industry (ind4) with an average age of around 35 years and with sales mainly proceeding from the national market (more than 95 per cent). The average score for manager experience was the highest, at almost 27 years of experience. The majority of enterprises were classified as small or medium (see Figure 1) and average growth was the highest (9,38 per cent) (see Table 5). This industry therefore experienced the fastest growth over the previous three years, as measured by rise in total number of employees .

The automotive services industry stood out in terms of marketing innovations: almost 69 per cent of businesses having introduced a new marketing method in the previous three years, the highest figure. In addition, the investment in formal training was also high (around 80 per cent). However the investment in R&D activity was the lowest, with only 11 per cent of firms investing in R&D. Introduction of new products, process, logistics, maintenance systems and structures was in the middle (around 72, 60, 40, 68 and 67 respectively) (see Table 5).

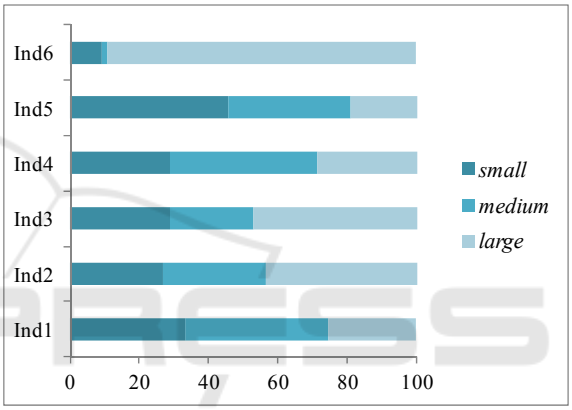

Figure 1: Size of business in each industry.

3.2.7 Other Services (Ind5)

83 businesses were included in the other services category (ind5) with an average age of around 26 years, with sales proceeding mainly from national activity (more than 90 per cent). The majority of businesses were classified as small or medium (see Figure 1) and the average growth was 5,25 per cent (see Table 5).

Around 73 per cent of enterprises had introduced new products or services, and of these, 78,7 were new to the market (the highest figure). Investment in R&D was medium (32,5 per cent) and investment in formal training was medium to high (almost 70 per cent). The other innovation variables were as follows: new processes around 56, new logistics around 45, new maintenance around 53, new structures around 58 and new marketing methods around 55 (see Table 5).

3.2.8 Retail (Ind6)

65 businesses were included in the retail industry (ind6) with an average age of around 18 years (the lowest) and where sales proceeded mostly from national activity (more than 96 per cent). The majority of businesses were classified as large (see Figure 1) and average growth was 6,13 per cent (see Table 5).

This industry stood out in investment in formal training (80 per cent of businesses). 76,9 per cent of businesses had introduced new products or services and of these, 64 per cent were new to the market. In addition, the retail industry made the largest investments in introducing new logistics and maintenance systems (around 49 and 69 respectively).

3.2.9 Differences between Industries

Based on previous information, and despite differences between industries, the Swedish businesses surveyed were proactive with respect to innovation, with only around 9 per cent of the sample not carrying out some activity linked to innovative activity or R&D investment. All remaining firms carried out at least some other innovative activity.

With regard to differences between industries, Firms in the machinery industry are ranked first in introducing new products or services, and the majority of these products or services were also new for the market as a while. In general, analyzing all the innovative variables, this industry could be considered as overall the most innovative, because it also ranks first in introducing new processes, and structures and investment in R&D was also highest. The remaining variables were also in the medium to high range.

Another industry very much interested in innovation activities was the retail industry: it has introduced the most new logistics and maintenance systems and made the highest investment in formal training. It also ranked as medium to high on the remaining variables.

However, the fabricated metal industry was considered least innovative in comparison: in general, it had introduced fewer innovations (products, services, process, logistics, maintenance systems, structures and marketing). In addition, it had the lowest percentage of marketing innovations and investment in formal training was also the lowest.

4 CONCLUSIONS

In the present day where knowledge is presented as an essential tool for achieving competitive advantages, this paper has analysed how Sweden manages innovation. Sweden makes for an interesting case study because it is considered a knowledge country, and therefore an example for others.

In order to analyse the Swedish strategy, this paper summarised the strategy of the Swedish government and provided an analysis of how individual companies manage their internal process of innovation. As a result of this analysis certain conclusions were obtained:

- The Swedish government has a proactive vision for innovation, highlighting its importance for the future and planning actions within an innovative strategy.
- The Swedish government strategy has a clear aim: to contribute towards a climate with the best possible conditions for innovations in 2020.
- The presence of such a plan indicates that Sweden has thought about the innovation process, and gives the very positive impression that they have taken the first step in order to achieve the goals.
- Analysing the behaviour of individual firms , there were no differences between regions in how innovation was managed
- However, significant differences were obtained between industries in how this was achieved.
- The Machinery industry was found to be the industry with the most proactive vision for innovation.
- The Retail industry also proved to be an innovative industry.
- The fabricated metal industry was considered the least innovative in this comparison, based on the analysis of relevant innovation activity variables
- Although there were differences between industries, the majority of Swedish businesses had a proactive vision linked to innovative activity and/or R&D investment.

This study and its findings prove to be interesting both for Sweden and other countries. . For Sweden the contributions are clear: the analysis has presented the situation for the country in 2013, therefore it provides feedback for the government on their strategy. This analysis is also useful because Sweden is considered an example of “a knowledge

country" that serves as an example and a reference for other regions.

The study has certain limitations. First, it is a static analysis because it includes data form only a single year: 2013. In addition, the role for public administration has only been analysed only from a theoretical viewpoint. With regards to the last limitation, a future research possibility would be to expand this research by carrying out an empirical analysis of innovation in Sweden more generally. In addition, it would be useful to do another analysis in 2020, the time horizon considered, and make a comparison between the situation before and after the implementation of the strategy. Another limitation relates to the services industry, which was not examined in much detail in this article due to a lack of relevant data, despite its importance to the wider economy. Another future possibility for research would be an exploration of this industry.

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