

Creating Entrepreneurial Universities: The Swedish Approach of Transformation

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Abstract—Sweden has succeeded to maintain a high level of growth and development and has managed to sustain highly ranked position among the world's developed countries. In this regard, Swedish universities are playing a vital role in supporting innovation and entrepreneurship at all levels and developing Swedish knowledge economy.

This paper is aiming to draw on the experiences of two leading Swedish universities, addressing their transformation approach to create entrepreneurial universities and fulfilling their objectives in the era of knowledge economy.

The objectives of the paper include: 1) Introducing the Swedish higher education and its characteristics. 2) Examining the infrastructure elements for innovation and Entrepreneurship at two of the Swedish entrepreneurial universities. 3) Addressing the key aspects of support systems in the initiatives of both Chalmers and Gothenburg universities to support innovation and advance entrepreneurial practices.

The paper will contribute to two discourses: 1) Examining the relationship between support systems for innovation and entrepreneurship and the Universities' policies and practices. 2) Lessons for University leaders to assist the development and implementation of effective innovation and entrepreneurship policies and practices.

Keywords—Entrepreneurial university, Chalmers university, Gothenburg university, innovation and entrepreneurship policies, entrepreneurial transformation.

I. INTRODUCTION

SWEDEN has established a unique position and a firm standing among the world's leading countries. The country has occupied the seventh position in the 2012 United Nations Human Development Index [22] and its welfare state is often seen as an example in other countries. Sweden's education system differs from that of other European countries. This naturally leads to different approaches to innovation and entrepreneurship in Swedish universities with some similarities but many differences caused by the Swedish approach to running universities and education policies.

Many studies [2], [3], [5], [14] have revealed that Swedish universities are playing a vital role in supporting innovation and entrepreneurship at all levels and developing the Swedish economy as one of the world's most advanced knowledge economies. The aim of this paper is to draw on the experiences of two leading Swedish universities, addressing their transformation approach to create entrepreneurial

universities and fulfil their objectives in the era of knowledge economy. Towards this aim, the paper is intended to (1) introduce the Swedish higher education and its characteristics, (2) examine the infrastructure elements for innovation and entrepreneurship in two Swedish entrepreneurial universities, and (3) address the key aspects of support systems in the initiatives of both Chalmers and Gothenburg universities to support innovation and advance entrepreneurial practices.

II. THE SWEDISH KNOWLEDGE ECONOMY

In international comparison, Sweden is at or close to the frontline, with high per capita income, excellent education and life standards, good health status and environmental quality, and high trust in institutions. Moreover, economy growth has been strong in recent years [16]. These outcomes are the direct or indirect benefits from good macroeconomic policies, large knowledge-intensive industry and service sectors, and functional National Innovation System.

Two main stakeholders dominate the Swedish National Innovation System (NIS). The first actor is a small number of large multi-national groups and the second actor is a similar number of universities. These two groups are the main investors in the R&D performed in Sweden [5]. Sweden has spent 3.4% of its GDP on R&D during the last three years [9] and ranks second in this respect, after Finland with 3.5% to 3.8% among the European nations. The knowledge infrastructure of Sweden is embedded in three metropolitan areas: Stockholm, Gothenburg, and Malmö. Gothenburg hosts the University of Gothenburg and Chalmers University of Technology, the two cases of this study.

According to the World Bank knowledge economy index, Sweden has successfully advanced from 6th place in 1995 to 2nd place in 2008, after which the country moved to the first-place position as the world's most advanced knowledge economy for the year 2012 [24], [25]. The index is based on four sub-indexes, which represent the four pillars of the knowledge economy:

1. Economic Incentive and Institutional Regime
2. Innovation and Technological Adoption
3. Education and Training
4. Information and Communications Technologies Infrastructure

III. HIGHER EDUCATION IN SWEDEN

Higher education institutes in Sweden are divided into five institution types: universities, university colleges, other colleges, art colleges and other higher education institutions. There are twenty state universities and three independent

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universities in Sweden [21]. Universities are able to offer all courses and are research oriented while university colleges are more focused on applied sciences and have limited rights in granting doctorates. These differences do not affect the standard of education in universities; on the contrary, many older universities are classed as university colleges and have very high standards of education with well-established reputations in Sweden.

The education in Sweden is compulsory up to the point of university but Sweden is set apart from other countries mentioned by the extent of subsidies available for education. In fact, to this date, there are no tuition fees for home students or students coming from within the EU and the EEA [6]. This is quite a profound difference in policy and leads to a major change in ideology in terms of universities' objectives. In the UK and other European countries, there are some very commercially oriented universities due to lack of government subsidies. This runs the risk of shifting focus away from education and possibly harming the institute.

Generally, Swedish universities hold positions in the top 500 universities worldwide [18], which is a very strong position to have. While there is no one university that holds a particularly high position, on average, they are all high and well regarded and academically respected in Europe. The Universities considered in this paper, both hold relatively good positions on league tables and are well established universities with good reputations.

In the beginning of the 1990s, Sweden announced its initiative to transform its national research, technology and development policies into policies for innovation. As bottom up responses to this initiative, Swedish universities need to transform themselves into entrepreneurial institutions [11]. The following sections provide a reflection on two university case studies from Sweden exploring their methods and how they led to success in becoming strong entrepreneurial institutes.

IV. CHALMERS UNIVERSITY

Chalmers University, one of the two universities located in the city of Gothenburg, is one of the oldest and largest higher education institutions specializing in science and technology in Sweden. Chalmers was established in 1829 through a donation from William Chalmers, a Swedish industrialist. It is the second largest technical university in Sweden, with about 10,000 students and 2,500 employees working in 16 departments. After its establishment, the university operated as a private venture for seven years until 1836, when it became a public institution. This phase came to an end in 1994, when the university became a private foundation again [11].

Chalmers University has maintained a strong focus on research, with conduction of over a thousand research projects and the publication of more than 2,700 scientific articles and research reports every year [10]. Chalmers University, similar to other Swedish universities, holds an average position in the top 500 universities worldwide. It was ranked the position of 175 for the year 2014/15 [18]. Whilst it is certainly an

advantage for a university to develop and have a world leading academic profile, statistics show that such profiles are not essential nor are they a measure for advancing universities' positions in the innovations and entrepreneurship ladder [15], [18].

Chalmers University has recognized and succeeded in securing an entrepreneurial leadership position in Europe. Part of this success is associated with their unique framework of incentives and the supportive environment the university has created for innovative and entrepreneurial activities. To provide such an environment, innovation and entrepreneurship must be at the forefront of institutes' activities; there must be focus on incorporating these themes into the daily norm of the institute. This undoubtedly requires effort and time, and Chalmers University did not achieve their position overnight.

Chalmers University began development of an effective support system for innovation and entrepreneurship as early as 1970, including the development of an infrastructure for commercialization of research. The Chalmers Innovation Centre (CIC) has taken the main role in providing the required support at Chalmers from the late-1970s and to the mid-1990s. The Centre has provided a space for inventors, innovators and entrepreneurs alike to receive advice and support. In parallel with the initiative of developing of CIC, Chalmers University has launched Chalmers Industrial Technique and Chalmers Science Park in order to establish co-operation links with established industry.

By the year 1994, when the University became a private foundation again, the University had gained more freedom in exploring new paths without sacrificing their existing standard of education and research. By that date, the university has started replacing Chalmers Innovation Centre by developing a new infrastructure for supporting innovations and entrepreneurship. The main entities of this new infrastructure are illustrated in Fig. 1.

1. Innovations Kapital: Founded in 1994, an independent venture capital firm which is partly owned by Chalmers [11].
2. Research Patents West: Founded jointly in 1996 by Chalmers and Gothenburg Universities to become a leading technology transfer and patents commercialization organization specialized in nanotechnology. This organization has been terminated and replaced by Chalmers IPR, Inc in 2003 [7].
3. Chalmers School of Entrepreneurship: Established in 1997 in order to accomplish the objective of developing both high-tech entrepreneurs and high-tech ventures from technology transfer [7].
4. Chalmers Innovation: A high tech incubator established in 1998 at Stena Centre offer to provide the required money and experience for inventors and start-ups [11].
5. Chalmers Invest: A seed venture capital company started in 1998, and totally owned by Chalmers University. The company has been established to provide funding for the early stages of starting up a business [11].

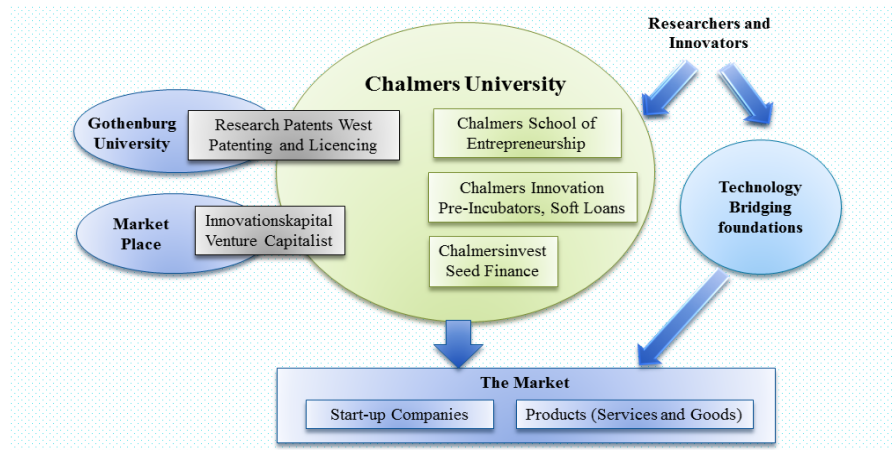


Fig. 1 The infrastructure elements for innovation and entrepreneurship at Chalmers University

V. SUPPORT AND INCENTIVES SYSTEM ASPECTS OF CHALMERS UNIVERSITY

The main aspects of support and incentives systems for innovation and entrepreneurship in Chalmers University can

be addressed through levels, the individual level, the organizational level, and eco-level. Table I outlined the main elements of the support and incentives system in Chalmers University.

TABLE I
AN OUTLINE FOR THE SUPPORT AND INCENTIVES SYSTEMS FOR INNOVATION AND ENTREPRENEURSHIP IN CHALMERS UNIVERSITY

Level of Activities	Innovation and Entrepreneurship Categories	Innovation and Entrepreneurship Activities
Individual Level	IP and Commercialization Support	<ul style="list-style-type: none"> Establishing an exclusive supporting infrastructure to provide a variety of help and support during the process of patenting and commercialisation. There are many sources of financial funds available for the patent costs.
	Student Support	<ul style="list-style-type: none"> Launching a business plan competition system called Venture Cup, the system acts as incentive for entrepreneurship and serves the aim of stimulating economic development in the region. <ul style="list-style-type: none"> More than 300 spin-off companies have been born at Chalmers.
Organizational Level	IP and Commercialisation support	<ul style="list-style-type: none"> Launching Chalmers Innovation, a unique incubator for businesses and business development, with financial assistance from a private donor. <ul style="list-style-type: none"> Establishing Innovationskapital, a venture capital company partially owned by Chalmers University. Co-founding Research Patents West, a regional patent and commercialization organization, with Gothenburg University.
	Education and Research; Groups/Facilities	<ul style="list-style-type: none"> Chalmers School of Entrepreneurship (CSE) was established in 1997 to serve two main objectives. The first is to develop high-tech entrepreneurs and the second is to use technology transfer in creating high-tech ventures
Eco System Level	Relations with Industry	<ul style="list-style-type: none"> Establishing close and useful links with various industries working in different fields, within biomedicine (Astra-Zenica), information and communication technology (Ericsson, SAAB), transportation (Volvo Corporation, Volvo Cars, Autoliv), and manufacturing (SKF).

A. Chalmers Incubator Platform

The links and mutual influence between the entrepreneurial universities that have strong profiles and responsiveness and their region is evident [1], [4], [8], [17]. According to Lindholm Dahlstrand and Jacobsson [13], the strength of Chalmers University in the field of mechanical engineering can be seen in the industrial firms of Västra Götaland. As mentioned earlier, Chalmers University may not have a world leading academic profile but their work over a long period of time in innovation and entrepreneurship has given them a powerful reputation.

As part of their initiatives in developing a unique Incubator Platform, Chalmers University has launched Chalmers Innovation with financial assistance from a private donor, the Olsson family foundation in Sweden, during 1998. The University has also been involved in the building of Venture Company and the creation of an entrepreneurship education

program. Chalmers Innovation is described as an institute to aid with the dynamic process of business development and delivers guidance with a very hands-on approach to starting businesses [23]. They call themselves a business incubator, providing a sophisticated array of services with a capacity of 30-40 companies, and it normally operates at full capacity. Although Chalmers Innovation in general can be considered an incubator for businesses and business development, they act directly as a valuable incentive for not only students but anyone within the community near the University. The presence of a very capable business incubator with an experienced team continually supplemented by new insight from students greatly improves prospects for entrepreneurs.

What distinguishes Chalmers is the use of their Chalmers Innovation centre in conjunction with Business students. By providing some core experience for students with real businesses, they will be much more likely to succeed in their

own exploits. Students also do a project involving starting up a business, again using the Chalmers Innovation resources; students can start their own businesses with their own innovative ideas.

B. Competitive/Financial Incentives

Chalmers innovation has been recognized in providing the best practices in using incentives, including financial incentives, to generate business ideas and support other entrepreneurship activities. The innovation and entrepreneurship policy of Chalmers University is mainly based on three pillars: Entrepreneurship education, venture capital and intellectual property facilities. In 1994, Chalmers University established Innovationskapital, a venture capital company partially owned by the university, to play a vital role in implementing their policy. This move was completely new to the Swedish context and proves their leadership in this field [11].

Another example of their initiatives in this direction is the business plan competition system called Venture Cup. Venture Cup started in 1998 in order to act as incentive for entrepreneurship within the institute and serve the aim of stimulating economic development in the region. The idea of Venture Cup was so successful that it has spread to all other universities in Scandinavia [23].

Venture Cup's popularity and the reputation of Chalmers Innovation have granted the Cup prestigious value beyond the financial incentive it offers. Even without this added dimension, the adoption of this idea by many other universities is evidence enough for its success as it complements the infrastructure already in place and enhances it to cement Chalmers' reputation as one of the most successful entrepreneurial institutes in Europe.

The Venture Cup has been running since 1998 and has expanded and changed throughout the years. In 2012, there were five categories and a total 1422 participants in the cup and this has been steadily increasing for the last few years. This is clear evidence of the cup's value in terms of incentivising participation in entrepreneurial activities in students from Chalmers as well as other universities.

C. Intellectual Property Facilities and Support

We have mentioned earlier that the entrepreneurship policy of Chalmers University is based mainly on three pillars: Entrepreneurship education, venture capital and intellectual property facilities. In developing these facilities, during 1996, the University co-founded a regional patent and commercialization organization with Gothenburg University Research Patents West to become a leading technology transfer and patents commercialization organization specialized in nanotechnology in that region. In order to explore further potentials in strategic intellectual property, Research Patent West was closed after seven years of operation in 2003, and replaced by Chalmers IPR, Inc. [7].

Sellenthin [20] has reported that innovators and entrepreneurs in Chalmers University have the advantage of choosing between many different ways to commercialise their

ideas. During the process of patenting and commercialisation, they are able to get a variety of help and support provided through an established supporting infrastructure.

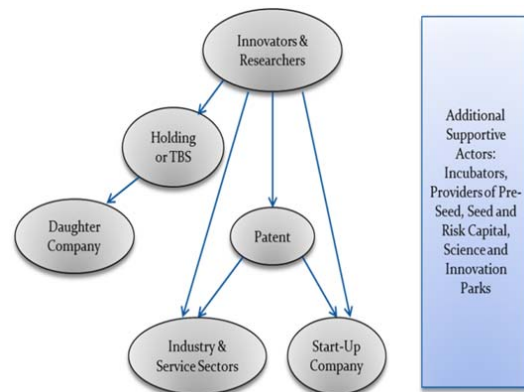


Fig. 2 The process of patenting and commercialisation in Chalmers University

As illustrated in Fig. 2, researchers and innovators can initiate the commercialization process of their innovative ideas using the University's supporting infrastructure or through the Technology Bridging Foundations (TBS); Swedish organisations that support universities in their third mission efforts. However, the use of the University's supporting infrastructure is usually the first choice. For both choices, the first stage in the process is usually to conduct a commercial assessment as well as provide researchers and innovators with advice and information and arrange contacts with other supporting actors. The next step in the commercialisation process is to apply for patent registration if the idea is patentable while there are financial funds available for the patent costs. When the patent is granted, it can be either used as an asset in a start-up or Spin-off Company or it can be sold or licensed to existing companies.

D. Entrepreneurial Education Support

The support of entrepreneurial education is a vital part of the third mission efforts of Chalmers University. In this direction, Chalmers School of Entrepreneurship began as a pilot project in 1996, and in the next year, it was established to serve two main objectives. The first is to develop high-tech entrepreneurs and the second is to use technology transfer in creating high-tech ventures [7]. Despite the efforts of Chalmers University in establishing the School of Entrepreneurship, some authors have criticized the school [10]. The main issue of the criticism is the failure of the school to design an entrepreneurship education that have some impact on the majority of students. Designing such education system is facing big challenges; it requires relatively high investments, and the ability to maintain the flow of admitted students who are ready and capable for such an education system.

Chalmers School of Entrepreneurship succeeded in starting its entrepreneurial education programs and research activities quickly. In the first year of the establishment, the school

developed and launched a one-year Masters programme in entrepreneurship, which later developed to become a two-year programme. Every year around twenty students from engineering, business, and design schools at the bachelor level are selected for this programme and the number of admitted students jumped to thirty seven in 2008 [10].

The qualified applicants are selected on the basis of comprehensive applications followed by an interview process by a panel from the School of Entrepreneurship and psychologists. The interview process involves analysing the traits and abilities of applicants, such as motivations and capabilities of becoming entrepreneurs, teamwork, responsibility, leadership and communication.

The study includes a wide range of core and optional courses such as Intellectual Property Strategies; Technology based Entrepreneurship, Design of Technological Innovations and Markets. The important part of the study is built around developing a real project where the students are divided to small groups wherein each group must establish a new venture on the basis of an innovative idea. For an idea to be accepted, it should meet a set of criteria: The idea has to have a high and preferably global potential, it has to be technically validated and more importantly, the idea intellectual property right issues are clear [19].

E. Relations with Industry

Chalmers' close relations with industrial firms, especially those who are science based, have provided numerous opportunities for the University's students and staff, as well as the industrial firms. Furthermore, these firms are among the international players in their respective fields and of the top industries in spending on R&D in the region. This is yet more impressive when considering Sweden leads OECD countries in terms of R&D intensity [12]. According to [7], Chalmers University has succeeded in establishing close and useful links with various industries working in different fields, within biomedicine (Astra-Zenica), information and communication technology (Ericsson, SAAB), transportation (Volvo Corporation, Volvo Cars, Autoliv), and manufacturing (SKF).

Chalmers' links with industrial firms act as incentives for innovation as they further encourage participation in the Venture Cup. This functions only as the University has such well-established facilities and can just work on directing new talent towards them. An example lies with the Venture Cup. A competition as high profile, as this is quite effective at attracting some high profile sponsors. Ernst and Young were the 2012 sponsors; this not only validates the importance of the cup, but also demonstrates the firm's interest in the competition and the University. Such interest is very valuable to students seeking jobs and often gives high placing participants in the Venture Cup an edge for employability.

VI. GOTHENBURG UNIVERSITY

Based in the second largest city in Sweden, Gothenburg University is one of the best academically ranked universities in Sweden. Being classified as a University, Gothenburg is strongly research oriented. Through their research, they have

been very successful in growing a wide network of relations with industry and other academic institutes, becoming somewhat of a hub of innovation and entrepreneurship alongside Chalmers University [23]. The majority of their efforts in this direction are facilitated through the University's holding company, known as GU Holding, Fig. 3. The company is financially supported by the Swedish government and is the body that controls most of the University's entrepreneurial activities

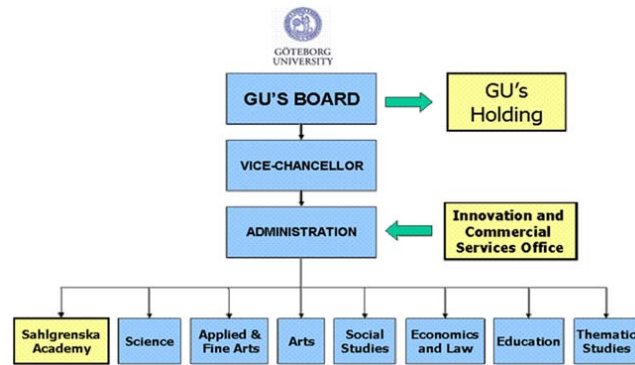


Fig. 3 An organizational chart for Gothenburg University

GU Holding was responsible for the foundation of a number of institutes and research centres. Through these institutes, the university has achieved most of its research based innovation. Many of these institutes offer services and support for their students in order to incentivise innovation. Whilst the range of services offered is vast, heavy focus is put on the commercialisation of research where there are many examples of students having successfully commercialized their projects with the guidance of GU.

VII. GOTHENBURG'S SUPPORT AND INCENTIVES SYSTEM ASPECTS

The main aspects of support and incentives systems for innovation and entrepreneurship in Gothenburg can be addressed through the following elements outlined in Table II.

A. Relations with Industry

Gothenburg is a strong part of Sweden's research output in a number of fields. It has maintained its research output through the expansive network of industry partners [23]. The majority of funding for research in Gothenburg comes from this network as opposed to government funding. Through its partners, GU Holding has been able to do more than just fund research; it has founded a number of self-contained commercial research institutes which will be explored later. Gothenburg also has close relations with universities with similar objectives. Pooling resources between universities is very efficient and allows initiatives like the Venture Cup to grow and become more effective tools. In fact, many initiatives run by Chalmers Innovation are also generally available to students in Gothenburg and vice-versa.

TABLE II
AN OUTLINE FOR THE SUPPORT AND INCENTIVES SYSTEMS FOR INNOVATION AND ENTREPRENEURSHIP IN GOTHENBURG UNIVERSITY

Level of Activities	Innovation and Entrepreneurship Categories	Innovation and Entrepreneurship Activities
Individual Level	IP Support	<ul style="list-style-type: none"> GU has secured the 6th AP government sourced fund which provides financial support for innovators in securing Technologic and Engineering patents Sahlgrenska academy's support systems and business incubators provide specialised support to secure IP Research and Commercialisation support, e.g. Sahlgrenska academy has supported the commercialisation of 35 student research projects.
	Student Support	<ul style="list-style-type: none"> Financial support/Investment to launch companies, many of students' commercialised projects, they are now successful companies.
Organizational Level	Commercialisation support	<ul style="list-style-type: none"> Eighty companies have been financed and launched by GU Holding
	Research Groups/Facilities	<ul style="list-style-type: none"> GU Holding has founded a number of facilities and institutes, closely working with Chalmers Innovation. Sahlgrenska academy for the Health care faculties is the University's biggest research facility being the origin of 52% of the innovations in GU.
Eco System Level	Relations with Industry	<ul style="list-style-type: none"> The majority of funding for research in Gothenburg comes from a network of industry partners

Gothenburg's relations with industry have brought many valuable resources to the University; these facilities directly benefit students and are focused on Gothenburg's strongest research scene: Healthcare. Table III summarises the facilities offered by associated firms to Gothenburg's students.

Gothenburg's partnership with Chalmers' Innovation (CI) allows sharing of resources and relations belonging to CI; together they can provide an array of support services for student innovators wanting to work independently or in conjunction with one of GU holdings' business partners. One must also consider the effect of the heavy financial input into research; it has allowed Gothenburg to continually innovate and incentivise the progress of commercialised research within GU Holding. The key figures for GU Holding investments in the last few years, as illustrated in Table IV, demonstrate the continued success of GU Holding, specifically investments and companies in their portfolio. The figures show a long-term consistent growth: There is no sudden increase at any point, but gradual growth seems more sustainable in the long run, demonstrating GU's intention and ability to keep such initiatives active in the future so they can continue to reap the rewards of their active entrepreneurial community.

TABLE III
THE SERVICES OFFERED BY THE SWEDISH FIRMS TO GOTHENBURG'S STUDENTS

Facilities	Associated firms
Clinical trials	Scandinavian CRI
Medical digital training simulators	GU Science Partner
Medical commercialisation services	SurgicalScience
IT research and product development	A+Science Actar
	The Victoria Institute

TABLE IV
KEY FIGURES FOR GU HOLDING INVESTMENTS - ADAPTED FROM GU HOLDING ARCHIVES

	2008	2009	2010	2011	2012
New Investments	8	7	9	6	7
Follow-up investments	9	7	4	9	12
Companies	24	26	29	29	35

B. Research Facilities/Groups

The analysis of 2013 GU Holding archives has revealed that the Sahlgrenska academy for the Health care faculties is the University's biggest research facility. The academy has produced 52% of the innovations in GU Holding, and it is responsible for the establishment of many research products as well as their commercialisation. There are many examples of students' research ideas being commercialised with support from the academy, both financial and tailored support for specific issues. So far, eighty companies have been financed and launched by GU holding. Having a thriving research community acts as an incentive for innovation as it provides students with an environment where research and innovation is successful and this may encourage them to contribute to the research community. By incorporating their industry relations into their research, GU Holding has provided funding and further incentive for students interested in working with particular high profile firms.

C. IP Support

Intellectual property (IP) is another element that has been addressed by Gothenburg University and its entrepreneurial arm, GU Holding, in order to support entrepreneurs working with their institute. IP is a very important consideration with innovative businesses; within the field of healthcare, securing IP is essential to the development of ideas into commercially viable businesses. There is also funding secured from the government, in the form of the 6th AP fund, dedicated to the support of innovators developing patents. This is financial support, not an investment in the start-up which can be very beneficial in conjunction with other support services offered by the university. In other research areas, there are services offered by A+Science and Actar, who have close relations with GU Holding. These firms offer support for medical IP and the commercialisation process.

VIII. CONCLUSION

The studies and statistics have revealed that the Swedish universities are playing a major role in supporting innovation and entrepreneurship at all levels and developing the Swedish economy as one of the world's most advanced knowledge

economies. This research study has selected and analysed two university case studies from Sweden exploring their methods and how it led to their success in becoming strong entrepreneurial institutes. The cases are Chalmers University and Gothenburg University. Sweden has managed to establish a unique position and a firm standing among the world's leading countries. The country occupied the seventh position in the 2012 United Nations Human Development Index and successfully jumped to the first-place position as the world's most advanced knowledge economy in the same year.

Sweden's education system differs from that of other European countries. This naturally leads to completely different approaches to innovation and entrepreneurship in Swedish universities with some similarities but many differences caused by their unique approach to running universities and education policies. The lessons learned from the initiatives of Swedish universities in supporting innovation and transform themselves into entrepreneurial institutions are summarized in the following points:

- The success in securing and sustaining an entrepreneurial leadership position undoubtedly requires effort and time and usually cannot be achieved in a short period of time. An important element in the success of Swedish universities is their continuous efforts in the development of an effective support system for innovation and entrepreneurship, including the development of an infrastructure for commercialization of applied research.
- The positive impact of exploring new paths in supporting innovation and entrepreneurship is valuable. The Swedish universities have maintained the development of a new and exclusive supporting infrastructure for innovation and entrepreneurship that provides a variety of services during the process of patenting and commercialisation. The main elements of their infrastructure, which is role driven, are seed venture capital and independent venture capital companies, technology transfer and patents commercialization organizations, entrepreneurship schools, and a unique incubator platform to provide the required money and experience for inventors and start-ups.
- The influence of competitive financial incentives is evident in generating business ideas and supports other entrepreneurship activities. An example of the role of such incentives is the business plan competition system called Venture Cup. The system has been used as incentive for entrepreneurship within Swedish universities and serves the aim of stimulating economic development in the region. The idea of Venture Cup was so successful that it has spread to all other universities of Scandinavia.
- The benefits of developing specialized intellectual property and commercializing facilities are tangible. Such facilities have provided the capability for Swedish universities to explore further potentials in strategic intellectual property, as well as giving innovators and entrepreneurs the advantage to choose between many different ways to commercialize their ideas, and getting a

variety of help and support during the process of patenting and commercialization.

- The support of entrepreneurial education is a vital part of the third mission efforts of universities. Designing an entrepreneurship education system that have some impact on the majority of students is facing big challenges; it requires relatively high investments, and the ability to maintain the flow of admitted students who are ready and capable for such an education system.

REFERENCES

- [1] Baptista, R., and Leitão, J., (2015), *Entrepreneurship, Human Capital, and Regional Development*, E-book, Springer.
- [2] Benneworth, P., Conen, L., Moodysson, J., & Asheim, B. (2009), Exploring the Multiple Roles of Lund University in Strengthening Scania's Regional Innovation System: Towards Institutional Learning? *European Planning Studies* 17(11), pp. 1645-1664.
- [3] Berggren, E., & Lindholm Dahlstrand, Å., (2009), Creating an Entrepreneurial Region: Two Waves of Academic Spin-offs from Halmstad University, *European Planning Studies*, 17(8), pp. 1171-1189.
- [4] Boucher, G., Conway, C., And Der Meer, E., (2003), Tiers of Engagement by Universities in their Region's Development, *Regional Studies*, 37.(9), pp. 887-897.
- [5] Chaminade, C., Zabala, J., and Treccani, A. (2010), The Swedish national innovation system and its relevance for the emergence of global innovation networks, *National innovation systems and global innovation networks, Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE) Lund University*.
- [6] European Commission, (2015), *National Student Fee and Support Systems in European Higher Education*, Available at: http://eacea.ec.europa.eu/education/eurydice/documents/facts_and_figures/fees_support.pdf
- [7] Fogelberg H., and Lundqvist, M., (2013), Integration of academic and entrepreneurial roles: The case of nanotechnology research at Chalmers University of Technology, *Science and Public Policy*, 40, pp. 127-139.
- [8] Guerrero, M., and Liñán, F., (2009), Entrepreneurial Universities and Regional Development: A Spanish Case Study, in the *Handbook of Regional Economics*. Nova Science Publishers, Inc.
- [9] Grueber, M., Städt, T., Horowitz, M., Tripp, S., Gillespie, A., Rosenberg, E., McCoy, P., and Kuchta, C., (2014), *Global R&D Funding Forecast*, Battelle.
- [10] Hofer, A., Potter, J., Fayolle, A., Gulbrandsen, M., Hannon, P., Harding, R., Dahlstrand, A., and Phan P., (2010), "From Strategy to Practice in University Entrepreneurship Support: Strengthening Entrepreneurship and Local Economic Development in Eastern Germany: Youth, Entrepreneurship and Innovation", *OECD Local Economic and Employment Development (LEED) Working Papers*, OECD Publishing.
- [11] Jacob, M., Lundqvist, M., & Hellsmark, H. (2003), Entrepreneurial transformations in the Swedish university system: The case of Chalmers University of Technology. *Research Policy*, 32(9), pp. 1555-1569.
- [12] Ketels, C. H.M. (2012), "Sweden's Position in the Global Economy." *Globaliseringsforum Rapport, Entreprenörskapsforum*, Stockholm, Sweden.
- [13] Lindholm Dahlstrand, Å. and Jacobsson, S.: (2003) "Universities and Technology-based Entrepreneurship in the Gothenburg region", *Local Economy*, 18 (1), pp. 80-90.
- [14] Marklund, G., Nilsson, R., Sandgren, P., Thorslund, J.G., Ulström, J. (2004), *The Swedish National Innovation System 1970-2003*. Vinnova Analysis VA 2004:1.
- [15] NCGE, (2011), *The Entrepreneurial University of the Year 2010/2011*, National Centre for Guidance in Education.
- [16] OECD, (2013), *Main Science and Technology Indicators*, Volume 2013/1, Paris: OECD. Available at: http://www.oecd.org/sti/2013_1_documentation_e.pdf.
- [17] Pfeilstetter, R., (2013), Entrepreneurship and regional development in Europe: A comparative, socio-anthropological case study in Germany and Spain, *Anthropological Notebooks*, 19 (1), pp. 45-57.
- [18] QS Quacquarelli Symonds, (2015), *QS World University Rankings, 2014*, Available at: <http://www.topuniversities.com/university-rankings/world-university->

rankings/2014#sorting=rank+region=+country=+faculty=+stars=false+search=.

- [19] Rasmussen E., and Sørheim, R., (2006), Action-Based Entrepreneurship Education, *Technovation*, 26, pp. 185–194, Elsevier Ltd.
- [20] Sellenthin, M., (2004), Who should own university research? An exploratory study of the impact of patent rights regimes in Sweden and Germany on the incentives to patent research results, ITPS, Swedish Institute for Growth Policy Studies.
- [21] Swedish Higher Education Authority, (2013), Higher education in Sweden, 2013 status report. Available at: <https://www.uk-ambetet.se/download/18.1c251de913cebc40e780003405/1403093616367/annual-report-2013-ny.pdf>.
- [22] United Nations Development Programme (2013), Human Development Report, The Rise of the South: Human Progress in a Diverse World, 1 UN Plaza, New York, NY 10017, USA.
- [23] Vilà P., and Cufi, P., (2002), Detection of Best Practices in the Field of University Entrepreneurship, An Analysis Of 13 European Centers of Entrepreneurship, CIDEM (Center for Innovation and Business Development) of the Generalitat de Catalunya..
- [24] World Bank, (2008), Knowledge Economy Index Rankings, Available at: http://siteresources.worldbank.org/INTUNIKAM/Resources/KEI2008Highlights_final12052008.pdf.
- [25] World Bank, (2012), Knowledge Economy Index Rankings, Available at: <http://siteresources.worldbank.org/INTUNIKAM/Resources/2012.pdf>.

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