

Innovation based on cultural tradition



Picture: Tourism Salzburg

Mozart 4.0

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Foreword

This study was compiled in 2014 and 2015 on the basis of publicly available information, several meetings with institutions in Salzburg and a research visit of Ludovit Garzik to Silicon Valley in 2014. The prognosis market was performed with support of Salzburg institutions in October/November 2014. It is the first implementation of a prognosis market on the topic of Austrian regional innovation systems. The authors thank all the cooperation partners in Salzburg for their support in order to bring forward the Salzburg region in a common effort.

The opinions expressed in this study reflect the opinions of the authors and do not necessarily reflect the official views of any institution.

A shorter version of the study proposing a Triple Helix Systems-based regional innovation strategy for the Salzburg region was published earlier in the Austrian Council for Research and Technology Development book *“Designing the future: economic, societal and political dimensions of innovation.”* Echomedia Buchverlag, Vienna, 2015:

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Abbreviations

AIFMG	Alternative Investment Fund Management Law
AWS	Austrian Economic Service Agency
BCCS	Business Creation Center Salzburg
BMWFW	Federal Ministry of Science, Research and Economy
BVFS	Research Institute for Construction Technologies
CEO	Chief Executive Officer
COMET	Competence Centers for Excellent Technologies
DG	Directorate General
EIU	Economist Intelligence Unit
EPO	European Patent Office
ERC	European Research Council
EVCA	European Private Equity and Venture Capital Association
FFG	Austrian Research Promotion Agency
FH	University of Applied Sciences
FP	Framework Program
FWF	Austrian Science Fund
GCB	Global Corruption Barometer
GCS	Global Competitiveness Survey
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitoring
GERD	Government Expenditure on Research and Development
GNP	Gross National Product
GRP	Gross Regional Product
GSK	Humanities, Social and Cultural Sciences
GUF	General University Fund
GWP	Gallup World Poll
HES	Higher Education System
ICT	Information and Communication Technology
IP	Intellectual Property
IPR	Intellectual Property Rights
IT	Information Technology
IZ	Impulse Center
K Center	Competence Center
MIT	Massachusetts Institute of Technology
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organization for Economic Co-operation and Development
ÖVP	Austrian People's Party
PDI	Power Distance Index
PEREP	Non-commercial pan-European private equity database
PhD	Doctor of Philosophy
PMU	Paracelsus Medical University
QS Ranking	Quacquarelli Symonds Ranking
R&D	Research and Development
REC	Research Organisation
S&P	Standard & Poor's 500
S&T	Science and Technology
SBIR	Small Business Innovation Research
SME	Small and Medium-sized Enterprises
SPÖ	Social Democratic Party of Austria
TP	Techno Park
UAI	Uncertainty Avoidance Index
USPTO	United States Patent and Trademark Office
WEF	World Economic Forum

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Executive Summary

The study analyses the current status of the Regional Innovation System in the region of Salzburg which is one of the nine regions in Austria. Thanks to its historical development, Salzburg is a region with a rich cultural heritage that has remained fresh and vibrant until present. In order to get a comprehensive picture of the Regional Innovation System in Salzburg, a Triple Helix Systems analysis is undertaken. Thus, a well-developed Knowledge Space with a broad variety of players has been identified. In the Innovation Space, an important deficit comes from the poor capacity of the majority of institutions, including companies and universities, to transform their knowledge into innovation. The Consensus Space, which is sufficiently well developed institutionally for effective functioning, (e.g. the presence of the Salzburg Council for Science and Research and different strategy papers) still has a limited impact, as communication is very inward-looking, concentrating on the internal structures, and lacks efficient connections to other system elements.

Based on the Triple Helix Systems analysis and the identified deficits, the innovation potential of the Salzburg region is assessed in the next step via two modules. The first module consists of a classical survey asking selected groups about their propensity to engage in innovation and entrepreneurship. As there are limits to the explanatory power of classical surveys, a new method has been applied to answer the same question: the Prediction Market. This is a well established and scientifically valid method to shed light on the attitudes of respondents regarding predefined research questions. The difference between the survey and the prediction market is that the survey asks what the respondents themselves think and *what should be* the case in the future, whereas the prediction market asks the respondents on their opinion about what others think and *what will be*. This study is the first implementation of a prediction market in the field of research and innovation. In applying the prediction market method, only a small number of market participants is needed, but on the other hand, the effort in explaining the participants what they are expected to do is comparably higher compared to a classical survey.

The five questions raised in the prediction market provided different insights into the attitudes of respondents. Positive expectations regarding innovation development have been expressed regarding the promotion of entrepreneurial education and raising the number of start-ups. This corresponds with the survey result which shows a high interest in entrepreneurship, but nevertheless a negligible number of respondents that would actively become engaged in entrepreneurship. As expected, the level of risk acceptance is likely to stay the same in the next years because of the stable cultural setting.

In order to assess future developments, a question regarding the political energy that needs to be invested in order to improve the framework conditions of the Regional Innovation System was raised. Results show that traders in the prediction market expect no change in the level of political activity. Comparing the predicted impact of the tested questions and the related political capabilities reveals a poor correlation between the predicted impact and the expected political action in these areas. Instead of a reactive policy by politicians, there is a need for active policy-making. Therefore the ability of the government to innovate is of crucial importance, especially in those fields where the

predicted impact is expected to be high as the community could be more willing to support efforts in these areas.

There is a variety of challenges to be addressed within the Regional Innovation System in Salzburg to become more efficient such as the relation between basic and competitive funding of fundamental research and the orientation of applied funding to regional needs. Furthermore, public procurement could be a major innovation driver. Yet, statistics in Salzburg and all over Austria leave the impression that it is not a topic being discussed neither in the community nor at political level. Analysing the values and resulting behaviour behind this situation, we find a surprising imbalance in the power distance and uncertainty avoidance that differs from most of the other regions in Europe. Here, we find a cultural pattern that takes a lot of time to change, centuries rather than years. Nevertheless we also find hints that the role of government in changing such attitudes and values has an important influence in creating the scope for cultural change.

The question is how to strengthen the above mentioned Spaces of a Triple Helix System in order to foster the development of the Regional Innovation System in Salzburg. The evolution of the Knowledge Space is powered by the availability of human capital in the region and its education quality. The discussion of the student-faculty relation and the aspects of migration in the sense of brain circulation demonstrates that there is a lot of room for improvement in the management of institutions and the contributions that politicians could make in the framework of their current legal portfolio.

The strengthening of the Innovation Space is more demanding, due to a set of cultural parameters that hinder the emergence of a large number of innovations and innovators. In the given cultural setting, the major responsibility for the lack of innovation in the region is within the management of those organisations that contain most of the well-educated human capital. Entrepreneurial spirit is inherited and transferred top-down. If there is neither motivation nor will for innovative activity in the management of an organization, how should the staff be motivated to do so? These organisations provide perfect opportunities to avoid competition and the implementation of new ideas. The responsibility of management is to motivate knowledge transfer and reduce life-long convenience. The basic spirit for entrepreneurship has to be created in the first sectors of the education system. This challenge has not been met in Austria so far.

The Consensus Space holds the key to a positive development of the Regional Innovation System due to its ability to change existing system elements through strategies, inter-institutional communication lines and other framework conditions.

Salzburg has a solid basis of human capital, but in order to prosper in future, the region will have to find ways to release the potential of the cultural heritage into activities that pave the way for innovation. Most of the human capital represented by graduates entering the job market every year flows into career models that are risk averse and do not call for entrepreneurship. This leaves just a minor part of the human capital available for the transfer of knowledge into innovation.

Mozart 4.0: Innovation based on cultural tradition

1 Introduction

1.1 Rationale of the Study

In a global economy largely shifting towards Asia, and in an ailing Europe still struggling to recover from the economic crisis, Austria, a country in the middle of Europe that has a well developed educational system and access to a European Union market of more than 500 million people, displays significant economic disparities among its regions.

This study analyses the current situation of the Austrian region of Salzburg, one of the Austrian regions with a lower economic and innovative performance, that is characterised by a strong impact of history and culture on society and politics.

The assumption is that the institutional setting would be capable of generating higher growth rates, but the system is not able to convert the knowledge into innovation. This can be seen as a Stand-By-Mode of a region. The system could perform very well if somebody would push the „Power-On“ button. But that doesn't happen. Nobody pushes this button. The Stand-By-Mode doesn't really hurt anybody in the system. Still it uses some energy, but not so much to attract much attention. Everybody in the region is happy administrating the status quo. Nevertheless, the prospects for a prosperous future development are limited.

1.2 Framework Conditions in the Region of Salzburg

Salzburg is a region in Austria with a large cultural heritage and a geography that invites to leisure and tourism. But the region also has the ambition to play a strong role in the national and European innovation community. This study discusses the framework conditions and the consequences for a region deeply anchored in history when intending to design its regional innovation system for an innovation-driven future.

The region and especially the city of Salzburg have a long cultural tradition steeped in history and classical music, both of which have a broad influence on all the regional institutions. The region is

now seeking to build on its deep cultural roots to enhance its innovative capacity and ensure a sustainable development.

Despite the age-long history of Salzburg, dating back to pre-Christian times, it was in the „Gründerzeit“, the period of promoterism, when Salzburg developed its reputation as a centre of culture and arts. Wolfgang Amadeus Mozart is one of the major drivers of fame these days, often coming as a chocolate ball that is better known abroad than all technology could ever be.

In the year 2015 the situation is unchanged: intensive marketing of cultural tradition co-exists alongside efforts to develop a sustainable environment for R&D.

If we compare the percentage of overnight stays of 19.3% in Salzburg [Figure 1.2-a] with other regions in Austria and put it into relation with the region’s share of population in Austria (6.3%) [Figure 1.2-b)], we can see a clear sign of the strength of tourism in the area.

Figure 1.2-a: Overnight stays (%) in Austria, Source: Statistics Austria

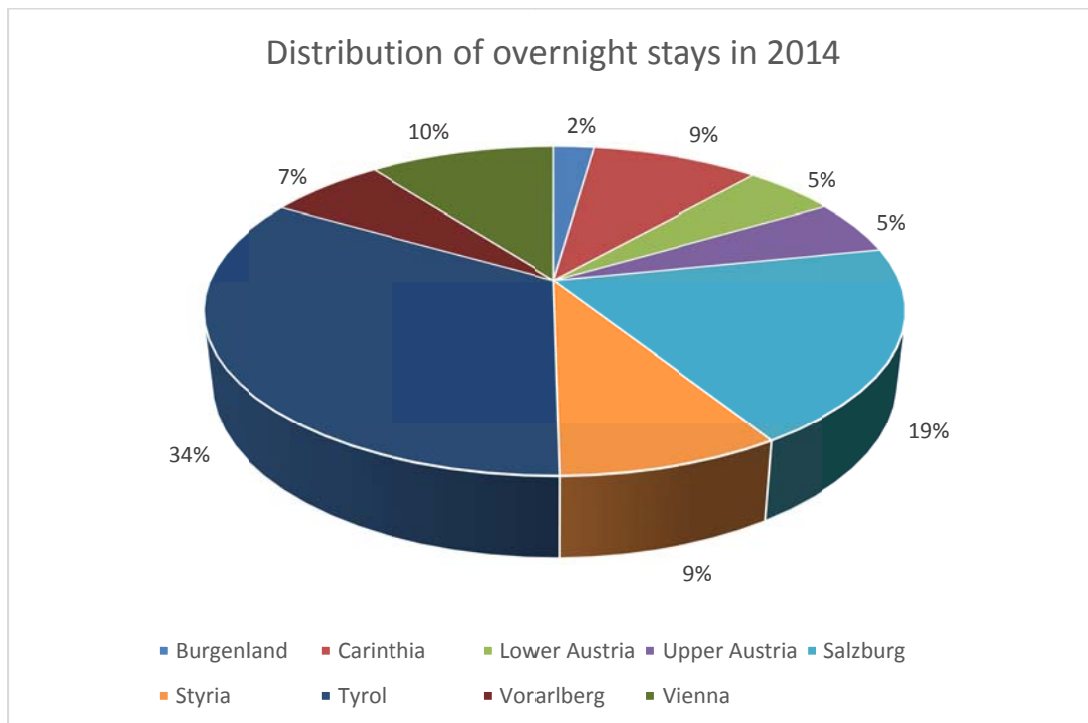
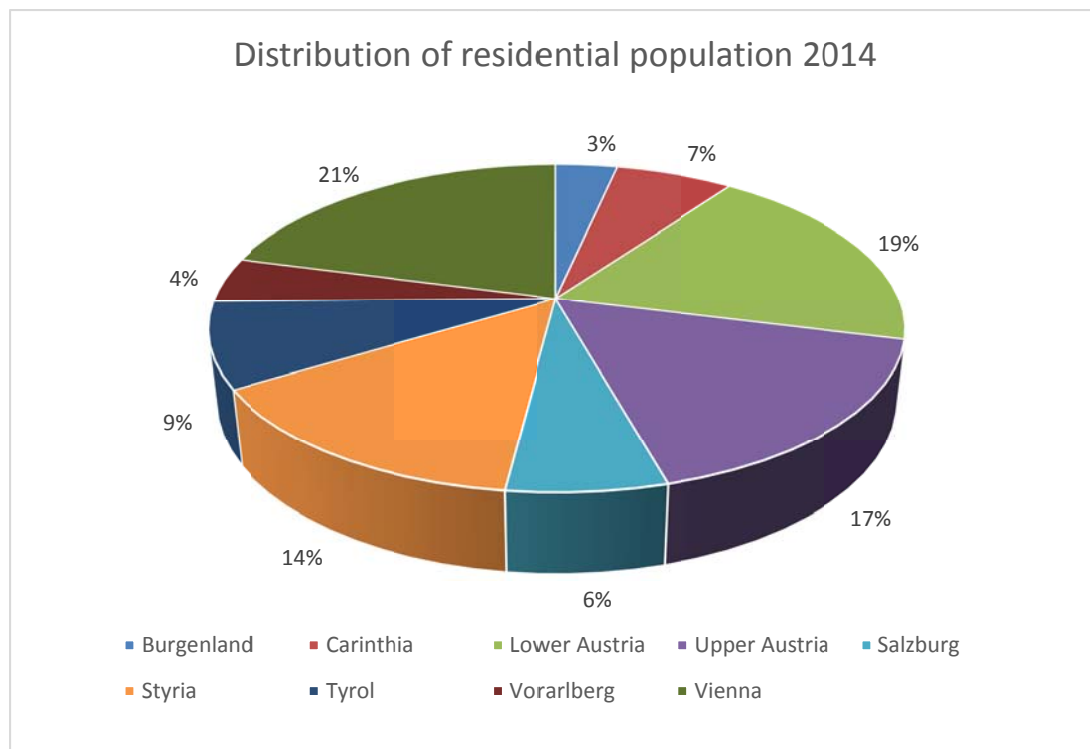
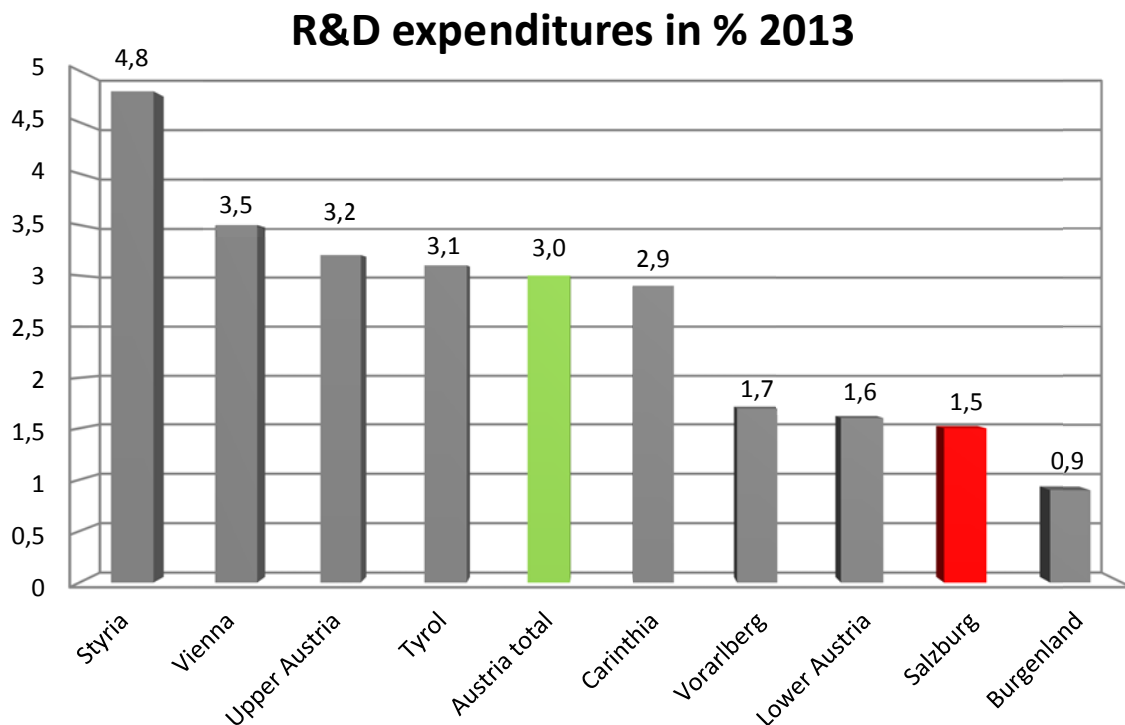


Figure 1.2-b: Share of population (%), Source: Statistics Austria

Tourism also dominates public discourse thanks to the large number of cultural events and the corresponding need for support of private and public funding. A reflection of the numbers of private and public investments into research, technology and innovation is provided in [Figure 1.2-c].

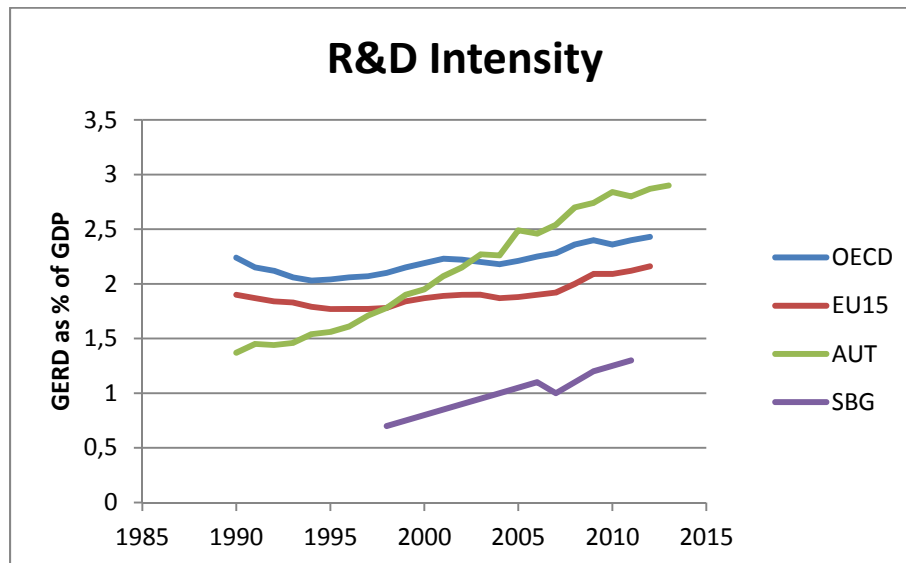
Figure 1.2-c: Gross Regional Products (GRP) 2013, Source: Statistics Austria



The investments of Salzburg are the second lowest in Austria, which means that there is even one region hosting no university - Vorarlberg - that is outperforming Salzburg. The second without a university would be Burgenland, which is behind Salzburg. The Austrian average of R&D expenditures is about two times the number of Salzburg. This picture will be complemented by the analysis in the Innovation Space section [Figure 4.2-s] with a low number of patents applied in Salzburg.

When putting these figures into an international context, we can observe the rising R&D quota of Austria in the last 25 years, with Salzburg unable, however, to follow suit [Figure 1.2-d].

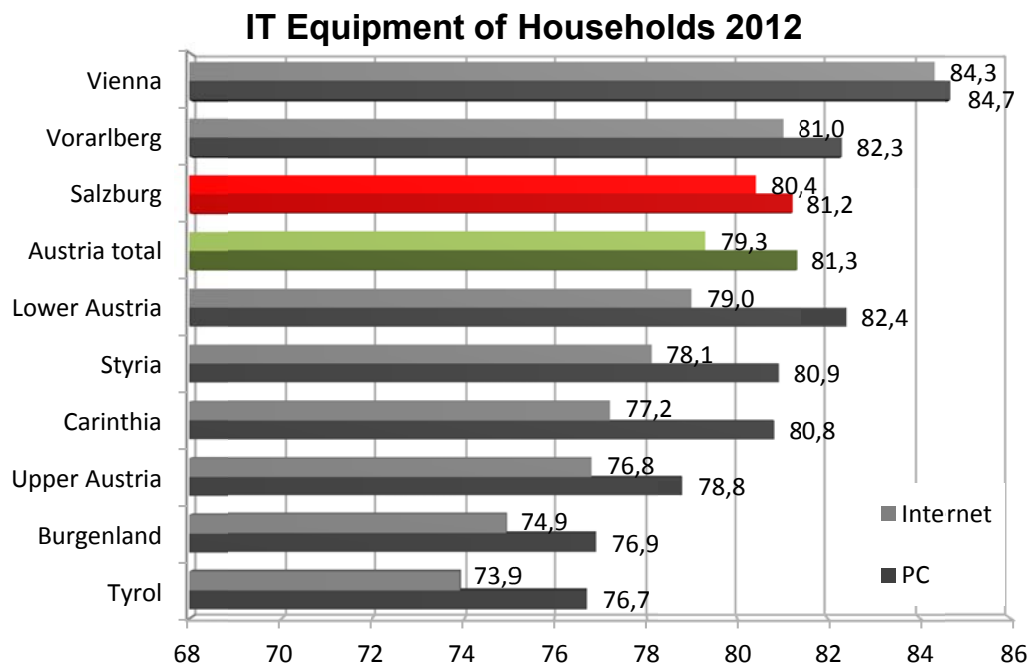
Figure 1.2-d: R&D Quota International Comparison 1990 - 2013



The ambition of a region to enhance its R&D capacity needs an appropriate setting of framework conditions. This paper analyses the actual status, the requirements and the options for action for a region that has its roots deeply embedded in culture and arts and at the same time a clear intention for future sustainability and wealth.

The preconditions for preventing a digital divide in the future can be seen in the distribution of IT infrastructure across the households in [Figure 1.2-e].

Figure 1.2-e: IT Equipment of Households 2012, Source: Chamber of Commerce Salzburg



2 Literature Review and Theoretical Framework

“National prosperity is created, not inherited. A nation’s competitiveness depends on the capacity of its industry to innovate and upgrade”. Porter (2001, p.73) makes clear that it is not luck or fortune that engenders wealth of a region but the ability of individuals and institutions to shape the future.

The literature framework and therefore the theoretical model of this study is based on the Regional Innovation System and Triple Helix models. The review of the literature is organised in different sections including the respective literature that belongs to the topics like regional governance, culture, financing, barriers or demand. Every reference to literature that is mentioned in the analysis or discussion afterwards will be assigned and introduced in this review. Additional literature references will be provided for the embedment of the theoretical framework. It starts with the review of the theoretical framework of Regional Innovation Systems and the Triple Helix and is followed by a variety of further literature references in the broader context.

2.1 Theoretical Framework of Regional Innovation Systems and Triple Helix Systems

The theoretical framework of this study is based on the regional innovation and Triple Helix literature. First, a review of key issues of regional innovation models is provided (e.g. origins, types, differences among them and criticism brought for several weaknesses), then the use of the Triple Helix model in regional innovation research is discussed, in light of the new perspectives it introduced, especially the recent Triple Helix Systems approach.

Regional innovation models entered the innovation policy debate in the early 1990s in the context of a shift from the shortcomings of the ‘traditional’, national state-led regional policy of the 1980s towards a regional endogenous capacity-building policy based on local factors like human capital, business culture and production capacity, education and learning addressed in Moulaert and Sekia (2003). Increasing internationalization of business and technology that blurred national borders and enhanced global competition, and the emergence of regional economic clusters also contributed to the process following Enright (2001). Localized learning, knowledge creation and transfer started to be seen as key to improving the innovation capabilities and performance of local firms, thus building competitive advantage for regions as stated in Asheim and Isaksen (1997), Maskell and Malmberg (1999), Asheim and Gertler (2004) and Asheim et al (2005). Regional innovation and cluster-building became policy objectives for many governments in the advanced economies in view of enhancing regional and national competitiveness (e.g. the BioRegio project in Germany in 1995 for the establishment of regional biotechnology clusters, or the UK government’s cluster-driven industrial policy for regional development since 1998) in Cooke and Memedovic (2003). A similar policy focus on technological modernisation and regional innovation was also present in the European Commission’s plan to narrow development gaps within Europe and accelerate catching-up processes by means of the 1993 pilot project called Regional Technology Plan (RTP) and its successors Regional

Innovation Strategies (RIS), Regional Innovation and Technology Transfer Infrastructures and Strategies (RITTS) and Regional Technology Transfer Projects (RTT). Insights drawn from these initiatives documented the regional innovation dimension of the EC's *Green Paper on Innovation* (Route of action 12) in the paper of the European Commission (1995, p.45)

A variety of regional innovation models emerged in the academic literature of the 1980s and 1990s, from the 'territorial innovation models' family (e.g. 'milieu innovateur' in Aydalot (1986), industrial districts following Bagnasco (1977), Becattini (1987) and Brusco (1986), localised production systems as stated in Bouchrara (1987) and new industrial spaces in Storper and Scott (1988) and Saxenian (1994), to clusters of innovation from Enright (1999) and regional innovation systems in Edquist (1997) and Lagendijk (1998) up to learning regions in Cooke (1998). In spite of apparent semantic coherence, various ambiguities and even divergence appeared when these models were analysed in terms of: (i) innovation dynamics; (ii) role of institutions and organizations; (iii) view of regional development (evolution learning, role of culture); (iv) view of culture; and (v) type of relations among agents and with the environment as stated in Moolaert and Sekia (2003). For example, while innovation is often seen as a way of generating and implementing technology at firm level, there is an ambiguity on the meaning of innovation and culture, and a lack of a functional link between culture and market performance, or between culture and non-market aspects (*ibid.*)

The variety of regional innovation models and their conceptual ambiguities have often been a source of confusion in the definition and validation of empirical representations of regional innovation systems as stated in Doloreux and Parto (2004). While some argue that, due to the more descriptive than explanatory conceptualization of regional innovation systems, all regions have some kind of regional innovation, albeit very different in their effectiveness argued in Bunnell and Coe (2001), others identify features in the absence of which a region cannot be considered to be an innovation system, e.g. a collective identity generated from local competencies following Cooke et al. (1997) or a mechanism for knowledge integration brought forward in Vilanova and Leydesdorff (2001). The lack of conceptual clarity was attributed to the strong emphasis on process and inter-firm relations, in line with the Schumpeterian perspective and the main tenets of evolutionary economic theory stated in Cooke et al. (1997). This emphasis on process, rather than on structure, agency and performance, or in other words, no clear attribution of power, responsibility, or possible responses from the actors concerned, is seen as a cause for the proliferation of many "fuzzy concepts" in the regional innovation literature like Markusen (1999). Also, the continuous redefinition of regional innovation models through empirical investigation, e.g. at the level of main institutional actors and of the innovative profile and competitiveness of the region, have added to the 'fuzziness' in Doloreux and Parto (2004). However, the lack of conceptual clarity is not necessarily a reason to reject the regional innovation system theory, but rather to increase awareness on their variety and difficulty to replicate them comparing Cooke (2001) and Iammarino (2005).

Improved conceptualizations of regional innovation systems have been facilitated by further clarifications in: the definition of a region and the role of institutions, the distinctions between different scales of innovation found in Parto (2003), Doloreux and Parto (2004), Cooke et al (1997), Bunnell and Coe (2001), Cooke (2001; 2005) and Cooke and Schienstock (2000), and other definitory elements, such as: the knowledge base, industry and technology specialization, institutional arrangements and governance structures, corporate organization of firms, etc. as stated in Howells (1999), financing for strategic investments in innovation infrastructures, institutionalised learning

and productive culture conditioned by trust, reliability, exchange and cooperative interaction in Cooke et al. (1997), and cultural factors in Cooke (2005). Three of these key elements are discussed in more detail below, in light of their relevance to our study: the regional knowledge base, industrial specialization, and cultural factors.

- A region's knowledge base is seen by Autio (1998) as a set of two separate sub-systems: a knowledge generation and diffusion sub-system, consisting of local public research institutions, universities, technology mediating organizations, etc., and a knowledge application and exploitation sub-system, consisting of industrial companies, with their customers and horizontal and vertical networks. The interplay between tacit and codified knowledge in firms is a critical element for a region's knowledge base. Two types of knowledge have a critical role in determining the innovative capabilities of regional industries: an analytical one (in science-based industries) and a synthetic one (in engineering-based industries). They have different mixes of tacit and codified knowledge, different sectoral and policy support implications, and different relations to geographical proximity (more important for industries relying on a synthetic knowledge base and less so for industries drawing on an analytical knowledge base) (Asheim and Coenen, 2005; Martin and Moodysson, 2013). Knowledge-intensive sectors in production and services are important not only at the regional level, but also for national and international innovation systems, due to complementary interactions that each region must build in response to the knowledge-based global economy. Such external interactions outweigh internal innovative competences and construct a 'knowledge monopoly' to stand out in the global landscape (Tödtling, Lehner and Trippel, 2006; Ronde and Hussler, 2005; Malecki, 2010). Therefore, apolicy interventions need to consider both the nature of a region's knowledge base, as well as its institutional setup (Martin and Trippel, 2014).
- A region's industrial specialization depends on specific local factors, such as economic structures and industrial legacies, and efficiency in generating new knowledge, resulting from the R&D intensity of the local private sector and public research institutions (Martin and Sunley, 2006; Fritsch and Slavtchev, 2010). Regions with a higher specialization in high-technology services, or close to such regions are more innovative, due to a higher capacity to transform knowledge into innovation (Rodriguez, 2014). In contrast, regions with path dependency patterns are slower in the process of building location-specific industrial specialization and competitive advantages (David, 1985). In old industrial regions, path dependency may lead to lock-ins and slow industrial restructuring that may be difficult to correct through policy interventions (Hassink, 2005; Lambooy and Boschma, 2001). In less favoured regions (peripheral, old industrial and metropolitan), lock-in, fragmentation and organization 'thinness' can be major barriers to innovation (Tödtling and Trippel, 2005).
- Culture, seen as attitudes towards innovation, technology, exchange of knowledge, entrepreneurial activities, business and uncertainty (Hofstede, 2001) is an integral part of a regional innovation system, through its influence on institutions and individual actors, and the relations among them. The cultural settings of a region are extremely stable due to collective beliefs and values that give a distinct identity to the local people. This stability is further reinforced by the cultural patterns of regional institutions, which themselves emerged as products of the dominant cultural value system (*ibid*). Two cultural dimensions are important in the process: a *spatial dimension*, given by the attractiveness of specific locations to the creative class, and an *organisational dimension*, related to how public or private organisations can influence innovation (Gee and Miles, 2008). In changing an innovation culture, much depends on the transmission of attitudes from one generation to another, especially when they share geography and scientific focus (Azoulay et al, 2009).

In the regional innovation literature, cultural factors intervene in different ways in different models: as trust and reciprocity in 'innovative milieus' and industrial districts, as networking and social interaction in the new industrial spaces, as part of a local society-culture nexus for development in local production systems, as a source of learning by interacting in the regional innovation systems, and as part of the interaction between economic and social life in learning regions (Moulaert and Sekia, 2003). Later studies highlight cultural factors as a key dimension of high-tech clusters (e.g. Saxenian, 1994; James, 2005; Saliba et al. 2012; Salo, 2014), high-density art, cultural and media clusters (Currid and Connolly, 2008), 'cultural districts' (Le Blanc, 2010), 'cultural technology districts' (Di Pietro et al. 2014) and open innovation environments (Todtling et al. 2011). Regional cultures of innovation are part of the framework conditions for creating a knowledge economy and inform the organizational culture of incumbent firms in specific regions (Cooke et al., 2004; Cooke and Rehfeld, 2011), and 'productive culture' is one of the key subsystems of a productive region, which is locally embedded and operates through the local companies, networks and social system, determining the type of development in the region (Cooke, 1997). Other cultural aspects involved in regional innovation systems also include: a culture of cooperation, associative culture, and learning culture (*ibid.*). Newer insights into the complexity of a regional innovation system's culture have been derived by applying the concept of 'cultural framing' at the intersection of five frames (ethnic, landscape, political, labour and business) and four dimensions (attitudes and values, institutional setting, values, and impact) (Cooke and Rehfeld, 2011).

In spite of the remarkable volume and variety developed over the last two decades, the regional innovation systems literature is often criticised for lack of clarity and answers to several theoretical, empirical and policy issues. For example, Doloreux and Parto (2004) highlight the absence of a unified conceptual framework that could guide research and policy, as well as far too much emphasis on 'local' institutional landscape without much detail on the nature of institutions and their interactions. Uyarra (2007) notes the use of concepts based on assumptions that are often overstated and, in some cases, are not sufficiently grounded in empirical evidence. Asheim et al (2011) refer to gaps in explaining the very nature of the regional innovation system itself, the boundaries of industrial districts, clusters and regional innovation systems, the role of cognitive frontiers, knowledge transfer and learning. Sternberg (2007) identifies a lack of focus on the entrepreneurial dimension and a dominance of empirical studies on intraregional networks and linkages between innovative actors.

In the last fifteen years or so, an increasing body of regional innovation research has been developed in different parts of the world using the Triple Helix approach of innovation driven by university-industry-government interactions, which highlights the key roles played by universities, on the one hand and governments, on the other. For example, Casas et al. (2000) document the emergence of regional knowledge spaces in Mexico, built upon institutional interactions between public research centres and firms, and stimulated by government intervention. Defazio and Garcia-Quevedo (2006) highlight the role of the Catalan regional government in shaping the local S&T/R&D systems, and

Rolfo and Calabrese (2006) present a similar case for Italy. Portugal cases (e.g. Castro et al. 2008; Natario et al. 2012) sustain a triple helix-based model of organising institutional networking in both national and regional systems, especially in developing economies based on traditional and mature sectors, and in less favoured regions. Uneven concentrations of regional innovation capacities have been identified, from a Triple Helix perspective, also for Sweden (Dannell and Persson, 2003; Coenen, 2007; Coenen and Moodysson 2009), Finland (Jauhiainen and Suorsa 2008), UK (Huggins, 2008; Smith and Bagchi-Sen, 2012). These studies point out to the emergence of distinctive patterns of regional innovation and development that are determined by the relative dominance of the three components of the Triple Helix, and have higher intensities in high-growth sectors and lower intensities in small or peripheral regions. In the latter case, governments are called to provide proactive and fine-tuned policies to construct regional advantage and correct the region's weaknesses, skills and knowledge flows to the big regions, and lower role in high-technology. More recent studies use the Triple Helix approach also for investigating the relationship between universities and the regional creative economy, with strong implications for regional innovation and development (e.g. Augustinaitis and Reimeris, 2012; Suciú et al. 2013; Comunian et al, 2014).

A new framework for the analysis of Triple Helix interactions at regional level was introduced by the Triple Helix Systems approach (Ranga and Etzkowitz, 2013), which unifies elements of the Triple Helix model into an 'innovation system' format composed of components, relationships and attributes (functions), according to the innovation systems theory (Carlsson and Stankiewicz, 1991; Carlsson et al., 2002; Carlsson, 2003; Edquist 2005; Bergek et al., 2008). A Triple Helix System conceptualizes innovation as a set of actors and activities in the Knowledge, Innovation and Consensus Spaces that need to have strong and effective connections among them. The Triple Helix Systems framework provides a fine-grained view of innovation actors and relationships, and transcends sectoral or technology boundaries by focusing on the interactions between actors from all the three spaces. It explains variations in regional innovative performance by the structure of and articulation between the spaces, and can help regional innovation policy-making to be better tailored to the needs of the system's actors. On these grounds, the Triple Helix Systems approach is used in our study for its capacity to counterbalance some of the weaknesses of regional innovation models discussed above, such as unclear conceptual framework, too much emphasis on 'local' institutions without much detail on the nature of the institutions and their interactions, lack of focus on entrepreneurial activities.

2.2 Literature Review on Regional Governance, Innovation Culture, Demand, Barriers, Institutions and Financing in the Context of the Study

The role of the historical and cultural background of a region in influencing its capacity to change specific framework conditions and modify the speed and direction of change is a challenging question. This concerns, on the one hand, politicians and policy-makers who have a direct responsibility to promote these changes, and, on the other hand, the society they represent, and the type of relationship between the political system in place and society. Patterns in societal attitude towards science and innovation are important drivers of political decision-making. This relationship between society and politics can be much stronger than the relationship between politics and the research and innovation system, or society and the research and innovation system.

If the politicians are convinced that society is indeed interested in innovation, they will invest more energy into implementation activities. Some of the answers to these issues can be found in the culture of the region, whereby culture has many dimensions so that it has to be defined properly. If one searches the web for „culture“, there are about 500 million hits. What we want to focus on in this paper is the “spatial and organisational culture” as it is described in Gee and Miles (2008) with an emphasis on the part that is looking at spatial regional culture.

There have to be some fundamental limitations to the influence of the political system on the framework conditions of a regional innovation system. Politics should set the framework, it should not involve itself in the systemic process, one exemption being sociopolitical questions. Using that argument politicians often go further than they should - and fail. Politics cannot simply steer the wheel and change cultural patterns. But it can have visions and by these means change attitudes and values over generations. The other option politicians have in a shorter period of time is to understand the cultural patterns and adapt the legal and regulatory framework conditions for the best outcome. We therefore design a hypothesis that asks for exactly this kind of political energy that is needed to take the necessary decisions and adapt the framework conditions.

As there is strong feedback from (innovation related) society to the politicians, this can be regarded as a perpetual motion machine that according to Wikipedia “describes motion that continues indefinitely without any external source of energy”. If we transfer that to the innovation outreach, the society will be interested when there is information made available, as on a Science Day, or other awareness measures initiated by the government. Politicians will be more willing to invest time and money into the innovation system if they are convinced that their potential voters are interested in research issues. There is one critical point in the theoretical functioning of the perpetual motion machine that can be fully transmitted to our question: It has to be activated once. In regions where this works well, it has often been activated by a player serving in the Consensus Space. It need not necessarily be the political system or society itself.

These statements suggest that there is a certain, even strong role played by public policy within the responsibility and actions taken by politicians. This can be discussed and proven in Furman et.al. (2001, p. 930) with the conclusion that “public policy plays an important role in shaping a country’s national innovative capacity” where this term of the innovative capacity is defined as “the ability of a country to produce and commercialize a flow of innovative technology over the long term” (p. 899).

The step from country level to regional and local dimensions is discussed in Marquis and Battilana (2007, p.2) with the influence of local communities on institutions within their region. The main content of this paper is the role of universities in their environment because “local public authorities

may thus rely on universities to influence organizational and economic behavior, in particular to promote cooperation between organizations within the local community“.

When it comes from public policy to public R&D expenditure Guellec and v. Pottelsberghe (2000, p.3) discuss the “impact of public R&D expenditure and business R&D“, which will be addressed further in [Chapter 5].

The correlation between R&D and firm growth is discussed in Stam and Wennberg (2009, p.77) stating that “R&D matters for a limited but important set of new high-tech and high-growth firms which are key in innovation and entrepreneurship policies“. This marks innovative start-ups as important drivers of economic growth. Likewise the topic of entrepreneurship and firm formation is discussed in Klapper et.al. (2010, p.129), the basic line being that “entrepreneurship is essential for the continued dynamism of the modern market economy“. This topic too will be addressed in [Chapter 4.2.1.3].

The main intention of being innovative for companies is to make profits, but for a broader macro-economic view we use the discussion of Ahlstrom (2010, p.20) who claim that “profits are important but the main goal of a business should be to develop innovative new products – products that will generate growth and employment while also being economical and increasingly accessible to a wider range of the world’s population“.

Innovation Culture: The impact of cultural framework conditions on innovation has been discussed in theory but there is not too much evidence available in empirical reviews like in Didero (2008, p.3) that aim to “identify existing empirical evidence about the type of differences in the innovation culture between the regions and countries“. The dynamics in a Regional Innovation System include in its wider framework also the culture as an influencing factor in the institutions and their relations with each other. Hofstede (2001) argues by using terms of attitudes towards innovation, technology, exchange of knowledge, entrepreneurial activities, business and uncertainty. He analyses the cultural settings of regions and countries regarding their collective beliefs and values. Hofstede (2001, p.385) also finds evidence in his analysis of uncertainty and power distance that Austria is a special case regarding the reduction of uncertainty through power distance. The consequences and impact on demand conditions will be discussed in [Chapter 5.2].

The uncertainty undoubtedly also influences the readiness for change or deviations from norms people have been socialised with. This is one of the major indicators in Florida (2012, p.2) regarding the ability of an economy to attract and make use of the “creative class“. Their impact of these indicators will be discussed in [Chapter 5.2]. The same author contributed to the discussion of Lee et.al. (2004, p.1) with „a regional analysis of new firm formation“ regarding creativity and entrepreneurship.

Following Gee et.al. (2008) the cultural dimensions to be addressed are on the one hand the spatial dimension with “for instance the attractiveness of specific locations to the creative class“ or, on the other, the organisational dimension „in respect of economic organisations, with questions adressed at how corporate, small business and/or public sector cultures facilitate, inhibit, or otherwise shape innovation“ (p.2).

In this respect one of the most important issues regarding culture is what culture actually means for entrepreneurship regarding the “social, economic and institutional circumstances that reward innovation and risk-taking“ (p.2). They find that “links between attitudes and values, institutions and regulations, responses to innovative ideas and products, entrepreneurship and risk-taking, and

creativity and innovation, are all relevant“ (p. 58). The respective data for start-ups and spin-offs in Salzburg will be given in [Chapter 4.2.1.3] with an extended discussion following in [Chapter 5]. The attitudes and values in the cultural context are also addressed by Inglehart (1997) who put it together into a „Culture Map of the World“ shown in [Figure 4.2-a].

The important aspect of the impact of cultural traditions on the current economic development is described in Tabellini (2005) with the main finding that “in cross country comparison, distant history appears to be an important determinant of current economic performance“ (p. 30). This insight is further illustrated in the same paper with the statement that “the indicators of culture used in the paper strongly correlated with economic development“ bearing in mind that „culture is still largely a black box“ (p.31). If we look at regional comparisons of entrepreneurial culture and their effects on the economic development, we find in Beugelsdijk (2007) that “differences in economic growth in Europe can be explained by differences in entrepreneurial culture, albeit mostly in an indirect way“ (p.187). In this analysis data from 54 European regions was used to test the core idea that entrepreneurial culture is beneficial for economic performance, both directly and indirectly. Regarding the results of this sample “the extensive robustness analysis largely supports the claim that regions that have experienced higher economic growth rates have a culture that can be characterized as entrepreneurial“ (p.205).

The mentioned societal involvement is also dependent on predetermined historic development in the regions. Schumpeter (1934) called this an “entrepreneurial spirit“ that should be brought in by entrepreneurs and can be “divided into visionary beliefs and leadership abilities“. A more recent paper on the innovation climate including societal involvement is provided by Belitz et.al. (2011) showing that one main pillar of the innovative capacity is “the societal climate of innovation in a country consisting of innovation culture, attitudes towards science and technology as well as social capital and trust.“ (the other pillar being the National Innovation System). In a former work on the influence of attitudes and values on the innovation capabilities Belitz and Krin (2008) confirmed the positive correlations between the levels of innovation climate in a region and the respective innovative activities. After getting some evidence from an actual survey in [Chapter 4.3.2.2] there will be a discussion in [Chapter 5.1.1].

The change of the climate of an innovation culture is dependent on the level of social influence that connects one generation of researchers to the other. Azoulay et.al. (2009) find that scientists “adopt their advisers’ orientations toward commercial science as evidenced by the transmission of patenting behavior“ (p.2). The dominant factors of matching between these two groups are geography and scientific focus. The results show clearly that “exposure to a patenting postdoc adviser significantly increases a Scholar’s subsequent propensity to patent“ (p.32). This means that “advisers’ patenting behavior is imprinted on their trainees“ (p.33). The general observation of the paper is that “when actors connect based on a small set of attributes, it is often the case that some set of additional characteristics, which was never considered when a choice was made to develop a relationship, nevertheless become socially transmitted“ (p.34).

The question of imprinting is also discussed in Eesley et.al. (2014, p.33) demonstrating that “the organizational context where the venture idea was born shapes the strategic options available to the venture, and results in different performance depending on the business environment“. They find „that imprinting occurs both through the organizational context of venture ideation and through interaction with founder characteristics“.

When introducing innovation culture in the last paragraphs we had national or regional innovation culture in mind. It should not be neglected though that corporate culture, too, causes considerable

impact on the innovation performance of a region. Tellis et.al. (2009, p.3) address corporate culture as a “strong driver of radical innovation across nations”, which will be discussed in [Chapter 5.2].

Demand: Current debates in research and innovation are largely dominated by the supply side, including the innovation policy-makers at the political and civil servants level who try to put in place sophisticated programme measures for the community to use and to propose their research projects on. There is little attention on the demand side of innovation policy, reflected in a minor share of research papers. One reason is that the demand-pull model had been discussed intensively in the 1960s and 1970s and then disappeared into the multidimensional model, which can be seen in Godin and Lane (2013, p.32) as they have simply added complexity to the linear model“. It should be mentioned that in the course of the debate “need was whittled down to demand. Demand fits into economic theory and models while need does not“. (p.33) Nevertheless we will also focus on the discussion on demand, especially in the analysis in [Chapter 4.2.1.6] as well as in the discussion in [Chapter 5.2]. Demand for innovation has many different aspects. Two of them shall be mentioned here. It is on the one hand society itself with the consumers in the central role and public procurement on the other. In a report for the European Commission Business Decisions Limited (2003) described the power of consumers to drive innovation. The data of the respective survey will be provided in the analysis of the Innovation Space [Chapter 4.2.1.6].

Public procurement has become a topic of political discussion in most of the EU Member States in recent years. As Porter (1990) and more recently Edler et al. (2007) stated, public demand is “a major driver of any regional innovation system“. Especially the local effects of demand will be creating a critical mass to be able to implement and test new ideas, which is crucial to further expansion into globalised markets. A survey brought up in Georghiou et.al. (2012) confirms “that the barriers encountered by firms correspond to the deficiencies addressed by policies but do not address them sufficiently. The scope of policy measures needs to be extended in time, breadth of reach and depth“. The source of these deficiencies is located within the fact that “to design public procurement as an innovation policy tool still means that it is necessary to improve the cost benefit of a public organisation performing its function“.

Allman et. al. (2011) describe the wider framework conditions that are necessary for successful innovation. They rank demand as the “third most important framework condition after talent and competition“ (p. 27). That fact is proven empirical by the survey „Innobarometer“ (European Commission 2009) in which just a third of the investigated group of companies stated that supply side policies like taxation or direct subsidies have positively affected enterprises innovation activities (p.11). In contrast, variations were especially pronounced in “how much enterprises felt that demand side policy changes (i.e. changes in environmental or other regulations or in services provided by intermediaries) positively influenced innovation activities: those in the high-tech manufacturing sector (54%), in the large enterprise segment (61%) and those who felt that innovations can be sold as part of public procurement contracts (63%) were able to capitalise on such changes“.

Edler (2009) discusses the framework for demand conditions and demand policies in different European countries and states that a “catch up process could potentially be accelerated through a more explicit and systematic orientation towards demand for innovation – rather than focusing on supply side conditions“ (p.0). This does not mean that supply side measures should be stopped but the focus of discussion should be oriented towards demand conditions as they are treated very poorly in current policy design. The definition offered defines it as “a set of public measures to increase the demand for innovations, to improve the conditions for the uptake of innovations and/or to improve the articulation of demand in order to spur innovations and the diffusion of innovations“ (p.3). Regarding public markets the important variables of „corruption“ and „trust“ are introduced that “incentivise companies to invest in innovation activities and to enter into public market“, when

“the competition is based on clear criteria and [...] the best value for money succeeds” (p. 17). Society is also included with the statement that “demand oriented policies should try to influence the innovation culture in the society in general, trying to encourage more risk taking in consumers as buyers, making them aware of innovations and empower them to use them” (p.26). There are two indicators available on the national level that is introduced in (p.11) with the World Economic Forum Survey asking business leaders about how they perceive the demand situation. The results will be shown in [Figure 4.2-p/q]. There are no other valid indicators for the demand side, which shows the strong focus of political debates on the supply side.

Barriers to Founding Companies: Eberhart et. al. (2012) investigated the impact of failure barriers to the performance of new ventures. They found that the number but also the “type” of individuals who found companies vary with legal framework conditions known as potential barriers to entrepreneurship. (p.26ff) “Government policy that lowers failure barriers in the institutional environment influenced the decision of elite individuals to enter bankruptcy and start new firms, and that their firms are more likely to achieve superior firm performance.” One of the reasons is that these elite individuals have attractive alternatives to founding a company and are encouraged to do so by lowering failure barriers. This also includes the important conclusion that not just the number of individuals to found companies is essential but, even more so, the quality of entrepreneurs.

Literature on bankruptcy includes an unpublished background report of DG Enterprise in order to support the Competitiveness Report 2008. It states that a growing number in literature “suggests that bankruptcy law is an important determinant of entrepreneurial activity and entrepreneurial growth. The statistics “Doing Business” of the World Bank states for Austria that it is ranked number 21 regarding the level of ease when closing a business. The average time to close a business is 1.1 years and the recovery rate is 72.4 Cents on the Dollar (2008).

Armour and Cumming (2004, p.1) show that “temperate bankruptcy laws stimulate entrepreneurial demand for venture capital”, which will be further referred to in [Chapter 4.3.2.1].

Institutions and Funding: The literature on the influence of institutional changes and the different effects of public and private funding mechanisms contains a broad basis for discussion on the significance for regional innovation systems. Eesley et.al. (2012) review some of the literature that focuses on the impact of public R&D and financial institutions on firm innovation and chooses a Chinese project to find relevant evidence. The important observation (p.32) is that “belief-changing policies, particularly those directed at educational institutions, can indeed alter entrepreneur’s beliefs and shape their behaviors” with an important amendment that “the degree to which this altered entrepreneurial beliefs and behaviors lead to higher performance will depend on that organizations and institutions are all embedded in the national level institutional environment”. A further discussion is included in Eesley (2009), regarding the direct implications of the institutional environment on entrepreneurship and the type of human capital involved in foundation activities. This will be discussed in [Chapter 5.3.5]. Especially the impact of IPR activity of universities is discussed by Astebro et.al. (2009) with an analysis of the role of the university in managing their own research results and the consequences for the local economic development. The impacts on the funding analysis are included in [Chapter b].

Universities have a special position in the Knowledge Space as shown in [Chapter 4.1.1]. The connection with the Innovation Space has some references in the recent literature. Roberts et. al. (2011) find evidence that the role of university alumni have some impact on the level of entrepreneurial activities. In a survey including MIT alumni from 1930 up to 2006 they find that living MIT alumni “founded companies that employ 3.3 million people and generate annual world revenues of nearly 2 trillion, producing the equivalent of the 11th largest economy in the world.” The

precondition according to this paper is that “universities must create a culture and programs that make entrepreneurship widely accessible to students.” The numbers for the region of Salzburg will be provided in [Chapter 4.2.1], with the discussion following in [Chapter 5.3.3].

The impact of universities on regional innovation is detailed in Uyarra (2008, p.16) with the opinion that “the missions ascribed to universities are seen as progressively expanding from traditional activities such as teaching and research to include market-oriented and knowledge transfer activities, as well as non-economic contributions to the region’s development.” That argument will be discussed further in [Chapter 5.3.1].

Universities are central players in any Regional Innovation System, not only because of their different functions that they have to fulfil as a single institution, but also in their role as a link to other institutions within the region. Stuart and Sorensen (2007, p.211) point to the „centrality of networks in every aspect of the entrepreneurial process“. The topic will be further discussed in [Chapter 5.3].

Financing: Considering the fact that it is extremely difficult to test the effects of financial constraints, Kortum and Lerner (2000, p. 691) found that “venture capital accounts for 14% of US innovation activity and that a dollar of venture capital stimulated three times more innovation than a dollar of private firm R&D“. Furthermore it is summed up with the statement that “increases in venture capital activity in an industry are associated with significantly higher patenting rates“ (Kortum and Lerner 2000, p. 674).

The interrelation with public funding is, first, that in the US SBIR Funding “crowds out firm-financed R&D spending dollar for dollar“ (Wallsten 2000, p.82) but that second SBIR funded firms grow faster than non-SBIR firms according to Lerner (1999) because of the “certification effect“ of the government allowing these firms to raise more private funding with the comment that this happens especially in regions where venture capital is available.

The analytics for venture capital are derived within the European Venture Capital Association (EVCA) in their PEREP analytics section (<http://www.evca.eu/research/about-research/perrep-analytics/>) and discussed in [Chapter 4.2.1.4]. In the same chapter there is a statement on the role of public policy within the venture capital industry as discussed in Keuschnigg (2003, p.0) which considers “short- and long-run comparative static and welfare effects of policy reform with regard to capital gains taxation, innovation subsidies, public R&D spending and other policy initiatives“. More details of “the effects of tax policy on venture capital activity“ are addressed in Keuschnigg and Nielsen (2004, p.175) and further discussed in [Chapter 5.3.5].

The institutional importance of universities and other institutions of tertiary education is confirmed by Coe et.al. (2008) who find “evidence that countries where the ease of doing business and the quality of tertiary education systems are relatively high tend to benefit more from their own R&D efforts, from international R&D spillovers, and from human capital formation“ (p.21). They specify that these effects get visible when the quality of tertiary education ranks among the best third.

We close the topic of financing with a link back to innovation culture. Malmendier and Nagel (2011, p.373) stated that “individuals who have experienced low stock market returns throughout their lives so far report lower willingness to take financial risk“. This fact is in line with the overall principle that social environment shapes attitudes and beliefs of individuals.

3 Methodology

3.1 Conceptual framework

The innovative capacity of the region of Salzburg is analysed from the perspective of the Triple Helix Systems conceptual framework. Institutional and individual innovation actors encompassed by the Knowledge, Innovation and Consensus Spaces are described, together with measures for knowledge and innovation diffusion among the spaces and various mechanisms of public and private support for strengthening them.

3.2 Research method

The case study was chosen as the research method for this study, and the focus was placed on Salzburg, one of the nine Austrian regions at NUTS 2 level. This region was selected in order to: (i) examine the way in which its rich cultural traditions have influenced the current structure and performance of regional research and innovation activities, (ii) assess how the existing research and innovation performance of the region can be improved for a sustainable development in the future. A qualitative analysis of the Salzburg region has been performed based on available regional data, which is relatively scarce at the NUTS-2 level. The performance of the region has been compared to that of other Austrian regions and some other foreign regions with different cultural backgrounds regarded as benchmarks in the academic discourse. A multiple set of regions with different cultural backgrounds has been selected.

a. Research Questions – Discussion of results in [Chapter 5]

1. What can we learn from the analysis of the Spaces in [Chapter 4] about how government can promote a successful innovation culture in the region (e.g. entrepreneurial spirit, knowledge spillovers, risk tolerance)?
2. How important is the demand side of the innovation system for the development of a Regional Innovation System and how could the impact of the innovation culture on the demand be discussed?
3. What are further options for improvement in the Regional Innovation System in Salzburg and how should they be discussed?

4 Analysis/Results

The Triple Helix System of Salzburg is described in terms of the Knowledge, Innovation and Consensus Spaces. As there are institutions that can be assigned to more than one Space, it will be mentioned repeatedly according to the appropriate functions.

4.1 The Knowledge Space

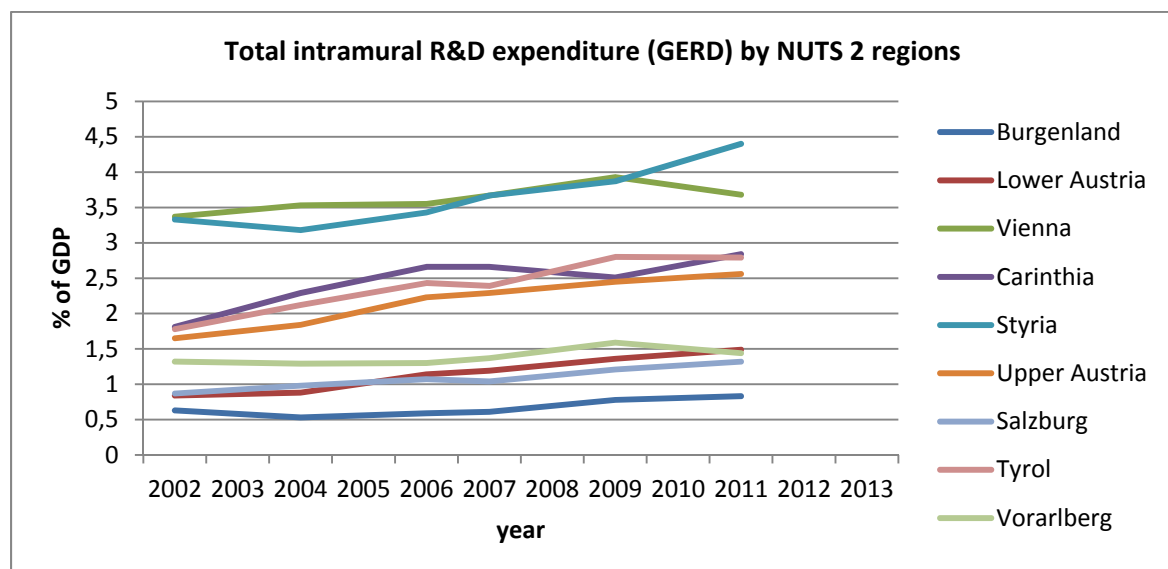
This section focuses on two key features of the Knowledge Space:

- a. 4.1.1. Institutional actors, represented by universities, research institutions and R&D-intensive companies, and individual actors (human resources for R&D)
- b. 4.1.2. Publications, as a key element of knowledge production and diffusion in this space

4.1.1 Institutional actors: universities, research institutions, R&D-intensive companies, individual actors

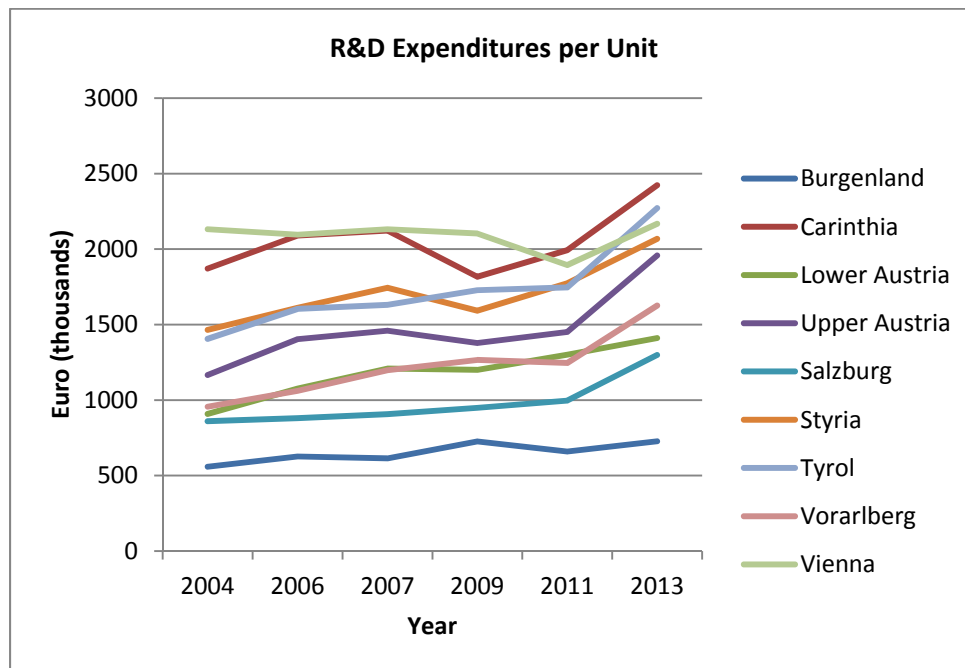
The government expenditure on research and development (GERD) shown in [Figure 4.1-a] is an indication for the commitment of policy and the respective absorptive capacities in a region.

Figure 4.1-a: Government Expenditure on Research and Development 2002-2011, Source: Eurostat



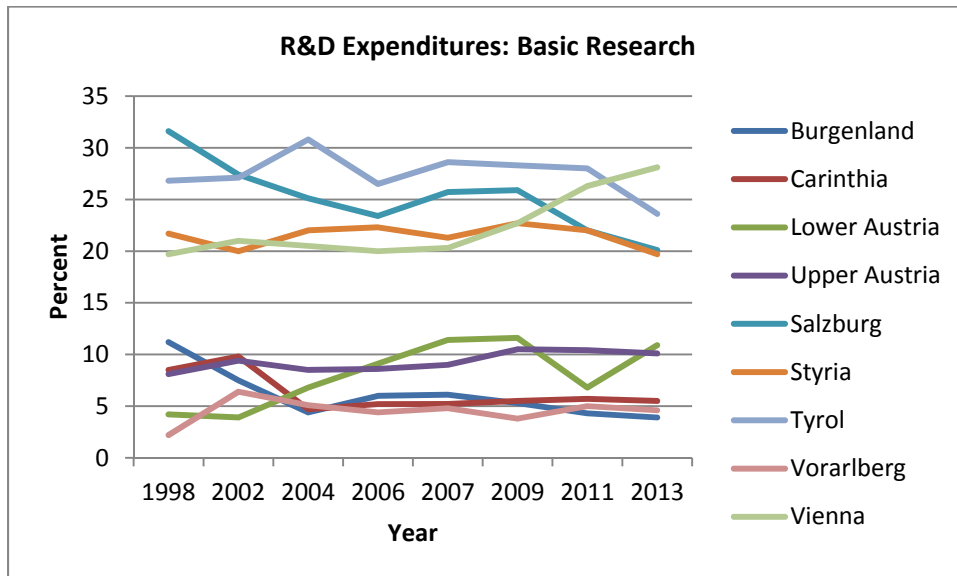
In 2011, Salzburg was on the second lowest level, only leaving Burgenland behind. The Barcelona target of the European Union was a 3% R&D quota in the GNP for 2010. At that time Salzburg managed to invest only a little more than 1 % into R&D. At the same time Styria crossed the 4 % threshold. Carinthia and Tyrol, with similar size and institutional structure, nearly met the 3 % target. We conclude that the absence of establishing R&D capacity has even slowed down the growth of the absorptive capacity in Salzburg so that this target will be hard to met in the next years unless there is a major additional R&D structure or a suitable company with a large number of R&D personnel settled in the region. Statistics Austria counts the economic units that are active in R&D in every region and provides a comparison with the respective expenditure on a regional level. If we correlate these two numbers we find the expenditures per unit shown in [Figure 4.1-b].

Figure 4.1-b: Expenditures per Unit, Source: Statistics Austria



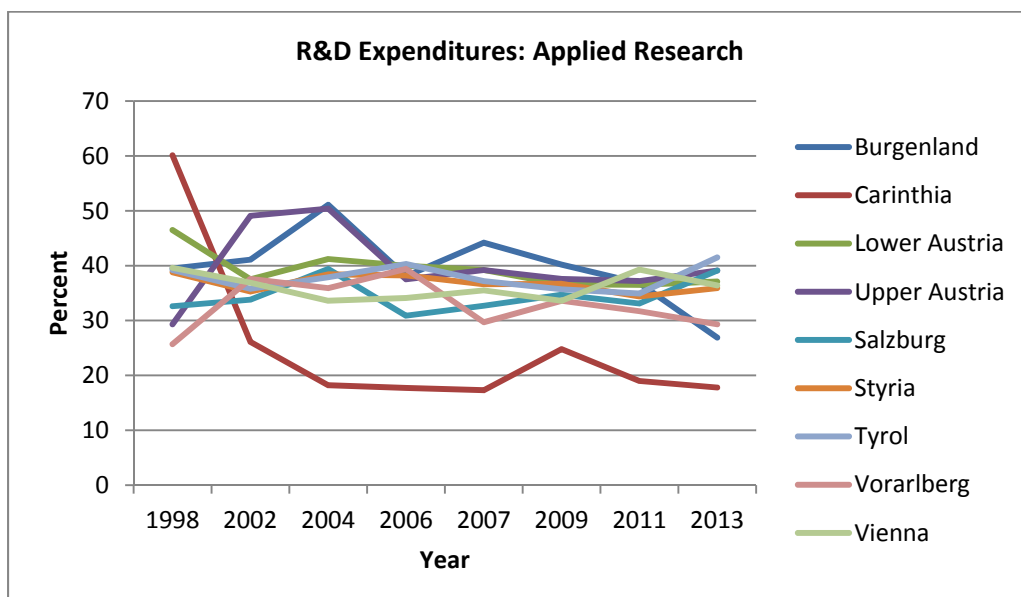
Two regions, Carinthia and Tyrol, showed an impressive growth at the beginning of the century. Carinthia lost some of its pace after 2007. Salzburg has since remained unchanged on a relatively low level. As these units are manifold and part of the university sector, the research institutions and industry, we have to take a closer look into the detailed data to be able to formulate an opinion on it. As there are different ways to detail the available data, we chose to split the R&D sector into basic research, applied research and experimental development. Here the picture changes depending on the sector we address. [Figure 4.1-c] show the numbers of R&D expenditures per unit and sector.

Figure 4.1-c: Expenditures per Unit, Basic Research, Source: Statistics Austria



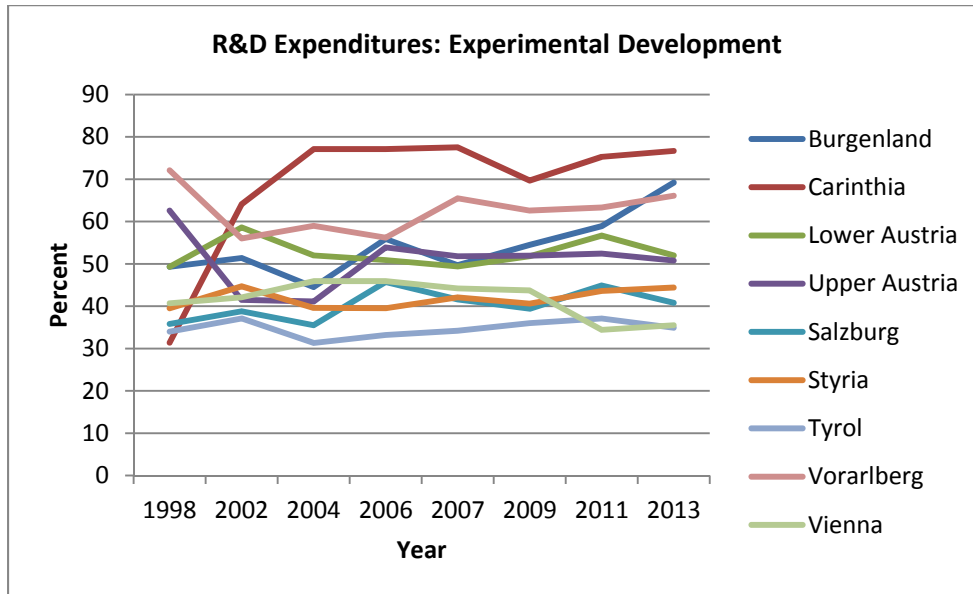
Regarding basic research the number of regions splits into two groups with a frontier group including Tyrol, Salzburg, Styria and Vienna. Vienna and Styria with one major hub in Graz are well known for their capacity in basic research. As absolute numbers of basic research investment are much lower in Salzburg and Tyrol, there has to be a different reason for them to appear in the frontier group. One interpretation can be that the low absolute investment numbers are still too high in relation to the number of units. In other words the absorptive capacity of the existing units is too low to cope with the money invested. With a rising budget, a region has to develop and adapt its institutional landscape. If that process is too slow, budget congestion is the consequence, and the efficiency of the money invested will decrease.

Figure 4.1-d: Expenditures per Unit, Applied Research, Source: Statistics Austria



The majority of regions are in a stable group that invests around one third of its budget.

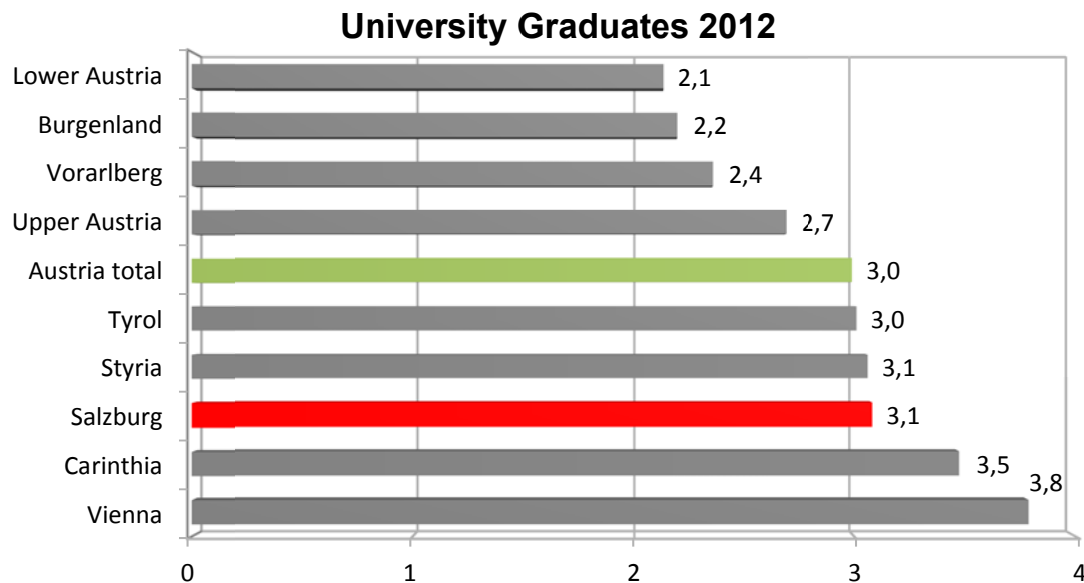
Figure 4.1-e: Expenditures per Unit, Experimental Development, Source: Statistics Austria



Keeping in mind the focus on Salzburg it is quite interesting that Carinthia has shifted away from intensity in the applied research into intensity in experimental development. In this regard we expect the number of units to be stable there. Regarding [Figure 4.1-b] we remember the rising budget in Carinthia between 1998 and 2006. A big portion of this growth has been invested into experimental development. While applied research and experimental development are quite low in Salzburg compared to the other regions, the level of funding in basic research has been on a high level for the last 15 years.

4.1.1.1 Institutions of Tertiary Education and Research

According to Stuart and Sorensen (2007), introduced in [Chapter 2], institutions of tertiary education and especially universities are the most important factors in a Regional Innovation System. These institutions provide the majority of well-educated human capital for the region. In Austria this circumstance is even more important due to the fact that mobility of people is quite low. Therefore every region tries to educate its own resources. The institutions of tertiary education in Salzburg educate a large number of university graduates in comparison with other Austrian regions, as shown in [Figure 4.1-f].

Figure 4.1-f: University Graduates per 1000 Citizens in Austria 2012, Source: unidata

The position of Salzburg is about the average of Austrian regions. This is a necessary precondition to use the potential of society but it is not an indicator about how usefully the knowledge of these graduates is used within or outside the region.

The region of Salzburg hosts many institutions of tertiary education and research. We will focus on five institutions that are deeply involved in the regional innovation system and we have to leave aside institutions like the Ferdinand Porsche university of applied sciences, the university of education or the design academy. Our focus contains two federal public and two private universities and, in addition, one university of applied sciences that is funded by federal and regional funds listed in [Figure 1.2-a]. The funding structures will be provided in [Figure 4.1-k].

Federal universities:

- University of Salzburg
- Mozarteum University of Salzburg

Private universities:

- Paracelsus Medical University in Salzburg
- Private University Schloss Seeburg Seekirchen am Wallersee

University of applied sciences:

- University of Applied Sciences Salzburg

All other institutions that are active in parts of tertiary education and could be listed here are not relevant for the further analysis and discussion owing to their size or alignments.

Figure 4.1-g: Universities in Salzburg region, Sources: University Webpages, Unidata, BMWFV

University	Type (Public/Private)	Inception year	No. Students Y13/14, of which foreign students	Structure (Departments)
University of Salzburg (Paris-Lodron-University)	Public	1622 (1964)	16718/5749	Theology - Law - Humanities, Cultural and Social Sciences - Natural Sciences
Mozarteum University of Salzburg	Public	1841	1695/976	Music – Theatre – Visual Arts
University of Applied Sciences Salzburg	Public	1995	2525/668	Engineering – Business and Social Sciences – Design, Media and Arts – Health
Paracelsus Medical University	Private	2003	908/203	University Clinics – Medical Institutes
Private University Schloss Seeburg	Private	2007	328/65	Economics and Management Sciences

The first and by far the largest institution in terms of student enrollment is the Paris-Lodron-University, which was founded in 1622 by Prince Archbishop Paris Lodron and was supported by a confederation of 33 Benedictine abbeys of Southern Germany, Austria, Switzerland and Salzburg. The university was closed down in 1810 after Salzburg's annexation to Bavaria, and was re-opened in 1962 as a public university. It started with a faculty of Catholic Theology and Philosophy. In 1965 a faculty of Law was added. Its current structure was mainly implemented with a reform in 1975, when the faculty of (natural) sciences was founded. Also, since 1975 there has been the plan to build up Austria's fifth faculty for Medicine but it was never realised. Instead, in the year 2003 the private Paracelsus Medical University was established. The University of Salzburg has its main focus on the humanities and cultural sciences.

The focus of the Mozarteum University of Salzburg did not change over the decades. The development of the university is very much in line with the reputation of Salzburg as a hub for culture and classical music. There is also a close link between alumni of Mozarteum and the cultural community in Salzburg. As long as this link remains, Mozarteum will continue to get applications from talented people all over the world. The international dimension is shown in the percentage of foreign students, which is more than 50%.

Universities of Applied Sciences were first established with the respective law in 1994. One of the first to register was the University of Applied Sciences Salzburg that in 2014 has got two campuses in Urstein (Hallein) and in Kuchl. Although the law would entitle universities of applied sciences to go for education and research, the focus on education is dominant. The curriculum is more structured and based on more fixed timelines than at universities. Universities of Applied Sciences promote their target to build a strong link to the regional economy. This is what happens in FH Salzburg as well where degree holders are very much asked for by regional industry.

The largest private university in Salzburg, Paracelsus Medical University, was established in 2003 and has strong institutional and personnel links to the Salzburg County Hospitals. In 2013 the board of PMU decided to establish a similar branch of medical education in Nürnberg. It is not possible for students to change between the two locations because either location is limited to 50 students only. Due to Austrian legislation it is not possible for private universities to get institutional funding from the national level for educational purposes. Therefore they rely on the budgets of regional authorities and private donations. The by far largest donation was contributed by Red Bull owner Dietrich Mateschitz.

The private university Schloss Seeburg attracts students of Management and Economic studies to the enjoyable surroundings of the Salzburg countryside. There are currently 328 students (Status 2014).

The analysis of the department structure of all the universities shows that from an overall number of 14 departments, just two are in the field of engineering and natural sciences and another two are related to medical sciences. All others are focused on culture, arts, humanities and social sciences.

The ability of a university to develop its focus and competitiveness depends on the possibility to select the students. [Figure 4.1-h] shows the results in the faculty/students relation depending on admission rules and enrollment fees.

Figure 4.1-h: Universities in Salzburg, Admission and Enrollment Fees (Status 2014), Source: Universities in Salzburg

University	Admission	Enrollment fees for EU students	Enrollment fees for NON-EU students	Faculty/Students Relation
University of Salzburg (Paris-Lodron-University)	No	No	Yes	15.57
Mozarteum University of Salzburg	Yes	No	Yes	5.23
University of Applied Sciences Salzburg	Yes	Yes	Yes	26.00
Paracelsus Medical University	Yes	Yes	Yes	13.97
Private University Schloss Seeburg	Yes	Yes	Yes	25.04

University of Salzburg provides the broadest offer for studies in different sciences like humanities, social and cultural sciences and natural sciences. This is performed in terms of the international Bologna system, where Bachelor, Master and PhD degrees are issued. The supply of courses in English language is in about 10 % of the full programme, which is 245 courses in English language (including language courses themselves) in the winterterm 2014/15 compared to 2898 courses in German language.

The same levels of degrees can be obtained from Mozarteum and from PMU. However, the range of disciplines is limited to Music and Art at Mozarteum with PhDs in Music Pedagogics, Music Sciences and Pedagogics in Art. The same applies to PMU for the PhD in Health Sciences.

The remaining institutions provide only the lower levels of degrees up to master level so that one cannot obtain a PhD there. The spectrum of disciplines is quite broad in the case of the University of Applied Sciences whereas the range of Schloss Seeburg is limited to business economics, economic psychology, and sports and event management.

There is a clear barrier for international non German-speaking students because there is a very limited supply of courses in the English language. The University of Salzburg, the University of Applied Sciences and Paracelsus Medical University have got websites in English language more or less understandable. At the website of Schloss Seeburg Private University there is no visible link to an English website.

In the next paragraphs we will discuss the position of Salzburg institutions in international rankings. Having in mind the limitations of all the processes leading to these ranking results, we will nevertheless use them to get an impression about the relative position of these institutions with regard to international equivalents. We will not overestimate the absolute positions or the data leading to these positions.

The historical development of Salzburg in international rankings shows some constant ups and downs on a low level during the last five years. The performance is quite low and depends on the criteria applied for the respective assessment. Therefore two different rankings will be taken into consideration to evaluate the international benchmarking shown in [Figure 4.1-i]. The Quacquarelli Symonds (QS) ranking has been published every year since 1990 and spans across 2000 institutions of higher education in 50 countries.

Figure 4.1-i: Universities in Salzburg International Rankings 2014/15, Source: Quacquarelli Symonds Webpage, Times Higher Education Webpage

	Quacquarelli Symonds rank	Times Higher Education rank
University of Vienna	156	182
Vienna University of Technology	246	226-250
University of Innsbruck	288	201-225
Karl-Franzens-University of Graz	411-420	351-400
Johannes Kepler University of Linz	551-600	not listed
Alpen-Adria-University Klagenfurt	701+	not listed
University of Salzburg	701+	not listed
Mozarteum (Arts&Humanities)	not listed	not-listed

The national comparison in the year 2014/15 of the QS ranking shows the University of Vienna in the best position at place 156. It is followed by the Technical University of Vienna 246th and University of Innsbruck (288th). Karl-Franzens-University of Graz (place 411-420) and Johannes Kepler University of Linz (551-600) are also outperforming the University of Salzburg that shows up in the rating block 701+ which was 551-600 in the last ranking 2012/13. The Alpen-Adria-University Klagenfurt ranking as well at 701+. Mozarteum is ranked in the section of „Arts&Humanities“ where it was listed at rank 399 in 2012/13 in the international evaluation and it is not listed any more in 2014/15.

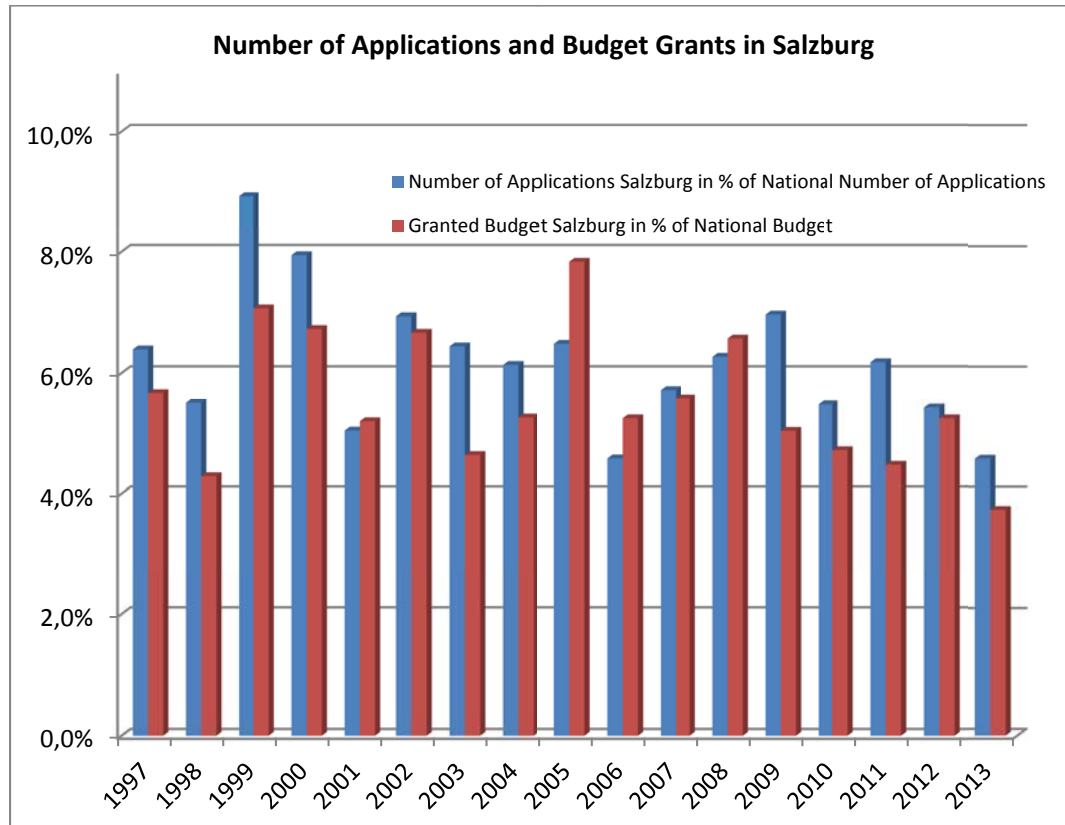
The other ranking taken into account is by “Times Higher Education“. None of the institutions in Salzburg is ranked within the list of 400 top universities. Tertiary education is not a closed system. The network effects on the impact possibilities of regional and international R&D efforts as mentioned in [Chapter 2] Coe et.al. (2008)] are lost if the quality of tertiary education is below the top third.

The funding for institutions of tertiary education in Salzburg follows the overall practice of the national and regional funding system. A large share of public money for R&D in Austria is channeled through institutional funding, a lower share is provided for competitive but thematically open bottom-up approaches. Regarding the time following the re-establishment of the Austrian university system after WorldWar II, there had been three major milestones in the development process that considerably changed university regulation. The first in 1975 should enable all social levels of society to participate in the tertiary education system. This mission is by the way still not yet fully accomplished nowadays, as education levels are still to a large amount inherited. The next milestone in 1993 established the more or less current governance system within universities. One year later the law for universities of applied sciences was put into force. The next step, the University Act of 2002, is the basis for the financing of the public universities in form of three-year performance contracts between each university and the respective ministry on national level. The funding is provided by the General University Fund (GUF), which is allocated by the ministry and whose share is about 90 % of the university core funding. In the contracts this is detailed into budgets for teaching, budgets for research and advancement of the arts, and budgets for large scale infrastructures. The part of performance-oriented allocation of institutional funds is based on indicators associated with teaching activities, R&D-related indicators and societal indicators. About 20% of the GUF budget is related to performance-based institutional funding. Every university is eligible for a quota of this fund: 4.55 % for the University of Salzburg and 1.94 % for Mozarteum.

The quota is not predetermined in advance but the movement between the 22 public universities in the last 20 years has been marginal. Rather, the challenge is that other framework conditions like the number of students or the volume of research projects change significantly over time. But there is still a possibility for universities to gain a bigger share of national funding, which is competitive project-based funding.

The major source for project-based funding of R&D activities is the Science Fund (FWF). The FWF is the main funding institution for basic research in Austria. Projects can be submitted either by individuals or by teams in all fields of science. The overall budget of FWF is about 200 M€. The share of the observed institutions in Salzburg can be seen in [Figure 4.1-j].

Figure 4.1-j: Number of Applications and Budget Grants in Salzburg compared to National Level, Source: Austrian Science Fund



The picture shows a quite volatile but stable share of participation between 1997 and 2007. The interesting and alarming trend begins in the year 2009. Since then there has been a clear downward trend. Compared with all other Austrian regions, Salzburg has been losing competitiveness with regards to the number of applications to the Science Fund. A second observation is the ratio between numbers of applications and the respective budget granted to these projects. In the years 2005 to 2008 there had been a quite even share in numbers and in budgets. Since 2009 granted budget figures have been diminishing more than the numbers of applications, which in turn means shrinking project sizes.

The same structure of analysis for the Life Science Sector is shown and discussed in [Figure 4.1-n].

The University of Applied Sciences is funded by national and regional funds according to the respective law and contracts between the owners. Private universities are not eligible to funding for educational purposes from the national level. They rely on public regional funding and private funds.

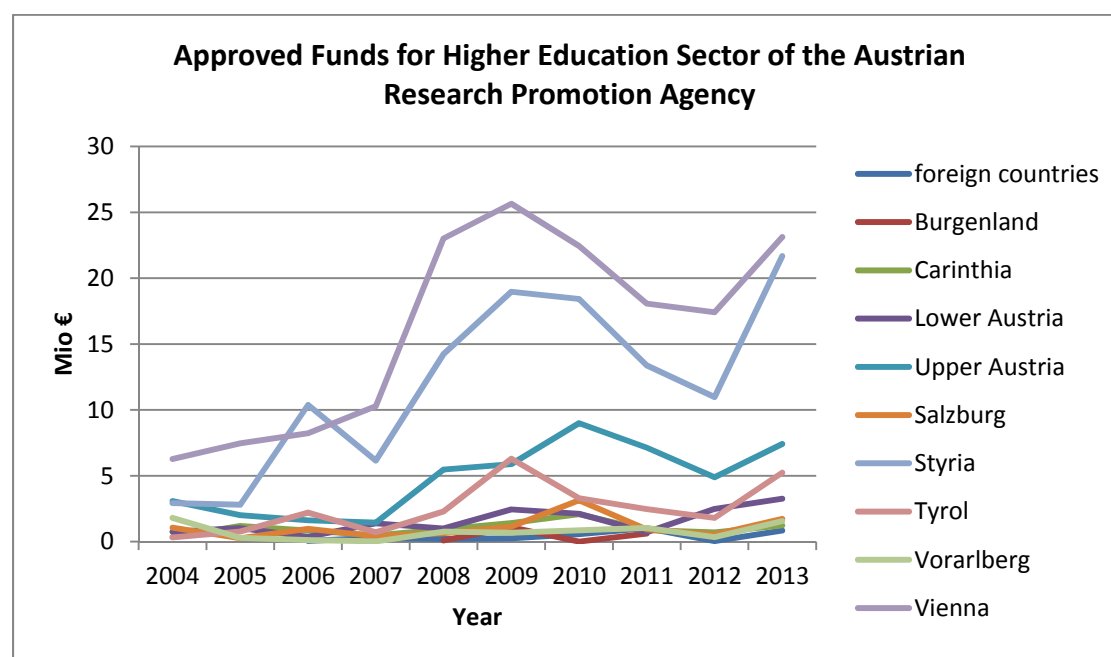
[Figure 4.1-k] shows the funding situation of the respective institutions in Salzburg.

Figure 4.1-k: Universities in Salzburg, Funding Structure 2013 (PMU 2012), Source: BMWFV, University administration

University	Overall Budget	Institutional Funding (National/Regional)	Competitive Funding from Public Authorities	Competitive Funding from Private Sources (Companies)
University of Salzburg (Paris-Lodron-University)	143.700.000	127.700.000	14.000.000	2.059.342
Mozarteum University of Salzburg	49.300.000	48.400.000	200.000	700.000
University of Applied Sciences Salzburg	26.200.000	22.400.000 (14.200.000 national, 8.200.000 regional)	900.000	600.000
Paracelsus Medical University	Not Available	1.700.000 (just regional)	6.700.000	770.000
Private University Schloss Seeburg	Not Available	Not Available	Not Available	33.000

Competitive funding is low compared with the institutional funding. Inside the block of competitive funding only the University of Applied Sciences has a reasonable share of private funds. Due to this lack of competition and hence the lack of international peer-review there is little evidence on the quality level of research in all the institutions of tertiary education. [Figure 4.1-l] shows the funds for all the programmes granted to institutions of the Higher Education Sector by the Research Promotion Agency (FFG) across the regions.

Figure 4.1-l: Funds Approved within the Higher Education Sector of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



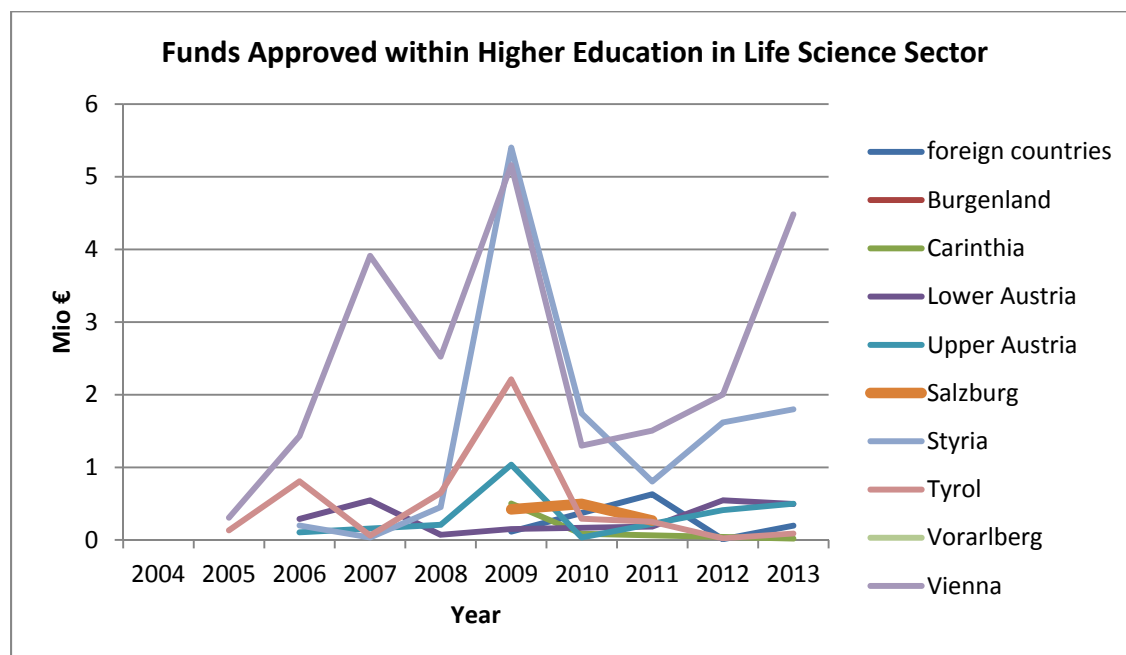
The lack of competitive funding in the Higher Education Sector is confirmed by the numbers of the largest funding agency for applied research, FFG. Salzburg ranks in a set of regions that have no university.

The Higher Education community in Salzburg experienced a major change in 2003, when the Private Medical University (PMU) was founded with the intention first to have a regional source of well-educated people and second to provide a hub for research cooperation in that sector. There is a strong link of the PMU with the regional hospital in order to base research on real-time experience and data. That decision by the regional government should result in a mid-term impact on the numbers in the Life Science sector regarding human resources, competitive funding and technology transfer. All these potential impacts will be addressed and discussed in the respective chapters.

The level of funding in competitive applied research is also an indicator for the ability of an institution to use the results of basic research and carry them one step further to be ready to discuss the issues with outside partners like industry or technology transfer institutions. This link with the Innovation Space is on a low level in all the institutions presented in this chapter. The impact can also be seen in the resulting low number of Start-Ups/Spin-Offs in Salzburg, which will be shown in [Figure 4.2-f].

In order to find out the potential implication of the foundation of PMU on the Regional Innovation System we analyse two sources of data especially for the Life Science Sector. First, the funds approved by the largest funding agency, FFG, which is the major actor in terms of funding for applied research in Austria [Figure 4.1-m]. Second, there is a special focus on Life Science topics in the Framework programme of the European Union. Here we take a look at the development of the participation of institutions in the Salzburg region [Figure 4.1-o]. Apart from this special Life Science focus there will be a discussion on the involvement of Salzburg in the framework programme in the Consensus Space [Chapter 4.3.2.3].

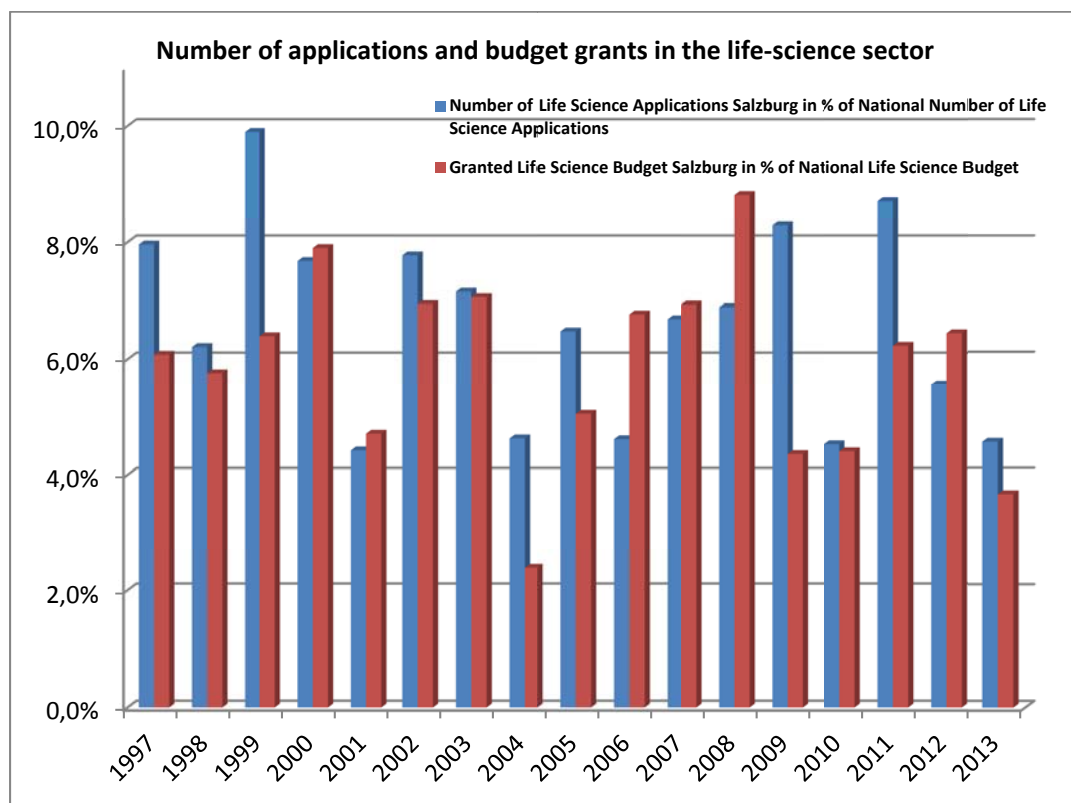
Figure 4.1-m: Funds Approved within the Higher Education Sector Life Science of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



Applied Life Science projects had been funded in the Higher Education Sector in Salzburg in the years 2009-2011 having in mind that these numbers represent the time of contract. Nevertheless there is a lack of continuity in applications, successful evaluations and contracting in this sector in contrast to other regions like Lower Austria or Upper Austria where there is a constant project flow on different levels.

The basic research numbers for Life Science will be even more important after the foundation of the PMU in 2003 as the claim to be a major actor in the Salzburg basic research sector of Life Science is evident. [Figure 4.1-n] shows the respective numbers of applications and budget for this sector.

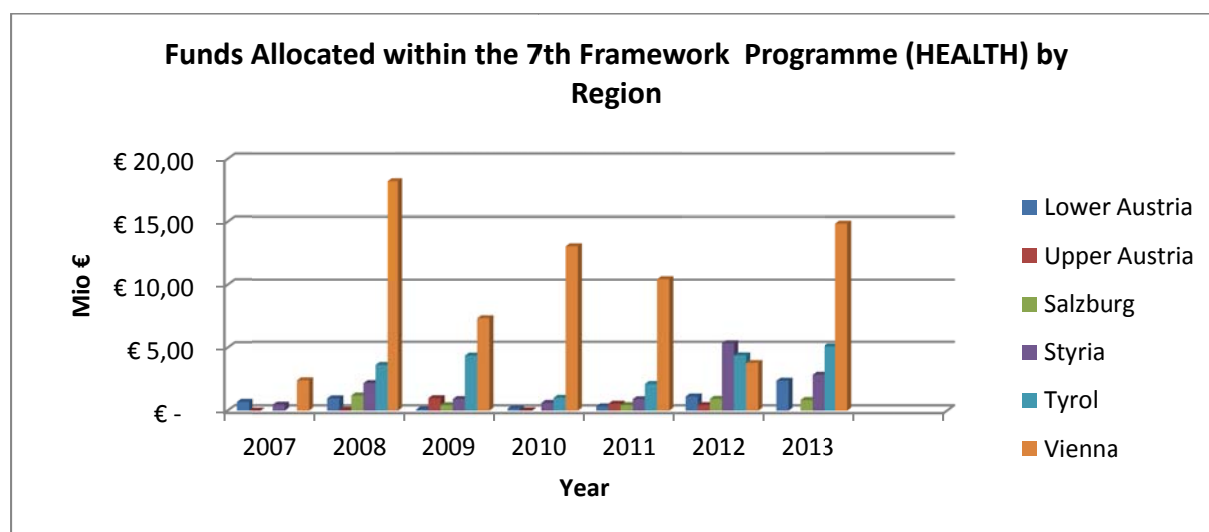
Figure 4.1-n: Number of Applications and Granted Budget in the Life Science Sector in Salzburg compared with National Level], Source: Austrian Science Fund



The mean share of participation has been around 5 to 6 % over the last 15 years. There is no evidence that the founding of PMU in 2003 has triggered a breakthrough in the competition with other regions in this sector. Even worse, the highest shares of 7 or 8 percent had never been reached again after the year 2008.

The same sector of Life Science on a European level shows the numbers in [Figure 4.1-o].

Figure 4.1-o: Funds Allocated within the 7th Framework Programme (HEALTH) by Region, Source: Austrian Research Promotion Agency



The participation in Life Science projects from Salzburg has been low but stable. As the data availability is starting in 2007 we can not compare the time line before the foundation of PMU, but there is no sign of rising levels of projects as from 2007 onwards. The institutional change of the foundation of PMU in 2003 has left no visible impact on project participation on the European level.

All universities share a common concern regarding the share of foreign students, which varies from 57 % (2013/14) in the Mozarteum to 20 % in the Private University Seeburg [Figure 4.1-p]. The majority of foreign students are from Germany, whose border is less than 6 km away from the university. The share of graduate foreign students is expected to see a rapid increase in the coming years. While the international exchange and the mix of cultures associated with these high shares of foreign students can be an advantage for a region, there is also a significant disadvantage arising from the fact that most graduate foreign students return to their home countries, leaving the Salzburg region with a significantly lower number of skilled graduates who would then get involved in the local scientific and economic process.

Figure 4.1-p: Share of Foreign Students, Source: unidata

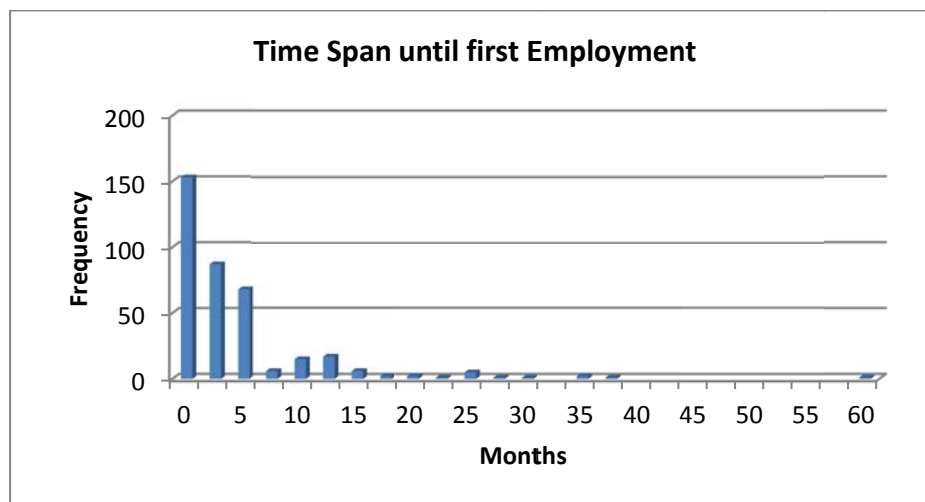
University	Share of Foreign Students	Academic Year
University of Salzburg (Paris-Lodron-University)	34.4 %	2013/14
Mozarteum University of Salzburg	57.6 %	2013/14
University of Applied Sciences Salzburg	26.5 %	2013/14
Paracelsus Medical University	22.4 %	2013/14
Private University Schloss Seeburg	19.8 %	2013/14

In spring 2014 there had been a survey among Alumni performed by the University of Salzburg. The objective was to describe the employment conditions of persons that had finished a bachelor, master or PhD at the University of Salzburg. Data from the interviewees had been gathered between July 2005 and March 2014. The university therefore disposes of a valid database of 4.830 persons whose active private mail contact data are available and who agreed to be part of such a survey.

In the period between April 11th, 2014 and May 5th, 2014, 1.063 interviewees returned the completed form, which makes up a share of 22 %. The average age of these persons is 30.8 years with a standard deviation of 7.4 years. Regarding the relation between finished bachelor and master studies in the various disciplines, the share of Humanities and Social and Cultural Studies is about 70 % compared with Natural Sciences. There is also a concentration on certain fields of study with the top 5 fields of study (Bachelor and Master) accounting for more than 60% of the alumnis. The average duration of study was 58.5 months with a standard deviation of 28.6 months.

The question regarding the moment of entry into the job market was answered by 368 persons. Answers differed from 0 months (seamless) up to 25 months. In the average it took graduates 4.2 months until the first employment shown in [Figure 4.1-q].

Figure 4.1-q: Time span until the first employment on the University of Salzburg, Source: University of Salzburg

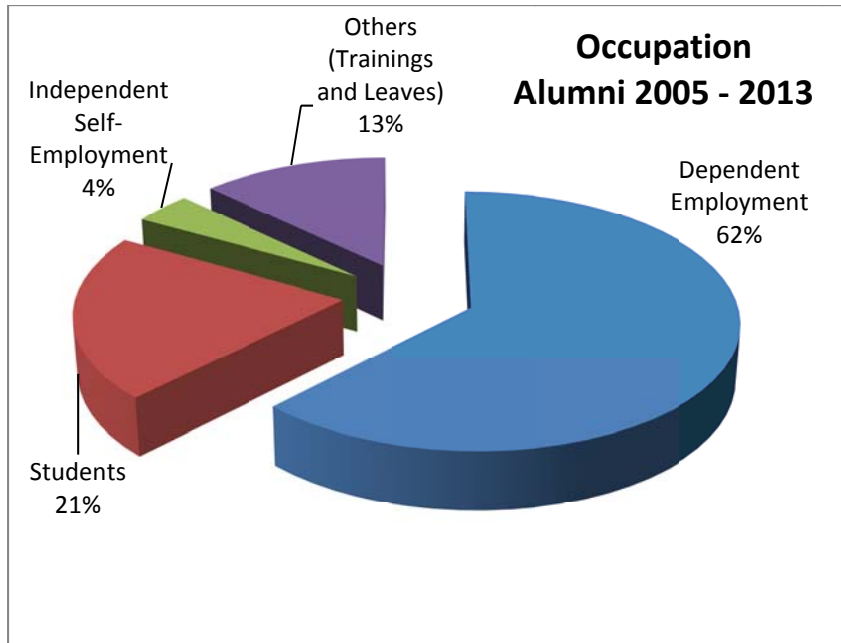


On the one hand, an average of 4 months seems to be quite a feasible waiting period after finishing the studies. On the other hand many students take up work in industry or services during their studies and simply need no time to look for opportunities. It is mainly these persons who take down the average waiting time to 4 months. For all those who have to search the job market with a degree in their pockets, the time period with no income could be much longer. Furthermore the inquiry did not ask if the work that had been chosen was in conformity with the level of the degree or if it was in the discipline people were educated in. We will see later on that 26.8 % indicated that their current job would not need a university degree. There is no data available for a regional, national or international benchmarking of the 4 months waiting period. But there are framework conditions to put this number in a context of university budgets. In South Korea parts of the university budget are allotted according to the time how long it takes the degree holders to get a job. The time limit for getting full funding there is 3 months. This means that a university that would have an average of 4 months has to cope with budget losses. The next question is where alumni end up after 4 months.

Currently, the biggest group is made up of persons who have an employment in public institutions or companies (with a share of 62.3 %), which is called „Dependant Employment“ in [Figure 4.1-r]. The second largest group is students with 20.9 %, which means that they are still in education, having taken up a PhD or studies in other disciplines. Persons who are self-employed and running their own

company make up 4.0 %. The rest are dependent occupations in the course of trainings or maternity leaves. But the majority is suspected to be sabbaticals or so-called „education leaves“, which in some cases is another wording for being unemployed.

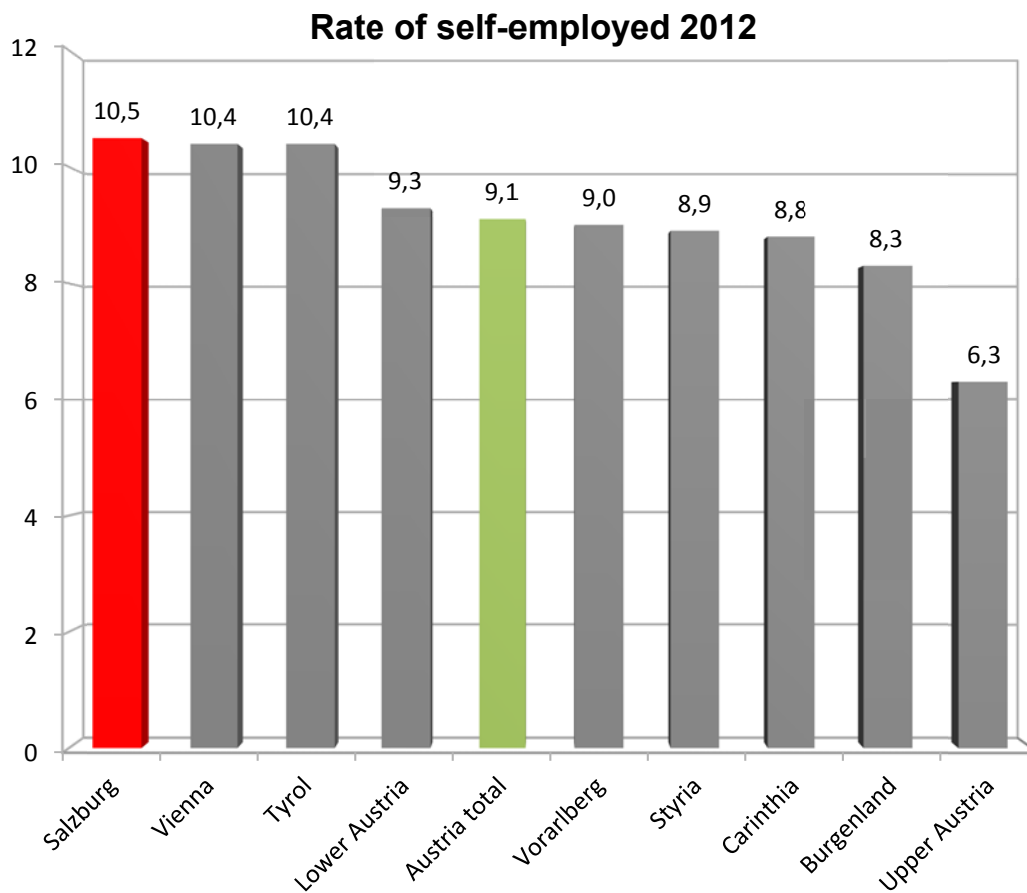
Figure 4.1-r: Status of Alumni Occupation 2005 – 2013, Source: University of Salzburg



The branches alumnis they are working in are private businesses (47.6 %) and non-private businesses (52.4 %) made up of public services (36,2 %) and non profit organisations (16.2 %). 31.6 % of the interviewees state that the current occupation is an interim solution and they aim for a long-lasting employment.

This seems to be in contrast with the rate of the self-employed in all branches and education levels as shown in [Figure 4.1-s].

Figure 4.1-s: Rate of self-employed 2012, Source: Chamber of Commerce Salzburg



The rate of self-employed is highest in Salzburg compared with the other Austrian regions. Compared with graduate self-employment of 4 % there is a significant gap of around 6 %. If we decide to put trust into these data there are two major lines of discussion. First one could state that 4 % of Alumnis are low. This can be interpreted with the range of disciplines in the Higher Education sector. In other words, the graduate share in the University of Salzburg of 70 % in humanities and social and cultural sciences provokes a lower chance for self-employment than would a technical discipline or natural science. Second the leading position of Salzburg states that the 10.5 % are high. The reason here could be that Salzburg is not just strong in culture but lives quite well as a tourism region. Many of the 10.5 % are expected to work in the tourism service sector.

4.1.1.2 Research Institutions

Three of the institutions active in tertiary education are also research institutions. These are the University of Salzburg, the University of Applied Sciences Salzburg and the Paracelsus Medical University. They have already been described in [Chapter 4.1.1.1]. Furthermore there are many non-university research institutions, especially in the field of humanities and social and cultural sciences: due to the large number only an excerpt is shown in [Figure 4.1-t].

Figure 4.1-t: Research Institutions in the Salzburg Region,
Source: <http://www.salzburg.gv.at/themen/bildungsforschung> (Status 2014)

Research Institution	Type	Area of Activity	Personnel
Salzburg Research	Non-Profit	Information and Communication Technologies / New Media	75
Bautechnische Versuchs- und Forschungsanstalt Salzburg	Non-Profit	Construction / Engineering	63
Academy of Sciences – Geographic Information Science	Non-Profit	Geographic Information Science	63
Research Studios Austria	Non-Profit	Diverse	11
Research Institutes for Humanities, Social and Cultural Sciences	Diverse	Diverse	N/A, estimated 675 persons in about 75 institutes [*]

[* Approximately 300 non-university institutes for the humanities, social and cultural sciences in Austria > 25 % in Salzburg >75 institutes with an average of 9 employees (Reference GSK in Austria 2008 Figure 4.1-x) > 675 employees]

The most important research institution in the region with regards to personnel is Salzburg Research Forschungsgesellschaft mbH, a research and technology organisation (RTO) specialized in applied research and development within information and communication technologies (ICT) and new media. It was established in 2000 and currently has 75 employees. It receives 30% of basic funding from the regional government and is closely connected with the regional authorities. Other research organisations mostly active in the humanities, social and cultural sciences are small-sized entities (about 9 employees on average).

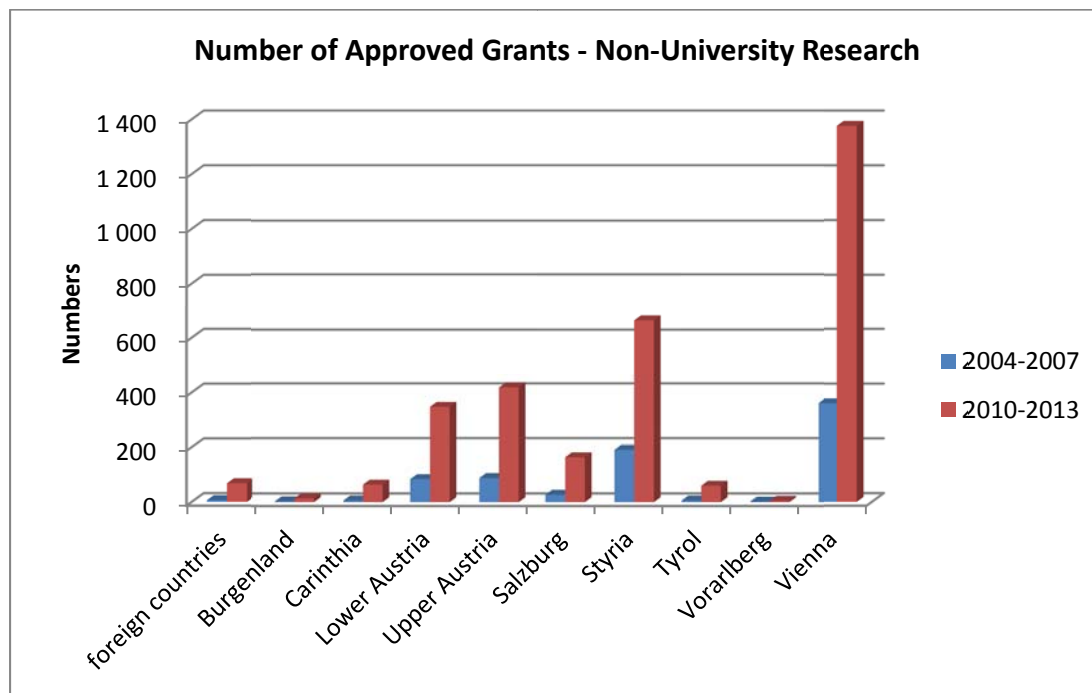
The financial structure of these institutes is based on regional basic funding, a small amount of national basic funding and project funding from regional, national and European funds. There is no data available on the percentages of these funding schemes.

As the institutional landscape is quite diverse we are interested in the activity and competitiveness of this sector. Therefore we use data of applications that were introduced successfully on the national

funding sources. To be able to judge on the historical development there are two 4-year-periods that were compared with each other.

[Figure 4.1-u] shows the number of grants dedicated to the non-university research sector from the largest Austrian funding agency for applied research.

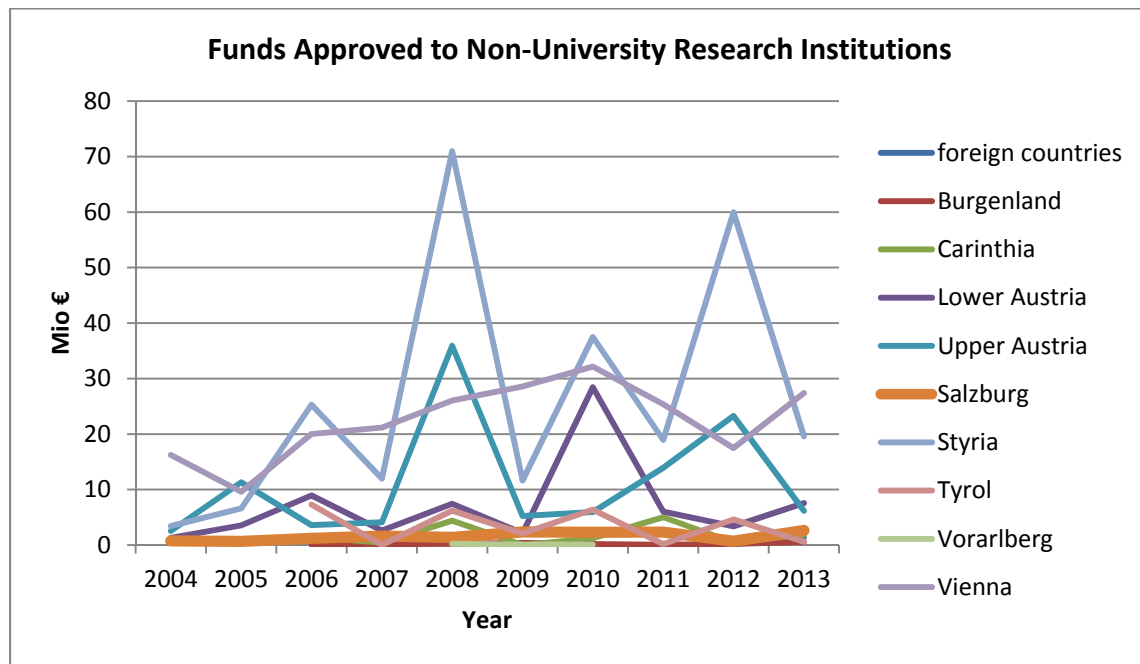
Figure 4.1-u: Number of Approved Grants to Non-University Research Institutions of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



The total number of assigned grants from FFG grew by four times during the chosen periods. Salzburg started from a very low level and managed to augment the number of grants by six times. Despite the fact that the relative growth is 6th highest compared with all other Austrian regions, the absolute position (5th) in Austria is notable because the position in the area of the Innovation Space like patents [Figure 4.2-s] or start-ups [Figure 4.2-f] are just 7th. There is an obvious mismatch in investment of national funding and the ability of the region to transform the gained knowledge into innovation. An intense discussion about that will be performed in [Chapter 5].

Apart from the absolute number of grants, the number of approved funds is also of interest. The resulting R&D capacity of the non-university research sector will be investigated with the total funds dedicated to this sector from the largest funding agency shown in [Figure 4.1-v].

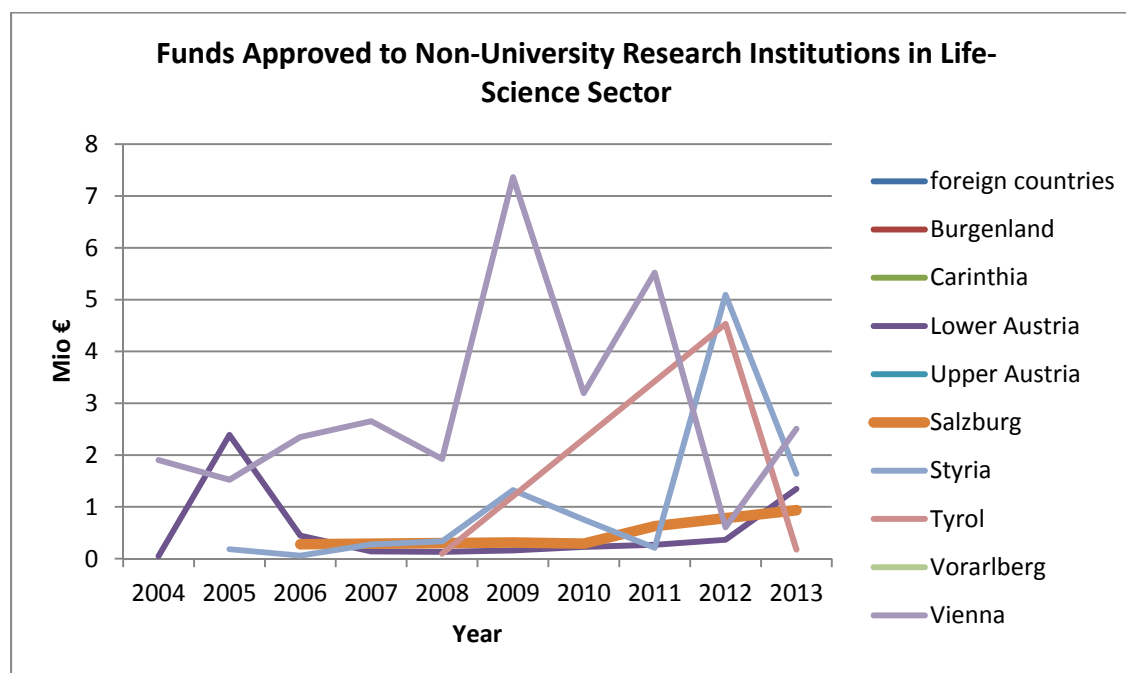
Figure 4.1-v: Funds Approved to Non-University Research Institutions of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



The peaks of the graph mark the milestones of the COMET program, responsible for a large portion of competitive institutional funding in the non-university research sector. In Salzburg there is no discernable activity. Comparable regions like Tyrol or Carinthia managed to have some success which can be explained with funds from the COMET program like K1 centers or K projects [Figure 4.2-I]. The allocation of K2 funds to Vienna and Styria can also be seen quite clearly in the graph above. Lower Austria, too, launched a successful initiative in 2010 with the K2 tribology center. In Salzburg the potential for K centers is present but the institutions would have to organize themselves inside the region and cross regionally. The Consensus Space will provide a discussion why this has not happened so far.

To be able to evaluate the potential impact of the foundation of PMU in 2003, we will look into the details of the Life Science sector in the data above. [Figure 4.1-w] shows the sector-specific development.

Figure 4.1-w: Funds Approved to Non-University Research Institutions in Life Science of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



The numbers for Life Science grew compared with the total funds in the non-university research sector. This is a hint that especially from 2010 onwards, there is an indication of an impact of the institutional change after the foundation of PMU.

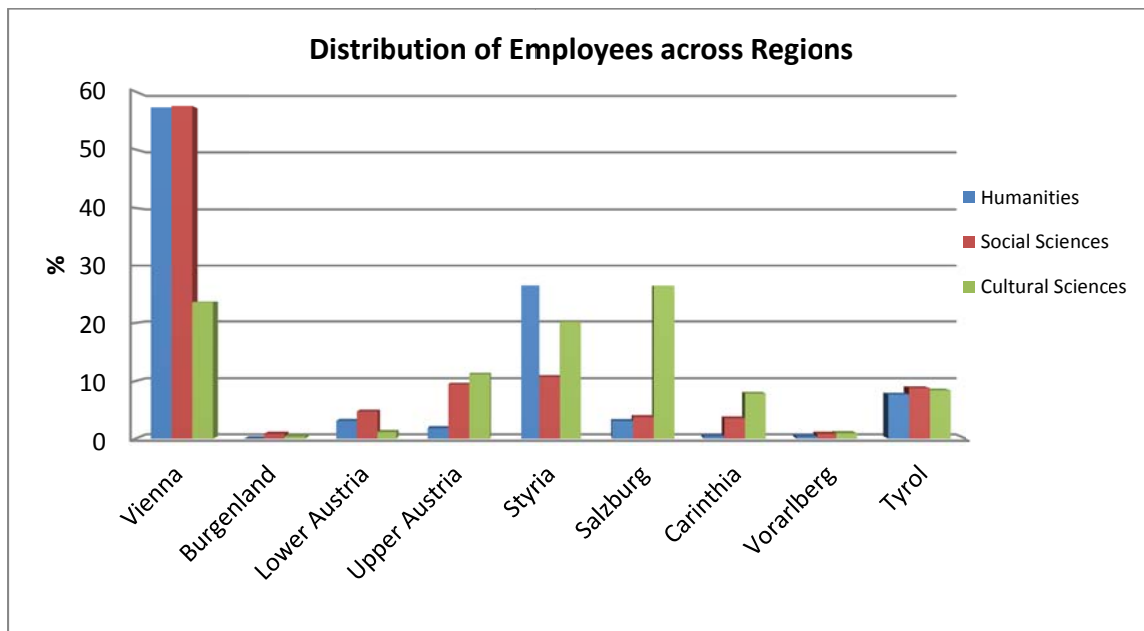
Due to the dominance of institutes in Salzburg that are active in the humanities, social and cultural sciences, we will take a closer look at the structure of these institutions in Austria and in Salzburg in particular. In Austria there are, as a whole, 583 institutes active in these disciplines as shown in [Figure 4.1-x].

Figure 4.1-x: Research Institutions of Austria in Humanities, Social and Cultural Sciences 2008, Source: Survey „GSK in Österreich“ 2008

Institute	Number
University Institutes	272
Academy of Sciences	36
Ludwig-Boltzmann-Institutes	17
Other Non-University Institutes	253
Total	583

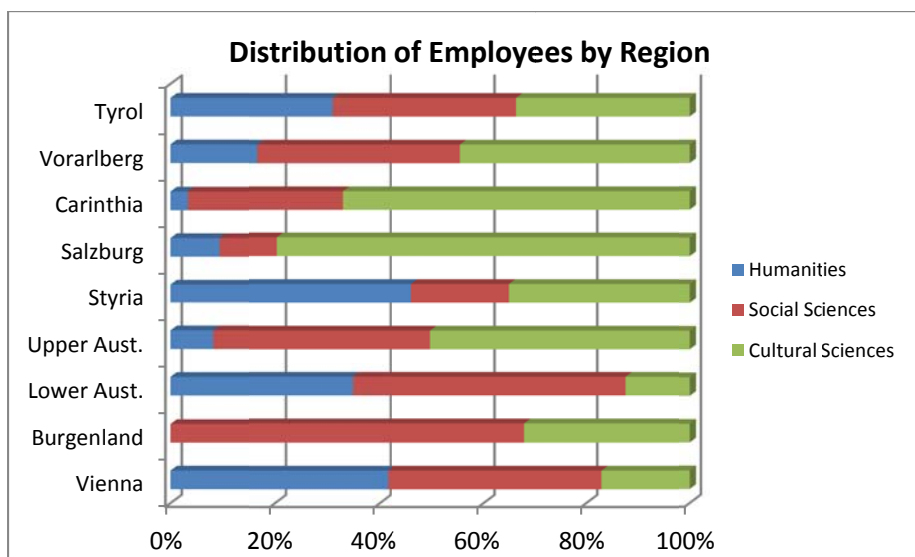
In comparison with other Austrian regions, Salzburg has a focus on cultural sciences, as shown in [Figure 4.1-y].

Figure 4.1-y: Distribution of employees across the regions, Source: Study GSK in Österreich 2008



With regards to all persons working in Cultural Science institutions in Austria, 26 % of them are based in Salzburg. Vienna and Salzburg are in the leading position with about the same percentage but the number of university graduates is much larger in Vienna. The total number of available human resources in a region being limited, if one sector draws a significant amount on its side, there is as a consequence a perceptible shortage for others. To get to know the relative position of Culture compared to Human and Social Sciences, we look at the relative distribution of employees within the regions in [Figure 4.1-z].

Figure 4.1-z: Distribution of Employees within the Regions. Source: Survey „GSK in Österreich“ 2008



Whereas in Tyrol there is an equal distribution among the three areas, Salzburg has an emphasis on the Cultural Sciences where 79 % of the employees are involved in the humanities and social and cultural sciences.

This concludes the analysis of the research institutions in Salzburg. Further discussion will be provided in [Chapter 5].

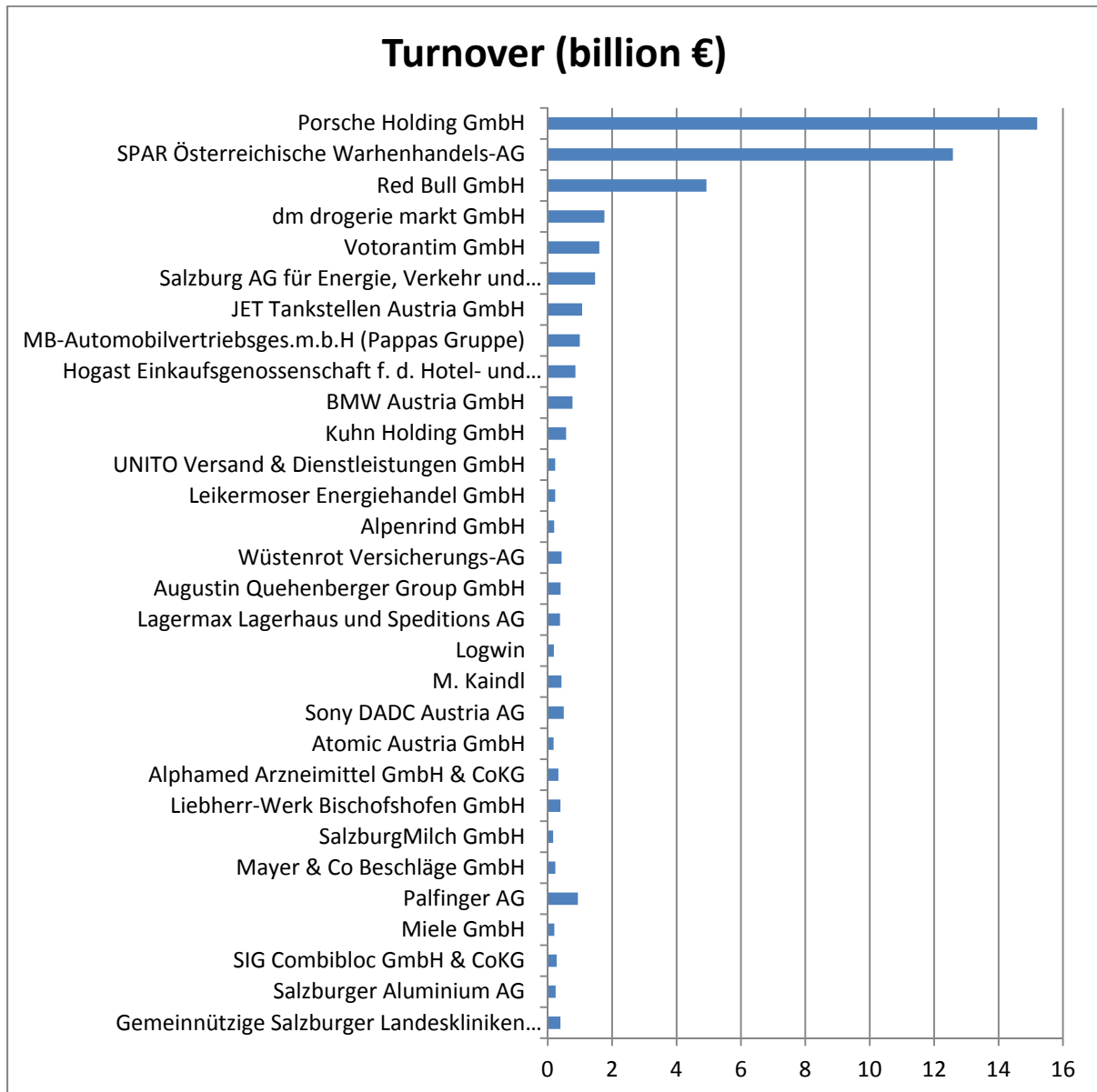
4.1.1.3 R&D-intense companies

Among the top 30 companies in the Salzburg region in terms of turnover shown in [Figure 4.1-aa], the first five are active in trading and conduct little or no R&D, which suggests a regional focus on trade and logistics. Among the other companies, only a few are active in medium/high-tech sectors. Most companies are SMEs that typically do not conduct industrial basic research but some incremental research activities. Some (usually the medium-sized ones) own a department for development, where incremental research is performed as well.

Companies in Salzburg Region

Activity sector	Turnover	R&D expenditure	High-tech employees (%)
Figure 4.1-bb	Figure 4.1-aa	No data on the level of single companies available	

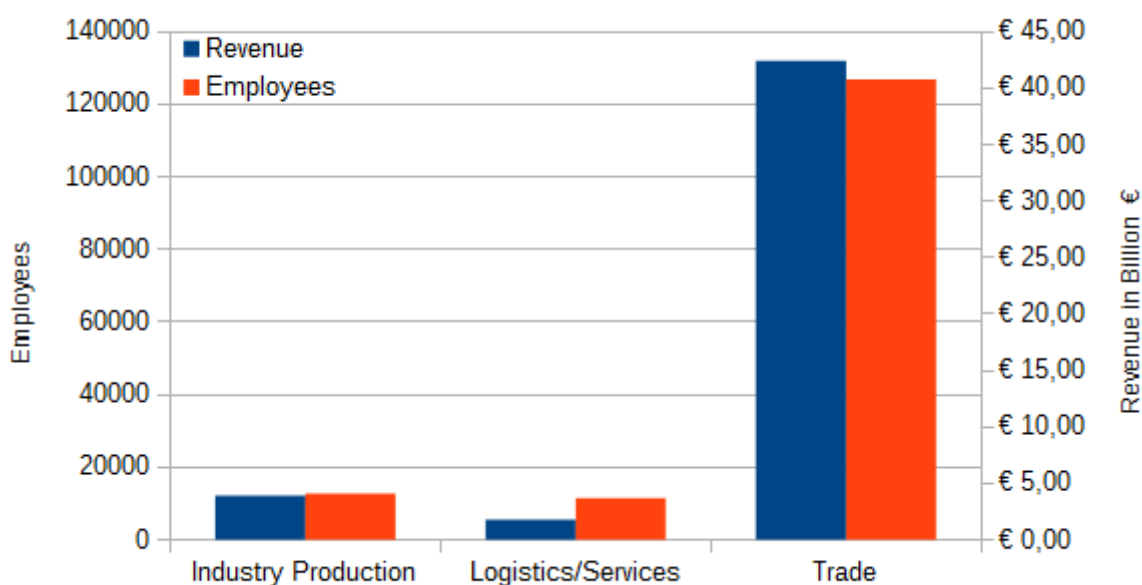
Figure 4.1-aa: Turnover Top 30 Companies in Salzburg, Source: Chamber of Commerce Salzburg



Among the top 10 companies, 8 are trading companies with national and international activities coordinated from their hub in Salzburg. These companies play a big role in the current employment market but there are only few new products or innovations that could impose macro-economic impact in the long run. And as was discussed in [Chapter 4.1.1.2], well-educated human resources are withdrawn from the R&D labor market.

Summing up the sectors by activity there is a large number of companies that show up in the „Trade“ sector according to [Figure 4.1-bb].

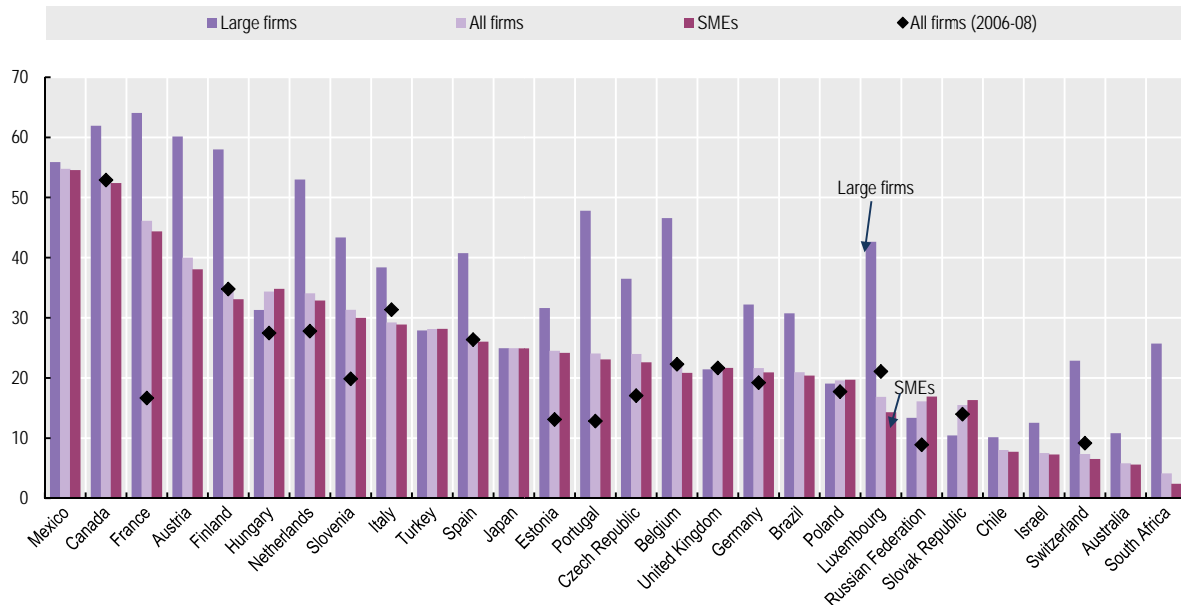
Figure 4.1-bb: Top 30 companies Revenue and Employees - Activity Sectors 2012,
Source: Chamber of Commerce Salzburg, Austrian Council



In 2011, 284 R&D-performing units were counted in Salzburg (Source: Statistics Austria), with an average R&D investment of € 1.012k per year. This can be considered quite low in comparison with the Vienna region, which accounted for an average R&D investment of €1.930k, or with Carinthia, which has a similar gross regional product and recorded an average R&D investment of €2.025k. This picture has not changed considerably compared with the 2007 statistical figures, when 227 R&D-performing units were recorded in Salzburg with an average R&D investment of €925k per year, compared with Vienna with an average R&D investment of €2.171k. The low relative R&D investments of Salzburg units clearly suggest a fragmented institutional landscape.

There is no data regarding the shares of R&D-intense companies by size on the regional level but there is some data in (OECD 2014, p.83) regarding the size differences for Austria. [Figure 4.1-cc] compares this data for the available international group of countries.

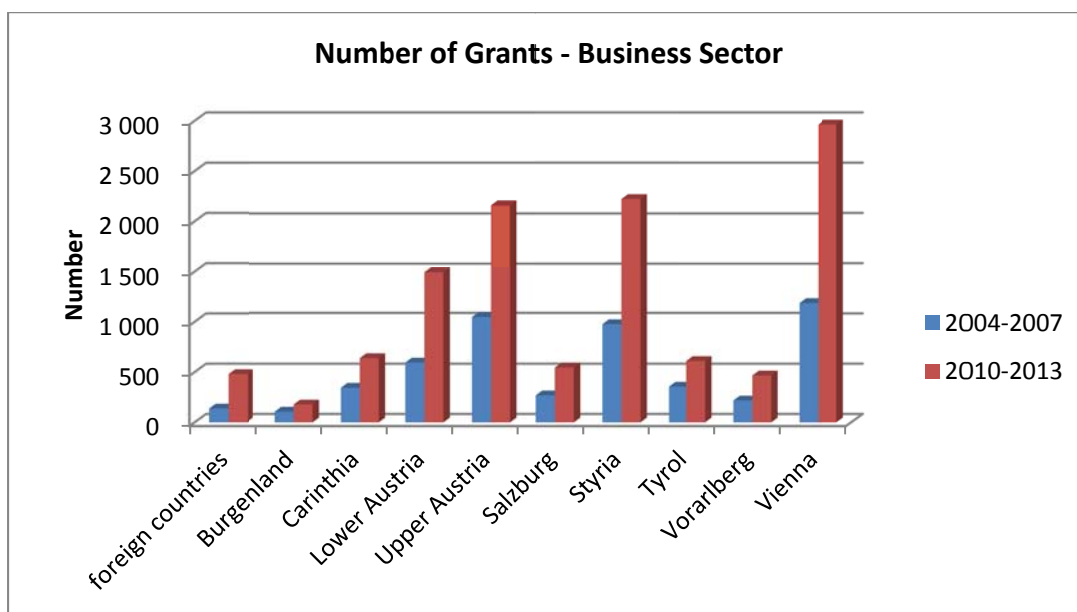
Figure 4.1-cc: Enterprises receiving Public Support for Innovation, Source: OECD Entrepreneurship at a Glance 2014



The R&D activities can also be tracked in the statistics of the largest Austrian R&D funding agency on a national level, the Austrian Research Promotion Agency (FFG). [Figure 4.1-dd] shows the number of grants that were allocated to the business sector (SME and Industry).

Figure 4.1-dd: Number of Grants - Business Sector of the Austrian Research Promotion Agency,

Source: Austrian Research Promotion Agency



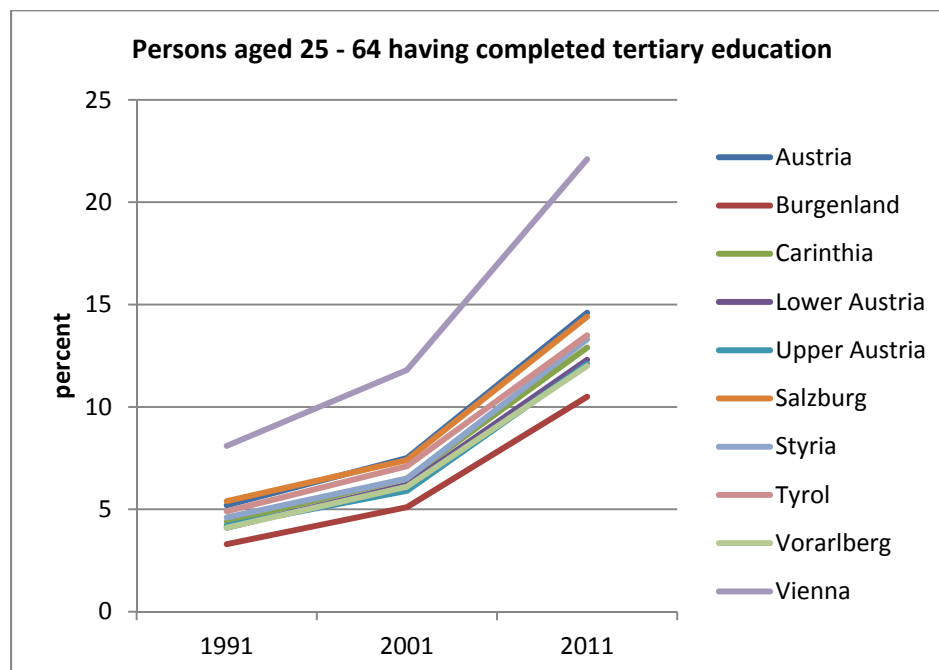
We choose the comparison of time blocks to be able to compare the change over the last ten years without negligible oscillations. The number of grants in Salzburg doubled in years 2010-2013 compared to 2004-2007. This is about the mean growth rate of all regions in Austria and leaves Salzburg at the 6th position within all Austrian regions.

In comparison with Carinthia and Tyrol there is no significant difference that could explain R&D performance disparities. There is knowledge incorporated in the business sector that is fragmented. This fragmentation makes it harder to be addressed by potential partner institutions.

4.1.1.4 Individual actors in the Knowledge space (human resources for R&D)

The regional knowledge pool consists of all human resources available in a region. Individuals who have completed tertiary education are regarded a major part of this group. [Figure 4.1-ee] shows the comparison of several historical levels of development in the regions.

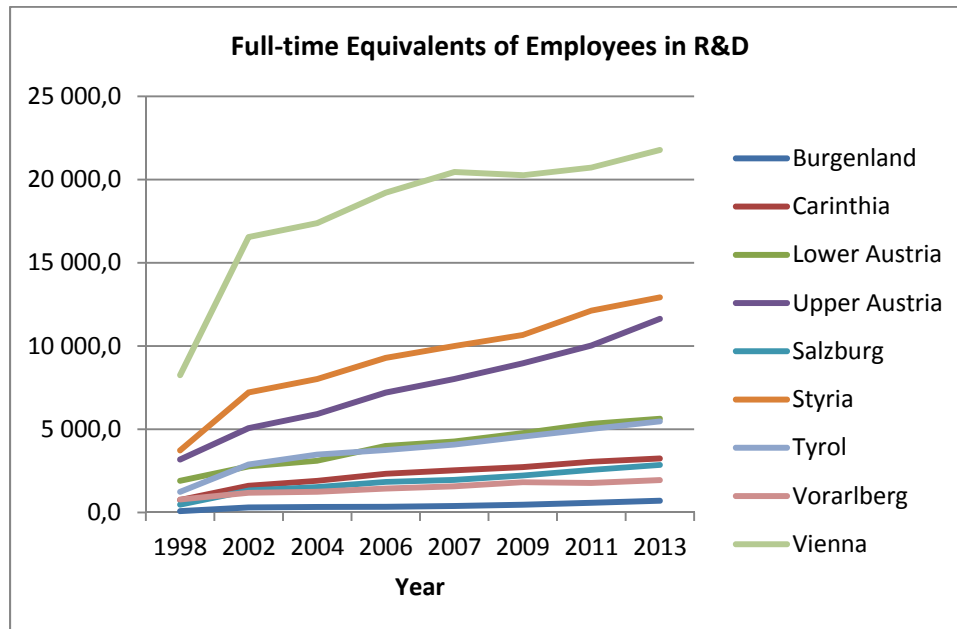
Figure 4.1-ee: Percentage population aged 25-64 having completed tertiary education, Source: Statistics Austria



The curves show that the measures implemented in the last 20 years had successfully involved a higher percentage of the population into tertiary education but that there is a limit to the change of dynamics which is path dependent. Salzburg is within a group of other regions that managed to speed up their performance. Compared with other parts in the Knowledge Space, Salzburg is at a higher level than most of the other regions even though it is a slight lead only. This is in line with the analysis of the university system that shows a high number of students and graduates from the respective institutions in Salzburg.

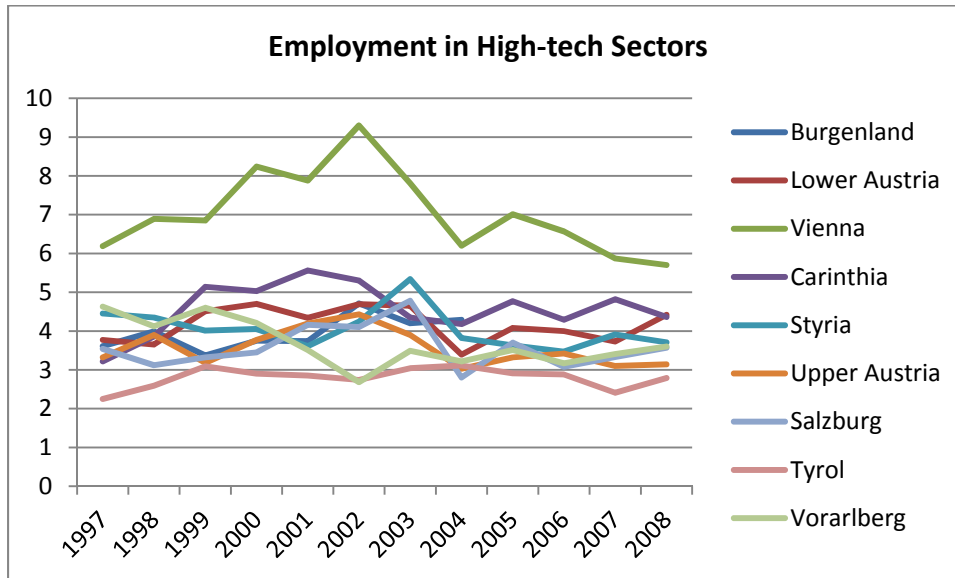
The number of persons available for and active in R&D has increased in the last 20 years in line with the rise of the R&D quota shown in [Figure 1.2-d]. As a whole, there were 50.668 researchers in Austria in 2009. [Figure 4.1-ff] compares the numbers of R&D personnel in Salzburg with the national numbers.

Figure 4.1-ff: R&D personnel 1998 – 2011, Source: Statistics Austria



Vienna, Styria and Upper Austria managed to broaden their resources in R&D personnel remarkably whilst the other regions keep a low level. Compared with the numbers of [Figure 4.1-ee], the line of Salzburg is still within the group of the other regions but has fallen to the lower end. So we assume that something happens between the ability of the regions to educate at a high level of tertiary education and the potential to keep R&D personnel inside the region. We try to get a more detailed picture by specifying employment in high-tech sectors. According to the definition of Eurostat (2014) the development of the last 17 years is shown in the picture in [Figure 4.1-gg].

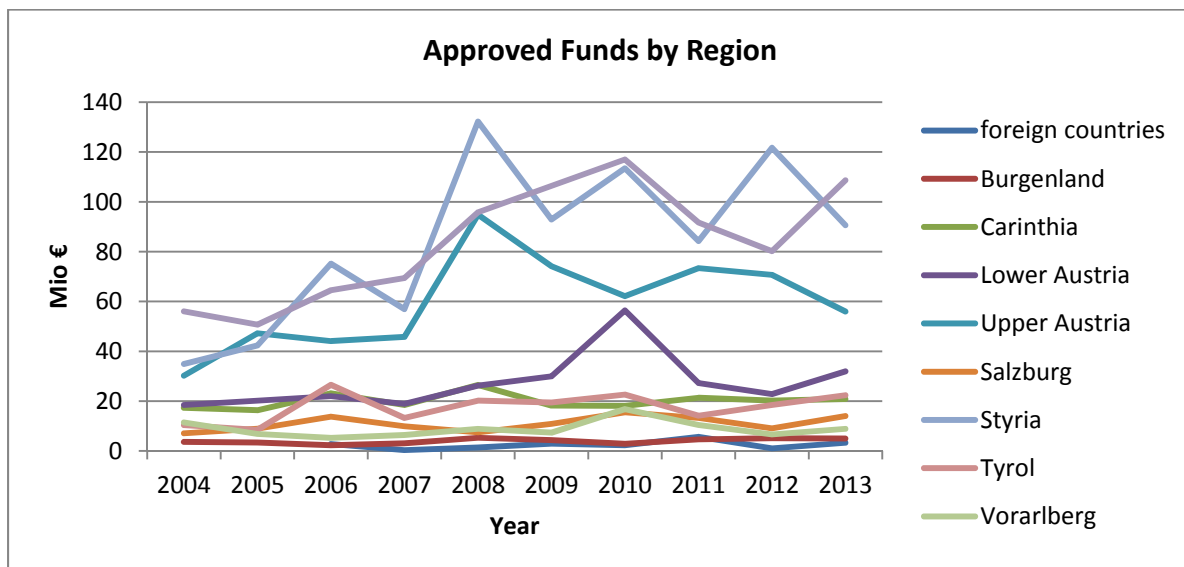
Figure 4.1-gg: Employment in High-tech Sectors (high-tech manufacturing and high-tech knowledge-intensive services), Source: Eurostat



The capital region of Vienna is by far outperforming the other regions regarding employment in high-tech sectors. Salzburg is in the middle of the bunch of all other regions, so there is no further conclusion we could draw from that picture.

Another way to evaluate and compare the human resource capacity of the regions is to sum up the totality of programmes and measures of the largest R&D funding agency. The results are shown in [Figure 4.1-hh].

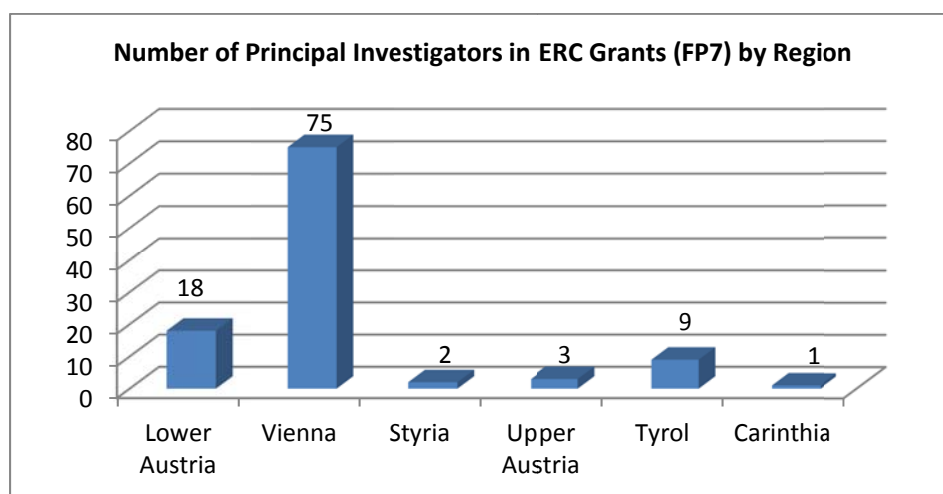
Figure 4.1-hh: Approved Funds by Region of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



The share of Salzburg has been low in the last 10 years, showing the lowest rates compared with regions that host at least one public university. Once more the comparison with regions that also host one university with a quasi similar supply of courses like Tyrol, Carinthia but also Upper Austria leaves Salzburg in the lowest position.

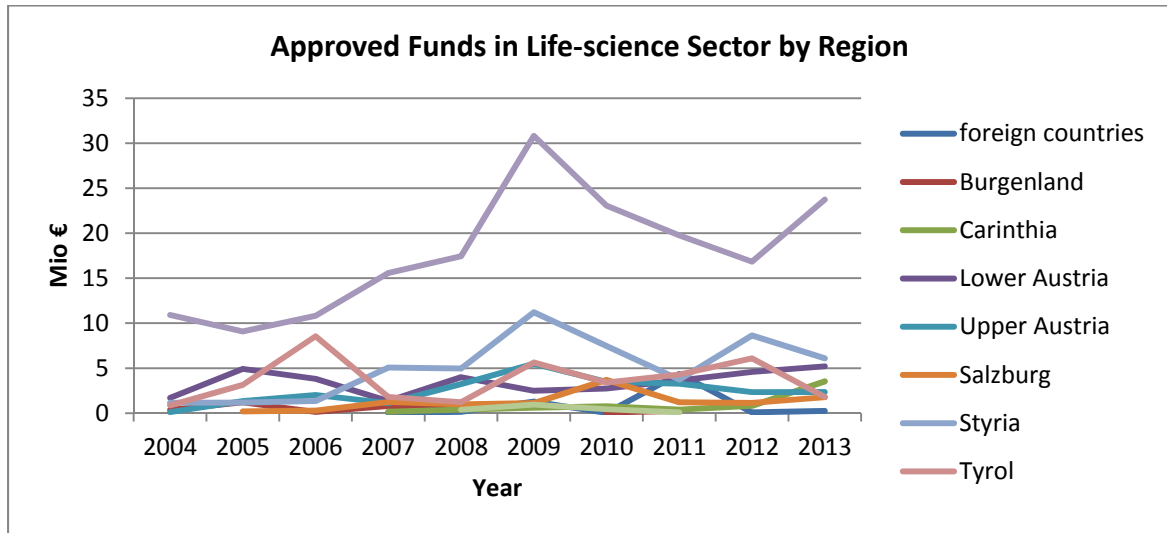
This picture will be tested with the number of ERC principal investigators in the different regions. [Figure 4.1-ii] shows regional distribution of ERC Grants.

Figure 4.1-ii: Number of Principal Investigators in ERC Grants by Region, Source: Austrian Research Promotion Agency



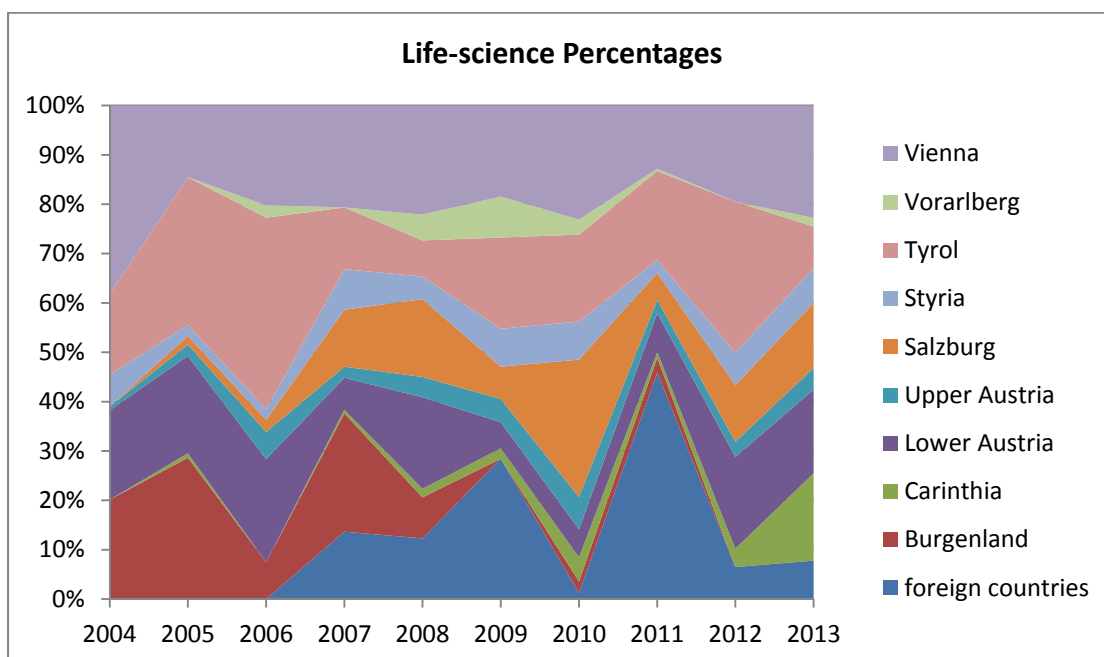
Salzburg is not in the list of investigators of ERC Grants in the year 2014. In the end of 2014 there was a first successful application of an ERC starting grant in Salzburg. The project starts in June 2015 at the University of Salzburg. The picture of the beforementioned approved funds per region is thus confirmed. We have now got an impression about the overall situation of individual actors of R&D in Salzburg. The special interest in Life Science due to the institutional change with the foundation of the PMU in 2004 will be addressed in two further graphs below. We will take this closer look into the sector of Life Science in [Figure 4.1-jj].

Figure 4.1-jj: Approved Funds in Life Science Sector by Region of the Austrian Research Promotion Agency, Source: Austrian Research Promotion Agency



As there was no substantial movement is recorded in Salzburg in 2004 and 2005 there could be an impact coming from the change in the institutional setting in 2003 when the Private Medical University (PMU) was founded. The ups and downs in the graph can be explained with the statistical methods of the Austrian Research Promotion Agency that uses the time of contract as the input for statistics. To verify the picture we compare the life-science sector in itself and draw the graph for the percentages with Austria as 100% in [Figure 4.1-kk].

Figure 4.1-kk: Life-science Sector as Shares of Regions, Source: Austrian Research Promotion Agency



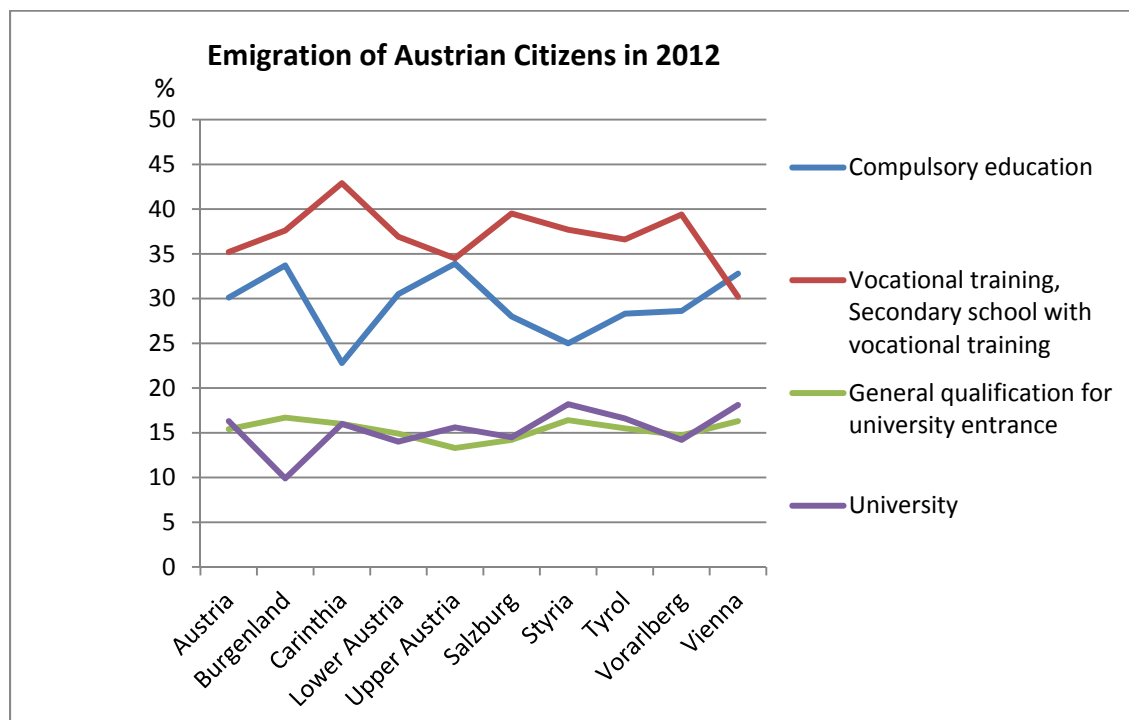
As there was no visible activity in Salzburg in 2004 and 2005, there are also some stable projects from 2007 until 2013 which can be credited with the institutional change in 2003.

Migration

Migration causes a major influence onto the system of individual actors in R&D due to the difference in numbers and education levels following when people move into and out of a region.

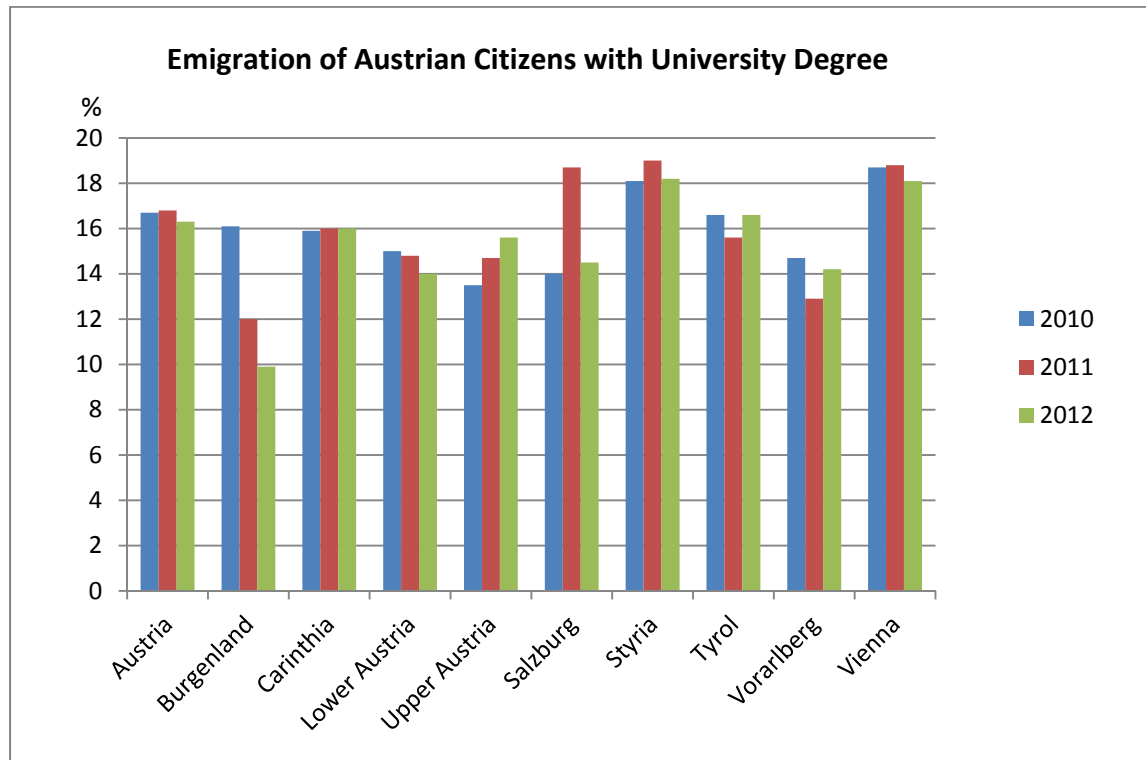
Migration numbers all over Austria have gone up in the last years. In 2012 the net migration gain was 43,797 persons, which is an increase of about 40 % compared to 2011 with 30,705 persons (Source Statistics Austria 2012). The numbers regarding the education level can, for statistical reasons, just be given for the numbers of people moving out. In other words [Figure 4.1-II] illustrates the respective numbers of “Brain Drain“ for the year 2012.

Figure 4.1-II: Emigration of Austrian Citizens in 2012, Source: Statistics Austria



There is a similar distribution between the regions for all the levels of education. If we compare different years for one specific level of education, the results can be seen in [Figure 4.1-mm].

Figure 4.1-mm: Emigration of Austrian Citizens with University Degree 2010 - 2012,
Source: Statistics Austria



Outgoing migration flows in higher education from Austria are relatively high. According to (Statistics Austria 2012) “the emigration rates are particularly high for university graduates (5.3 ‰) and persons with technical education or training in natural sciences (6.2 ‰)”. This „Brain Drain“ of university graduates makes the development of national and regional knowledge resources more dependent on other sources, such as those employed in local research institutions and those trained through education programmes in companies. For the case of Salzburg the graph shows in comparison with [Figure 4.1-ee] that the number of emigrated university degree holders corresponds with the mean percentage of degree holders in the region. This can be interpreted as there being no compelling reason for people who got a higher education in the region to use this knowledge for the advantage of the same region.

As stated above, there is no clear evidence of the education level of immigrants into the Salzburg region. Nevertheless there are numbers for immigrants already living there. According to the Chamber of Labour Salzburg

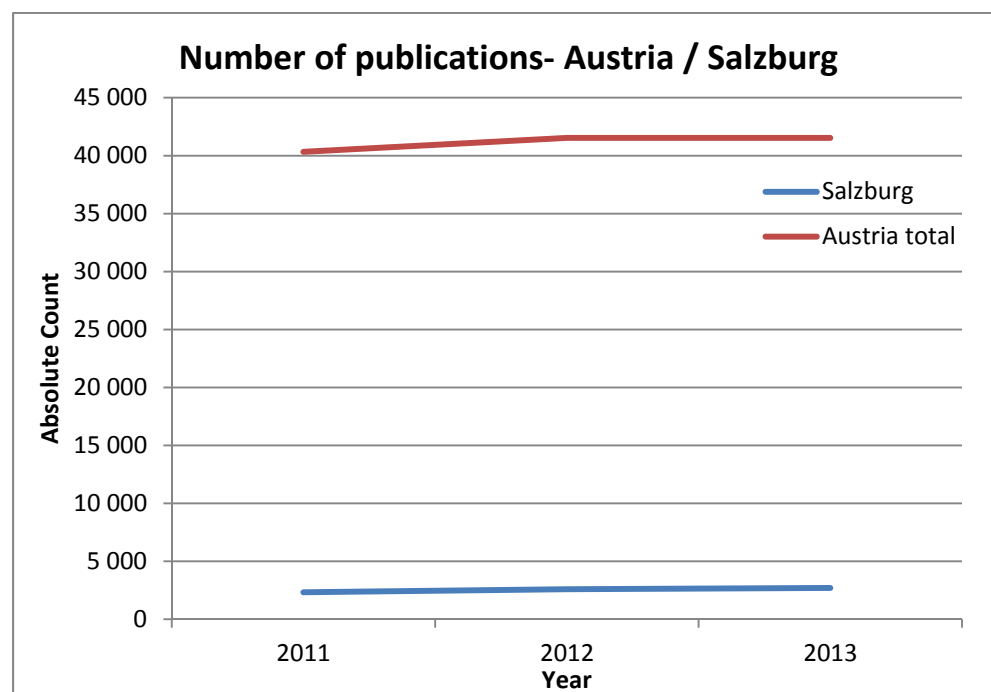
(http://sbg.arbeiterkammer.at/service/presse/pressemitteilungen/Jeder_zweite_Migrant_ist_fuer_s_einen_Job_ueberqualifiziert.html)

12% of the population of Salzburg is foreign passport holders, whereas 18% have some migration history. No matter what education level these people have, just about 20% of them apply for nostrification of their diploma, which means that 80% of them (counting for about 14 % of the inhabitants of Salzburg) are not capable of or interested in applying. One consequence is that more than 50% of migrants with medium or higher education level are employed in jobs that would require just a compulsory education level. In short, qualification is lost.

4.1.2 Publications

Institutions use different ways of providing reliable numbers of publications. On the one hand there are peer-reviewed publications in journals, but also non-peer-reviewed publications or contributions to conferences or book chapters. So there is no simple way to compare the publication statistics for Salzburg or other regions. Moreover the Universities of Applied Sciences do not publish their statistics and there is – even worse – no central facility for collecting this kind of data. We therefore follow the federal ministries' way of counting them, meaning that we concentrate on the public universities first and only then try to perform the same analysis on the private university sector. The overall number of publications in public universities in Austria is shown in [Figure 4.1-nn], which starts in 2010 where unidata began to collect data of publications in the current systematic way.

Figure 4.1-nn: Publications of Public Universities in Salzburg and Austria 2010-2012, Source: unidata

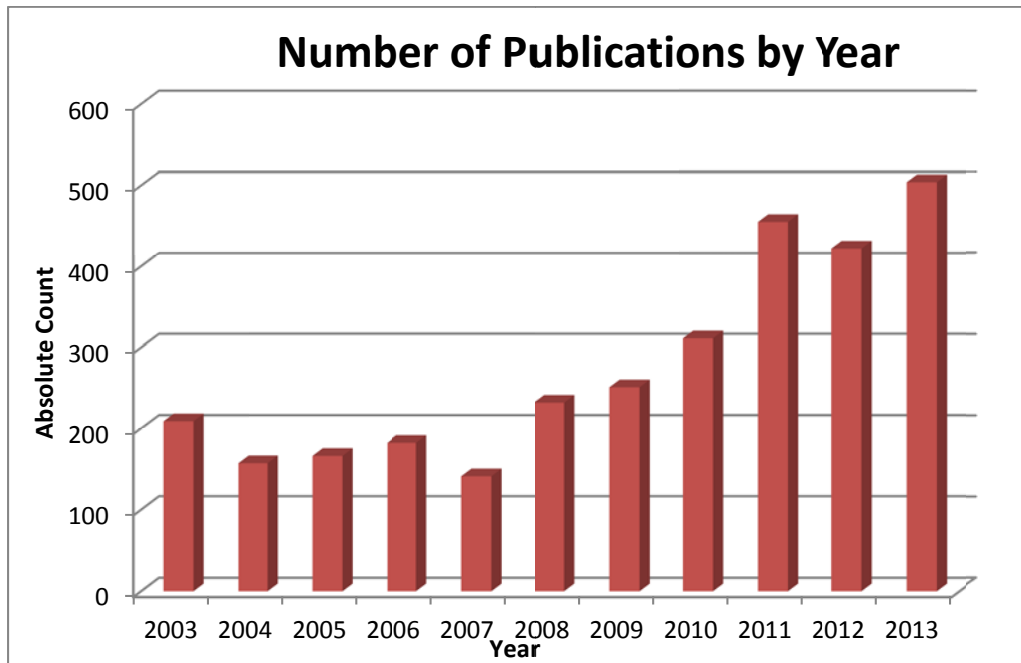


In 2012 public universities in Salzburg recorded a number of 2,581 publications for a number of fulltime-equivalents in scientific personnel of 1,230, thus the average publication rate per person being 2.1. This is a little more than all the universities in Vienna with 1.8 and, if counting the University of Vienna as the largest institution in that field, it is quite the same rate as we have 7.386 publications there compared to a number of 3.336 full-time equivalents, which is an average of 2.2.

There is no big movement in the graphs of [Figure 4.1-nn], which is not surprising because of the long-term planning of scientific institutions following the financing rhythms of the federal budget (GUF).

The foundation of the Paracelsus Medical University (PMU) in 2003 was one major changes in the institutional landscape of the Regional Innovation System in Salzburg. Therefore we take a closer look on their performance of publications. [Figure 4.1-oo] shows the development from the time of foundation until now.

Figure 4.1-oo: Publications PMU 2003 - 2013



The rate of publications does not remain at a stable level but shows two phases within the last ten years. The first phase starts with the foundation and can be seen as a stabilising period, lasting until 2009. Afterwards there was a higher level of activity established which has been stable from 2011 onwards and expected to provide a solid level of publications in the Medical and Life Science Sector for the coming years.

4.2 The Innovation Space

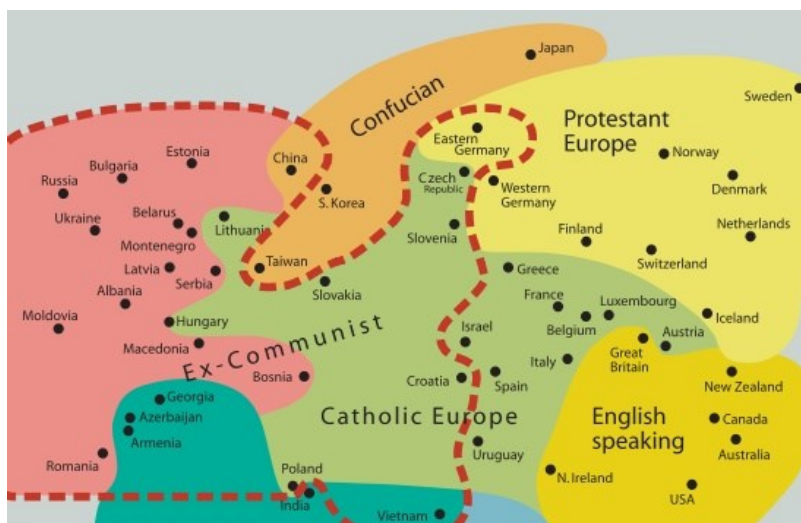
This section focuses first on two key features of the Innovation Space:

- a. 4.2.1 Innovation actors (companies, business support organisations, spin-offs and start-ups) and relationships between them
- b. 4.2.2 Patents as a measure of innovation diffusion in the economy

4.2.1 Innovation actors (companies, business support organisations, spin-offs and start-ups) and relationships between them

The precondition for innovation actors is the cultural framework described in [Chapter 2] as the attitudes and values present in a region. Austria is in this regard surrounded by countries known as innovation followers. This is also confirmed when we look at the [Figure 4.2-a] showing the Culture Map of the World proposed by Inglehart (1997) as introduced in [Chapter 2].

Figure 4.2-a: Culture Map of the World, Source: Inglehart (1997)



We can see the existing embedment of Austria in the area of catholic Europe and, in addition, the closeness to protestant and anglican zones. First, the position of Austria in the German speaking zone means a reduced connectivity to the international research and innovation activities following the translation barrier. Another point is even more important. The entrepreneurial activity is highest in the English speaking, Anglican zone. The cultural difference is hereby manifested through language and values based on different religious faiths. This fact is outweighed in part by the differences in the central European education system.

4.2.1.1 Innovative companies

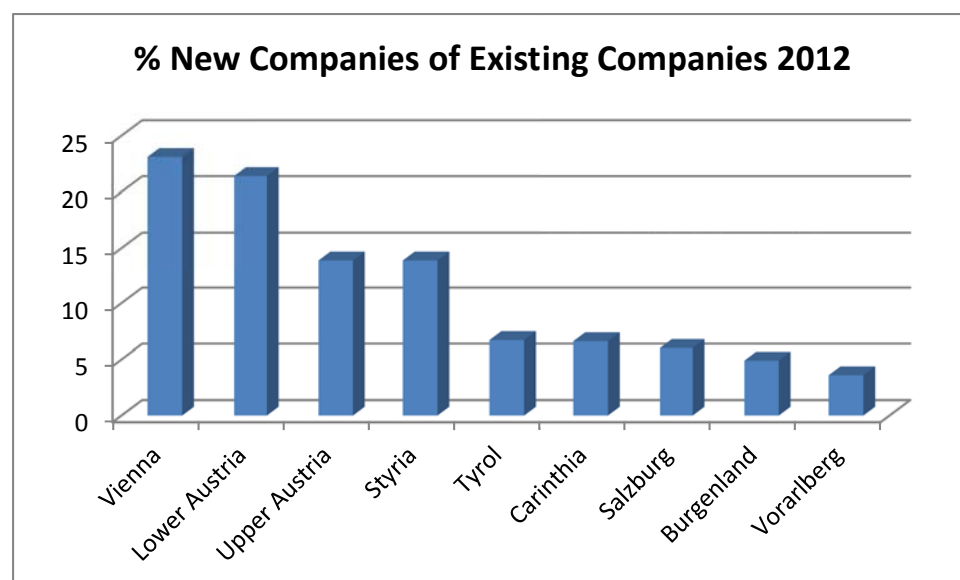
These are the most important actors in the Innovation Space. As shown in [Figure 4.1-aa] above, among the top 30 companies with the highest turnover in the Salzburg region, the largest share is operating in the trading or service business with little or no innovative capacity. Therefore we are going to analyse to what extent these and other innovative groups perform innovation, or, more precisely, determine their innovation intensity.

The Regional Innovation Scoreboard shows the Austrian data on a NUTS 1 level, therefore this source is not valid for the analysis of Salzburg. The Chamber of Commerce, which counts the number of companies in the region of Salzburg, does not make a distinction between innovative and non-innovative companies. So neither the Chamber of Commerce nor the Federation of Austrian Industries nor the Commercial Section of the regional Ministry provide numbers of the innovation intensity of companies or other institutions. All these institutions claimed in autumn 2014 that they were in the course of generating the respective data.

The input of financial resources into the Innovation Space is fairly well-developed in Salzburg in comparison to the other Austrian regions. But there seems to be a deficit in the output derived from the activities in the Innovation Space regarding the input numbers.

Innovative companies also come out of the pool of newly founded companies. The ratio of new companies compared to the number of existing companies varies a lot between the regions [Figure 4.2-b].

Figure 4.2-b: Percentage of New Companies 2012, Source: Statistics Austria



The percentage of new companies in Salzburg is quite low compared to other Austrian regions. This indicates low dynamics in the important renewal of the company sector. These numbers will be compared to the members of the Chamber of Commerce in [Figure 4.2-f].

4.2.1.2 Business Support Organisations

Business support organisations facilitate innovative activities of newly founded as well as established companies. They build a framework of technology transfer institutions, incubators or S&T parks that provide not just space but also know-how for innovation processes that assist companies in their effort to implement the respective process into their current corporate activities. The major actors in business support for innovative activities are shown in [Figure 4.2-c], most of them are directly funded and influenced by public authorities.

Figure 4.2-c: Business support organisations in the Salzburg region 2013,

Source: <http://www.innovationszentren-austria.at>

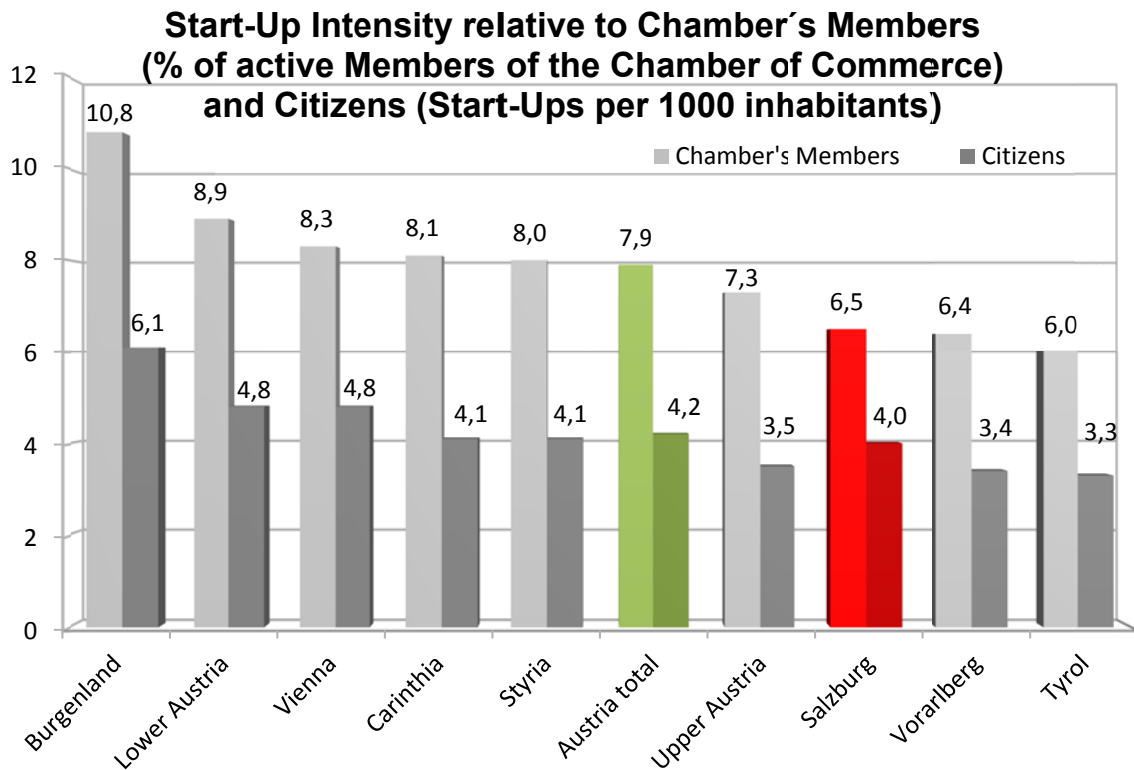
Business support organisation	Number	Number of companies/ of which newly founded	Workplaces
Impulse Centers (IZ)	5	57/28	377
Technoparks (TP)	2	96/63	646
Research Institutions [Figure 4.1-t]		N/A	900

There are Impulse Centers (IZ), TechnoParks (TP) and Research Institutions that boost the innovation capacity in the region. Most technology transfer institutions are managed by universities, notably by people trained in the university sector who have little or no work experience in the industry sector. Industry demand is therefore only slightly taken into consideration in the transfer activities coordinated by these institutions. S&T parks have a long tradition in the Salzburg region. Their success has always been determined by the level of capacity utilization, so that a key priority of park managers was to fill the space available. This leads to a distorted use of the park, from innovation support to a real estate development institution.

4.2.1.3 Start-ups/Spin-Offs

Start-ups are a major part of the dynamics of the company sector. As discussed in the literature Klapper et.al. (2010) they are “essential for the dynamism of the modern market economy“. The number of start-ups is a measure for the pool of the established companies to embed and integrate innovations through acquisition. The number is counted by the regional Chamber of Commerce, but similar to the innovation intensity of the companies themselves in [Chapter 4.2.1.1], there is no information available on their innovation intensity. Therefore the overall number of start-up companies will be considered for the analysis in [Figure 4.2-d].

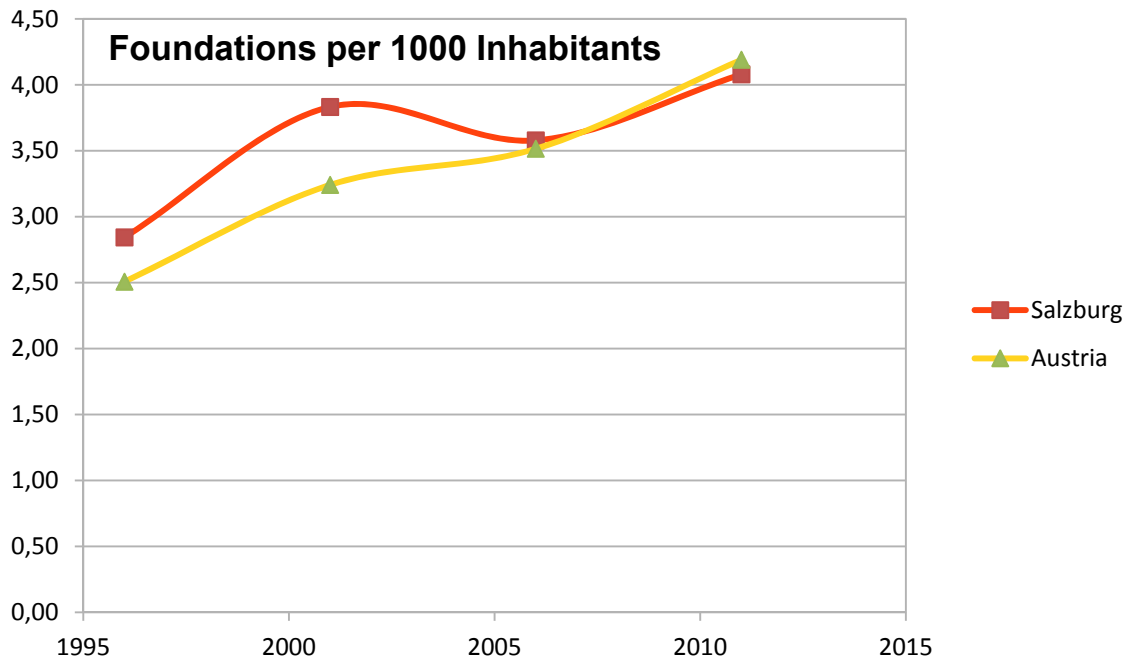
Figure 4.2-d: Start-Up Intensity 2012 with reference to the number of Chamber's Members and number of Citizens, Source: Chamber of Commerce Salzburg



The relative statistics include the chance for smaller regions with less industrial activity to show up in the front positions because the denominator is smaller. Burgenland realizes that and moves to the front position in both relative comparisons. Salzburg is on the low end and also below the Austrian average.

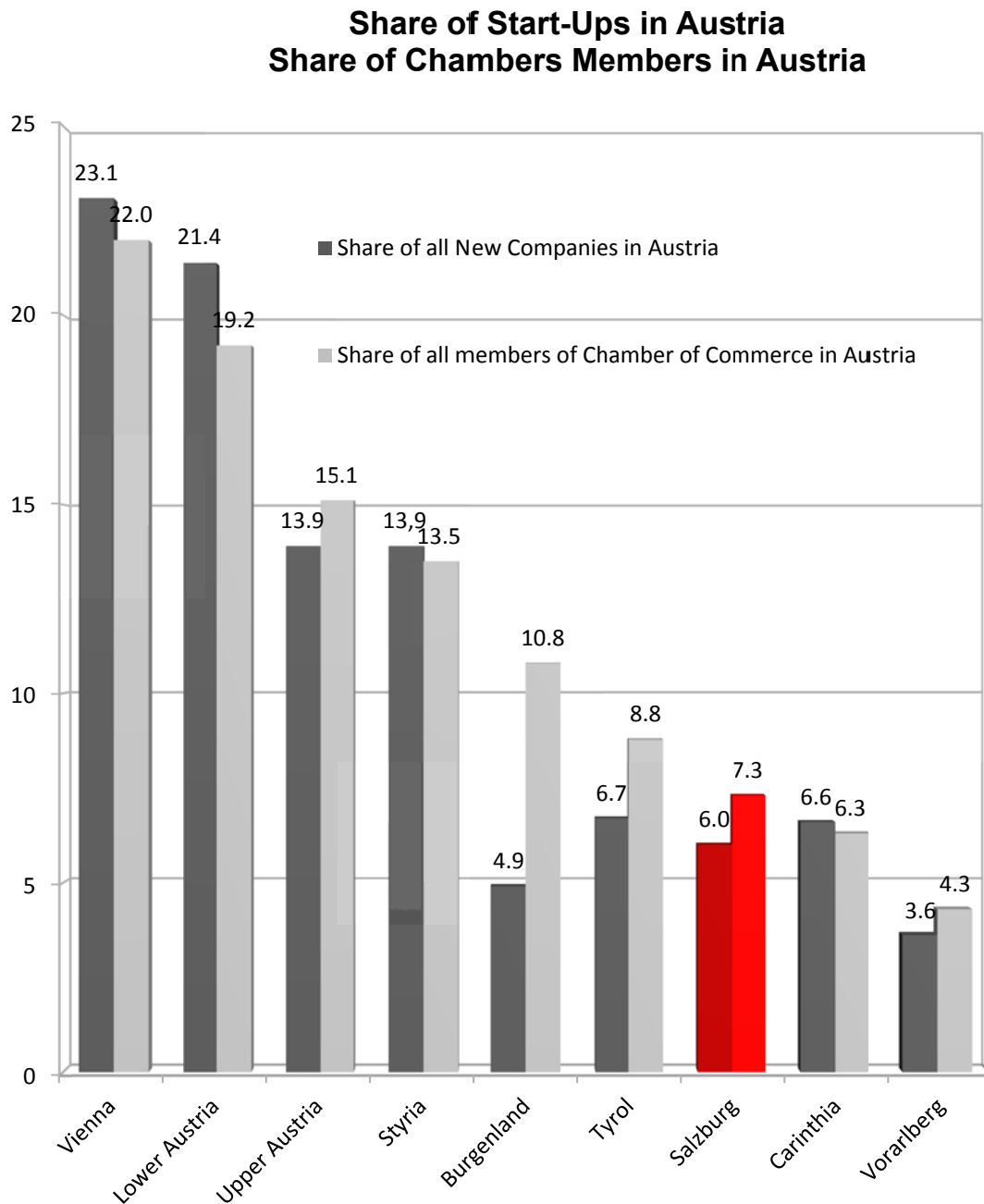
This has not always been the case as we can see in [Figure 4.2-e], which looks into the historical development of numbers of foundations.

Figure 4.2-e: Start-Up Companies 1996 > 2011 - Salzburg (Regional) and Austria (National), Source: Statistics Austria



Salzburg had a very active start-up scene in the beginning of last decade compared to other Austrian regions. It had lost its pace in the last years and fell below average in 2007. The active time span before 2007 can also still be seen in the rate of the self-employed shown in [Figure 4.1-s]. We look into the actual share of new start-ups compared to all other Austrian regions in [Figure 4.2-f].

Figure 4.2-f: Share of Start-ups in Austria/Chamber´s Members in Austria in 2012,
Source: Chamber of Commerce Salzburg



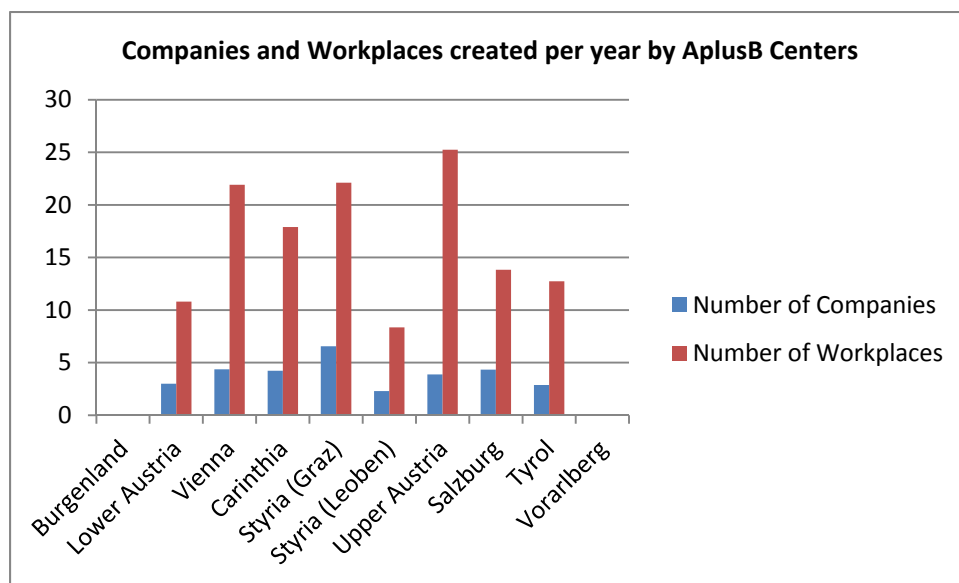
The share of start-ups is in the lowest third whether we count them in relation to all companies or to the members of the Chamber of Commerce. With 6.3 % the share of new companies is in line with the share of population derived from [Figure 1.2-b]. But there is more potential because the share of Chamber of Commerce Members is more than 7 %. This confirms the assumption of having a core area of non-innovative trading and tourism industry in the region.

In the course of the year 2015 a new survey is published containing regional entrepreneurship numbers by the „Global Entrepreneurship Monitoring“ (GEM).

Spin-Offs

There is no tracking of Spin-Offs from all the institutions of tertiary education in Salzburg. The University of Salzburg is one of the owners of the public (State) state financed incubator “Business Creation Center Salzburg” (BCCS), which hosted 8 start-ups in July 2014 and had a staff of 4 people. As per this date, there are 22 people employed by the start-ups hosted in BCCS. [Figure 4.2-g] shows the comparison of the workplaces created per year calculated on the basis of the year of foundation.

Figure 4.2-g: Companies and Workplaces created per year by AplusB Centers, Source: Austrian Research Promotion Agency



The number of companies that went through the support process of the Salzburg AplusB center BCCS lies within the average of the other regions. This picture does not change if we compare the respective workplaces. The number of employees in BCCS is high compared to international business incubators that employ in average one person per seven start-up companies. In the end of 2014 it was announced that the owners of BCCS will not prolong the institution for the next financing period. Therefore BCCS will stop its activities in 2015. A concept for a follow-up model for hosting start-up companies was announced by the regional administration.

4.2.1.4 Public and private support for the development of the Innovation Space

Public support measures

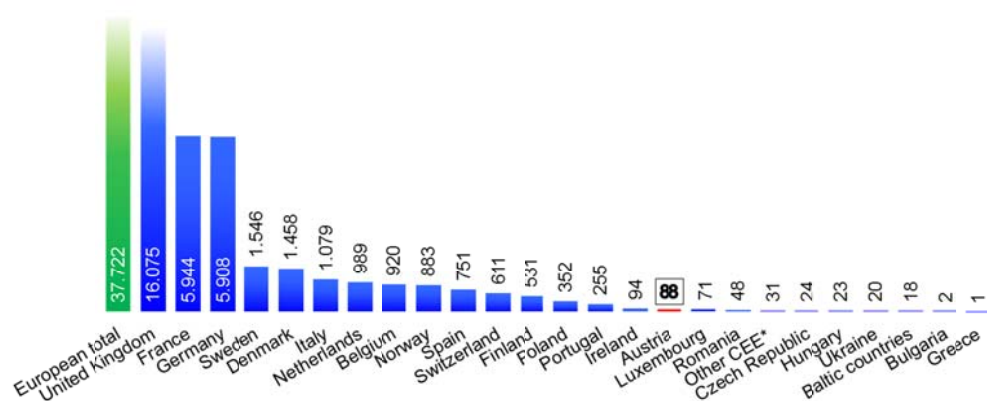
According to the website of the Austrian Research Promotion Agency the Innovation Voucher is a “funding instrument designed to help small and medium-sized enterprises in Austria to support ongoing research and innovation activities. It enables enterprises to enlist the services of research institutions and to pay for these services a maximum sum of either € 5,000 or € 10,000. The Innovation Voucher is designed to encourage SMEs to co-operate with research institutes. It should make it easier for small and medium-sized companies to overcome inhibition thresholds regarding cooperations with research institutions”.

The main lines of support follow a procedure that is administrated by the regional ministry. Its main basis is the “Economic Programm for Salzburg 2020” which provides five main areas for the innovation activities: Construction, Wood Products and Technologies, Creative Industry, Life Science and ICT and New Media. Guidelines and standard procedures can be found (in German language only) on the webpage of the respective department for Economy, Research and Tourism of the regional ministry (Source: <http://www.salzburg.gv.at/themen/wt/wirtschaftsfoerderung.htm>). This site also contains links to the main national funding agencies such as the Austrian Research Promotion Agency (FFG) or the Austrian Economic Service Agency (AWS).

Private Support measures

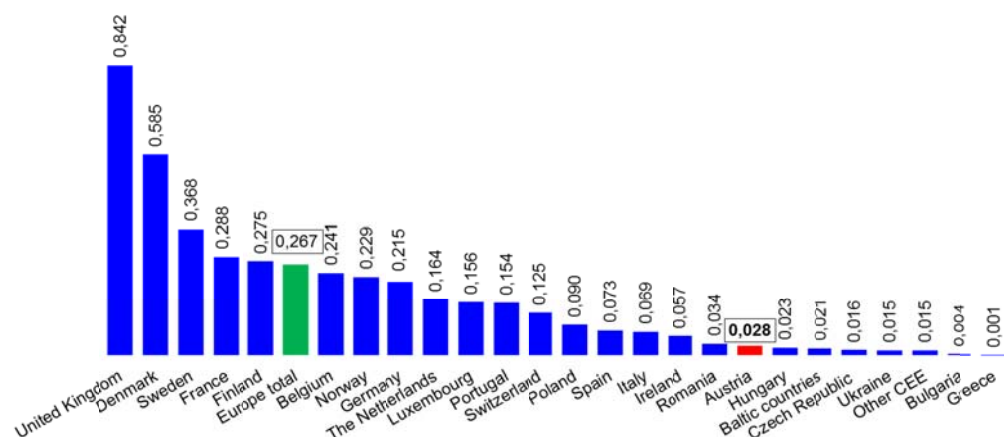
No strong links have been found between the R&D community and the potential funding institutions or individuals. Another reason for the poor condition of private initiatives for the regional innovation system is the overall situation of the risk capital market in Austria. Austria is part of the Basel System hindering banks from engaging themselves in high risk projects of existing companies or start-ups. The venture capital market had traditionally been weak all over Austria and a new downturn occurred during and after the years of the economic crisis after 2008. According to the ranking of the (EVCA 2013) not only the innovation leaders are outperforming Austria but also Eastern European countries like Poland as shown in [Figure 4.2-h].

Figure 4.2-h: Country Ranking of the Investment Volume in Risk Capital (Fonds with their Headquarters in Europe) in 2013, Source: European Venture Capital Association (EVCA)



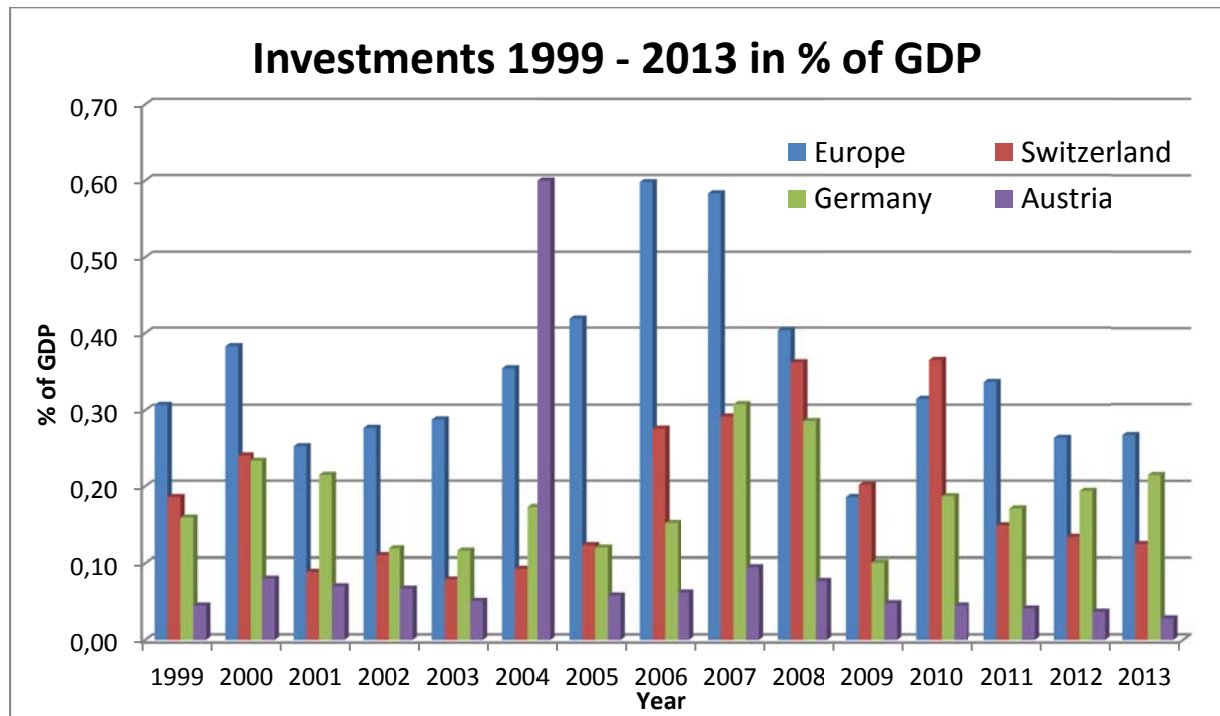
The argument that Austria is a small country is not valid as comparable countries like Sweden, which has about the same population and GDP, host a volume of risk capital 20 (!) times higher than Austria. Therefore we are also interested in the share of investment volume in GDP. [Figure 4.2-i] shows these numbers.

Figure 4.2-i: Country Ranking of the Investment Volume Share in GDP in Risk Capital (Fonds with their Headquarters in Europe) in 2013, Source: European Venture Capital Association (EVCA)



The picture in GDP is even worse, Austria finding itself in a region of Central and Eastern European countries like Romania or the Baltic countries. As these countries also have to cope with the Basel system there have to be other cultural and legal explanations for that position. To get a better idea of the historic development of this situation we will look at the numbers of the last 15 years compared with neighbouring countries and the total European level.

Figure 4.2-j: Development of Investment Volume of Funds in Austria, Germany and Switzerland in GDP Share in Risk Capital 1999 - 2013, Source: European Venture Capital Association (EVCA)



The situation in Austria in comparison with neighbouring countries had always been bad. We can see the downturn of investments after the crisis in 2000 and in 2008. But there is another, really bad outlook: In the last three years the situation in Germany has recovered from the last crisis and numbers have slowly gone up. The numbers in Austria, however, are still going down each year to lower and lower levels. Regarding the cultural reasons we will come back to this situation in [Chapter 5.2].

From the national level we now go on to the region of Salzburg even if there are no detailed data available. European private equity and venture funds invested 88 M€ into Austrian small and medium-sized enterprises in 2013. As there are no numbers for the regions, we suggest a share calculated out of the residential population in Salzburg of 6.3 % [Figure 1.2-b] which will provide a potential share of investment. This could be even lower because most of the venture activity is expected to stay in the capital region of Vienna. Salzburg is suspected to have an investment volume out of this investment class below 5.2 M€. Another calculation would be to convert the share of GNP quota of 0.028 % national level to the Salzburg Gross Regional Product. This 22.806 M€ (GRP in 2013) calculated on the 0.028 quota would result in an investment volume of 0.6 M€. With that share it is no surprise that there is no visible activity of start-ups financed by this kind of risk capital. According to Lee et.al. (2007, p.285) "in Europe, venture capital only supports approximately 13 percent of start-ups, whereas in the United States the rate is more than 30 percent". The supply of and demand for venture capital is also discussed in Armour et.al. (2003, p.31) - introduced in [Chapter 2] - where it is made clear that "favorable tax and legal environments facilitate the establishment of venture capital and private equity funds and increase the supply of capital. Similarly, temperate bankruptcy

laws [see also Chapter 4.3.2.1] stimulate entrepreneurialism and increase the demand for venture capital. Government programs by contrast, crowd out private equity investment“. This survey was based on data of the US, Canada and 13 European countries including Austria.

Therefore the analysis shows that aside from cultural aspects the legal framework in Austria is very unfavourable for venture capital investments. National authorities have not been providing conditions that attract investments e.g. with an amendment to the act „AIFMG (Alternativ-Investment-Fund-Management-Law)“.

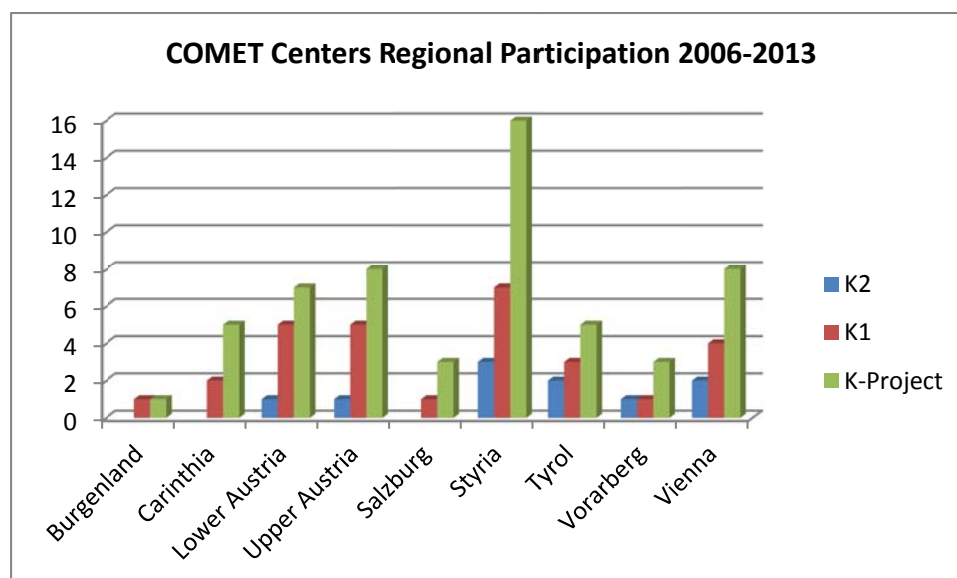
4.2.1.5 Hybrid Innovation Actors

Centers of Competence

Centers of Competence provide a contribution to the Innovation Space and to the Consensus Space. The cooperation aspects leave a much stronger impression than the output effects. According to the programme document on the website of the Austrian Research promotion Agency (www.ffg.at), the Programme COMET was launched by the Ministry of Science, Research and Economy and the Ministry of Transport, Innovation and Technology in the year 2006 in order to “strengthen the long-term research co-operation between science and industry in top-level research”.

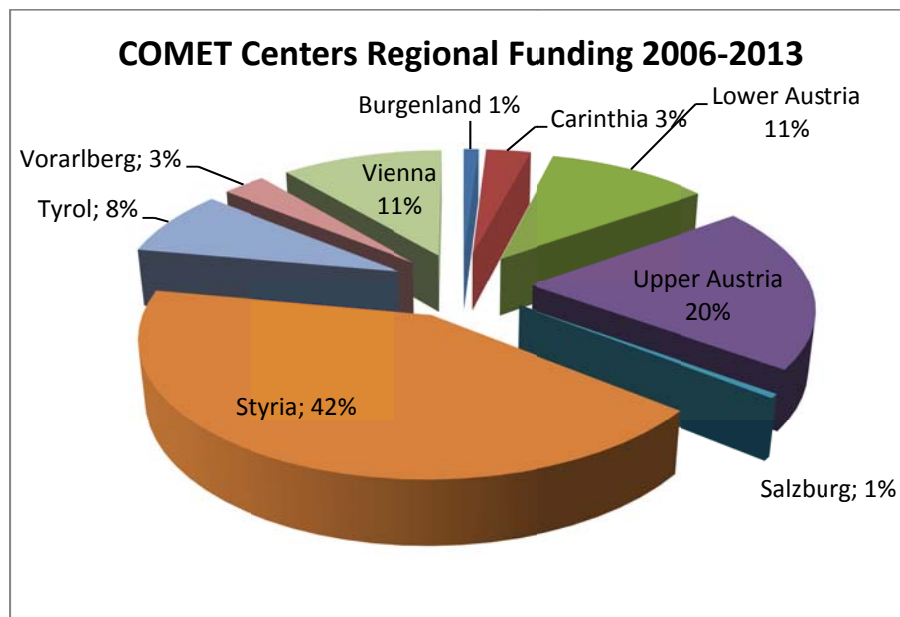
The top level is the five K2 Centers with a minimum of one scientific partner and five company partners. They operate throughout a period of 10 years with a maximum funding of 5 M€ per year and a public funding share of 40 % to 55 %. The other categories are K1 centers and K projects with shorter running time and less funding. The total volume of COMET in the end of 2013 was 1.1 billion€ funded by industry (527 M€), the federal level (351 M€), the regional level (176 M€) and scientific institutions (56 M€). The details of the regional involvement are shown in [Figure 4.2-k].

Figure 4.2-k: COMET Centers Regional Participation 2006 – 2013, Numbers of Projects in the Categories, Source: Austrian Research Promotion Agency



Salzburg is on the lower end of the regions regarding participation in the COMET programme, it participates in fact in just one K1 project. Involvement in the K project is larger with a number of five projects but there are no institutional structures within K projects, therefore the importance for the regional innovation system is less than for K1 or K2 centers. If we compare funding, the situation is even worse with Salzburg at the far end with 0.5 % as shown in [Figure 4.2-I].

Figure 4.2-I: COMET Centers Regional Funding 2006 – 2013, Source: Austrian Research Promotion Agency



In the evaluation report of 2013 the interviewees state that it is not only the center itself as an institution that counts but the cooperation aspects and the possibility to put into effect a research project that was planned within the participating institutions (Technopolis (2013, p. 40)). The low number for Salzburg shows the limited capability for cooperation within and beyond the region.

Christian-Doppler-Laboratories / Josef-Ressel-Centers

The Christian Doppler Research Association promotes cooperation between expert scientists and innovative businesses. The collaboration takes place in Christian Doppler Laboratories and Josef Ressel Centres. Christian Doppler Laboratories pursue application-orientated basic research at universities or non-university research institutions, while Josef Ressel Centres carry out research in a similar way at universities of applied sciences. The research groups are established for a limited period of up to seven years and are embedded in their respective academic research environment. The groups have a high degree of scientific freedom and are evaluated at an international level. Around 150 company partners cooperate with the research units.

Christian Doppler Laboratories have been established since 1989 in universities. In the year 2013 73 laboratories were active, employing about 700 scientific personnel. Six of these centers are active at the University of Salzburg.

Josef Ressel Centres pursue application-orientated research. In the year 2013 four centres were active, one of them at the University of Applied Sciences in Salzburg.

4.2.1.6 Demand for Innovation

The demand side of innovation was brought into the discussion in the literature [Chapter 2] with the report of Business Decision Limited (2003) where the power of consumers to drive innovation is described. It has performed a survey on more than 1000 enterprises and 125 associations to find out the main obstacles for innovations to reach the market. The results are impressive. Here the top four obstacles:

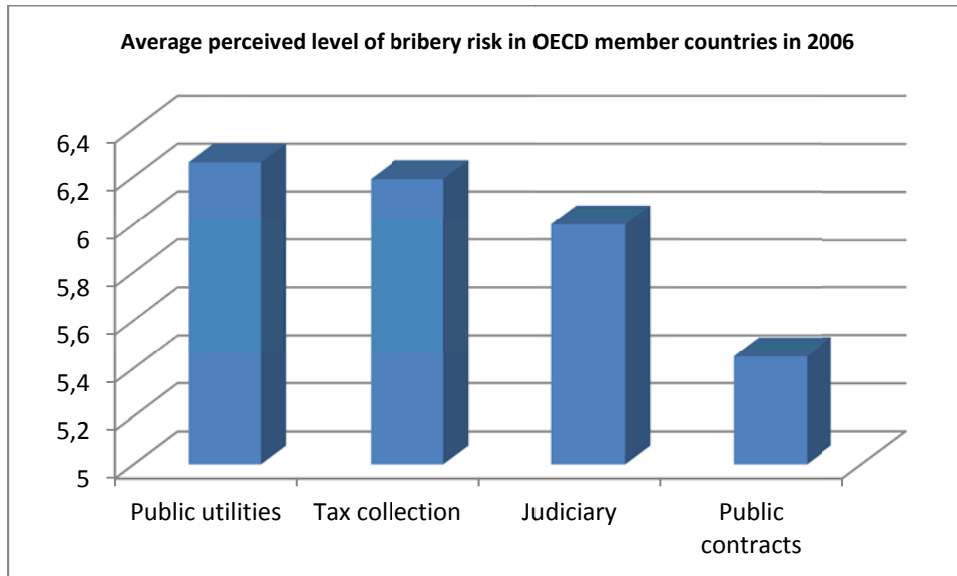
- Nr.1: The uncertainty of customers about security and quality of innovations (75%)
- Nr.2: Lack of awareness about innovations and their functionality (67%)
- Nr.3: High costs of the innovation and the associated products and services (62%)
- Nr.4: Lack of ability by the clients to use the innovation (60%).

This implies that just one of these, the cost factor in Nr.3, is not associated with the perceived usefulness or the perceived ease of use of the customer. In other words, if an innovation fails in the perception of the demand side, it is likely going to fail. As this is not just a technological issue but a cultural and societal issue, we will address this question in [Chapter 5.2].

In the same context the second barrier to innovation on demand side can be found, which is corruption and bribery. The reason is the link between levels of corruption and the innovative impact of public procurement. The higher the corruption the more likely it is that the same group of companies continues to get public contracts. Therefore this group of companies has no incentive to offer innovative solutions because they will anyway get the contracts in the end. The other group will of course not offer innovative solutions because they know that they have little chance to beat the established companies.

In a survey in 2006 the World Economic Forum (WEF) asked more than 11,000 business leaders in 125 countries about the situation of corruption and bribery in four different categories shown in [Figure 4.2-m]. The respondents were asked "how often firms would make undocumented extra payments or bribes connected with public utilities, tax payments, the award of public contracts and favourable judicial decisions." The responses range between 1 (common) and 7 (never occurs).

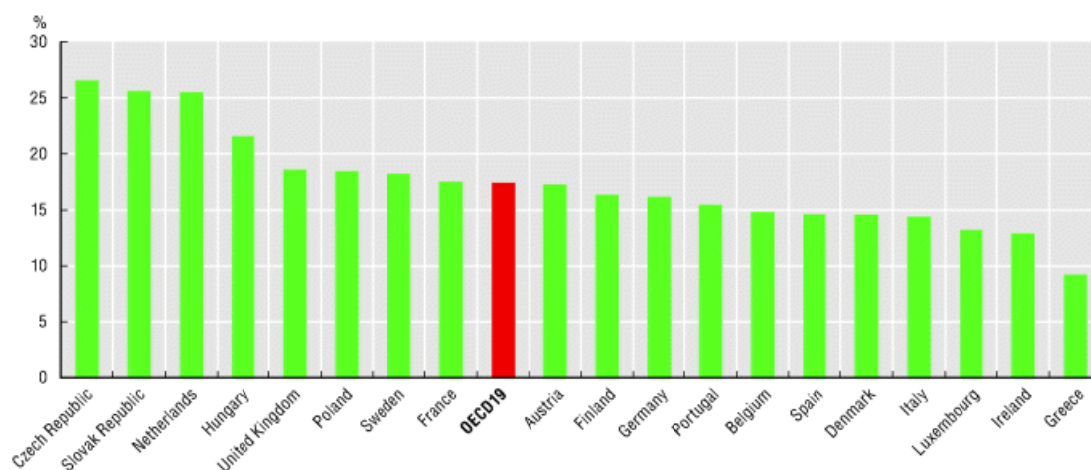
Figure 4.2-m: Average Perceived Level of Bribery Risk in Selected Government Activities in OECD Member Countries in 2006, Source: World Economic Forum, Executive Opinion Survey (2006), www.weforum.org/documents/gcr0809/index.html



The lower the number, the more common is the risk for bribery with a scale from 1 to 7. The survey shows that public contracts are most at risk to create a barrier to independent public procurement.

The size of markets for public procurement varies across different countries. The numbers for the year 2006 are shown in [Figure 4.2-n].

Figure 4.2-n: Public Procurement as a Percentage of GDP in 2006, Source: Eurostat 2006



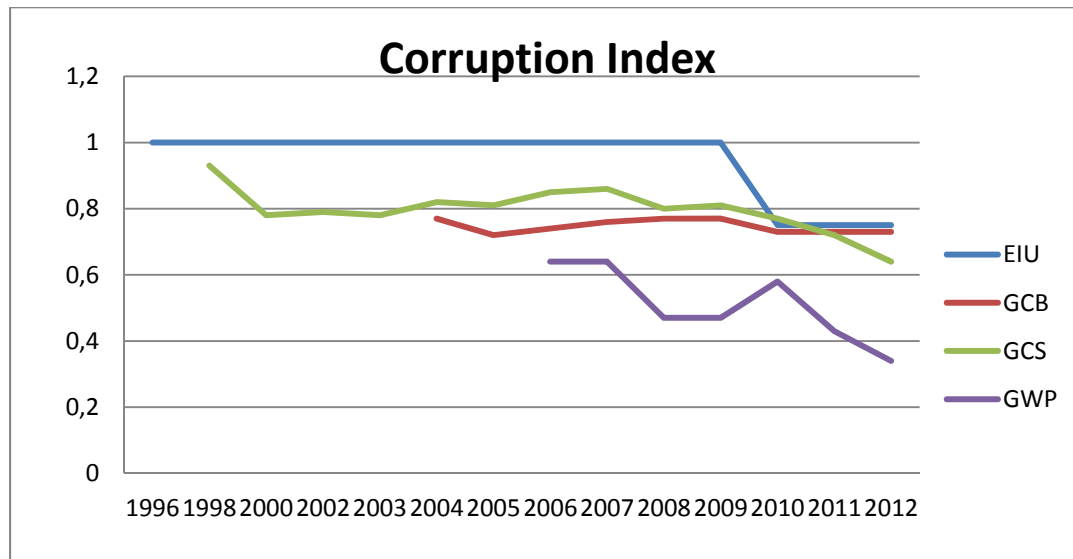
Especially after the crisis in 2008, public procurement was increasingly used for fiscal stimulus and the renewal of economic sectors. With rising importance of these measures the consequences of innovation stimulus through public procurement is rising and with that the importance of being a

barrier through corruption and bribery. As there are no numbers for corruption on a regional level, we take the national level as an indication in [Figure 4.2-o].

Figure 4.2-o: Numbers for Austria in the last 20 Years regarding Different Indices for Corruption

Sources:

EIU Economist Intelligence Unit
 GCB Transparency International Global Corruption Barometer Survey
 GCS World Economic Forum Global Competitiveness Survey
 GWP Gallup World Poll



The topic of corruption has never been addressed fully in the political discussion in Austria. Rankings and relative positions with regards to other countries were told to be in best order. The comparison of different rankings shows that all four indices have had some kind of downturn since 2009. This is a sign of a worsening situation that will have its effects on public procurement and the respective demand for innovative activities. As introduced in [Chapter 2] there is also a discussion on the role of entrepreneurship and firm formation in Klapper (2010, p.152) where the above-mentioned challenge is addressed with the conclusion that “countries with low barriers to entry and less corruption generally see higher percentages of firm registration and entry”. The numbers and especially the trend in [Figure 4.2-o] will cause a downturn in firm registration in Austria in the next years.

As mentioned in [Chapter 2] there are two indicators in the survey of the World Economic Forum that describe the demand conditions of public procurement. For Austria the scores and ranks are shown in [Figure 4.2-p] and [Figure 4.2-q].

Figure 4.2-p: Global Competitiveness Index Demand Scores, Source: World Economic Forum

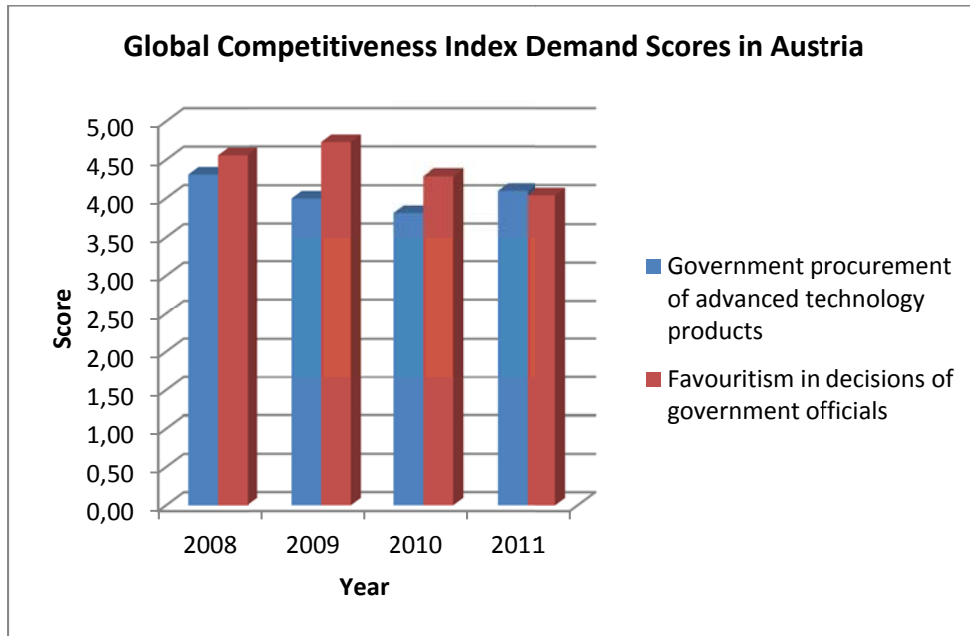
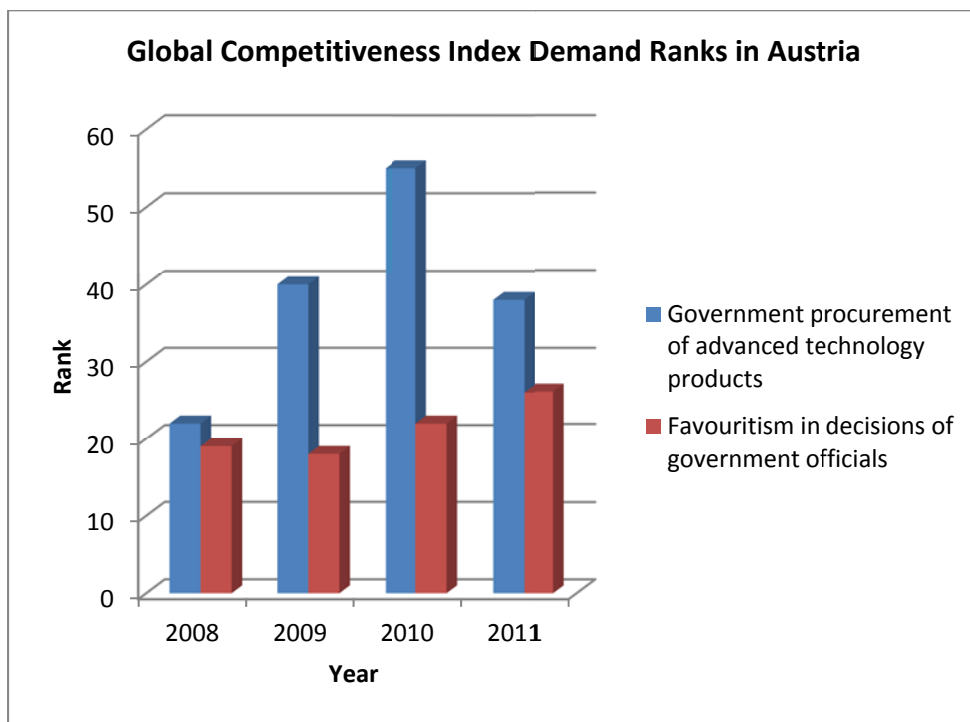


Figure 4.2-q: Global Competitiveness Index Demand Ranks, Source: World Economic Forum



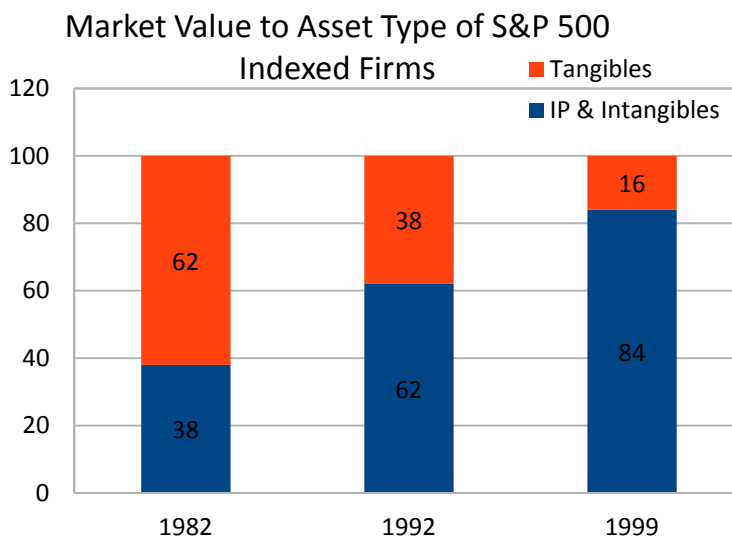
As the optimum scores would be 7, both indicators are in a medium condition. But favouritism in decisions by government officials is clearly moving in the wrong direction within scores and ranking. This development will have an impact on the demand of public procurement in regard to the innovative capacity. The question is who should invest energy to change this trend. It will not be the public sector because there the money will be spent anyway. It will not even be the Federation of Industry because their members are recruited largely from established companies that might benefit from a worsening situation. Young companies, which are the losers of the declining competition culture, could complain but they have few channels of communication to send their message.

4.2.2 Patents

The importance of Intellectual Property Rights (IPR) and especially patents has changed a lot over the last decades. As with the legal basis being established in the beginning of the 20th century the focus of IPR had rather been on the legal component in the beginning, the importance of the economic component rose during the last 40 years. [Figure 4.2-r] shows the change of importance of tangible and intangible assets for the S&P 500 between 1980 and 2000.

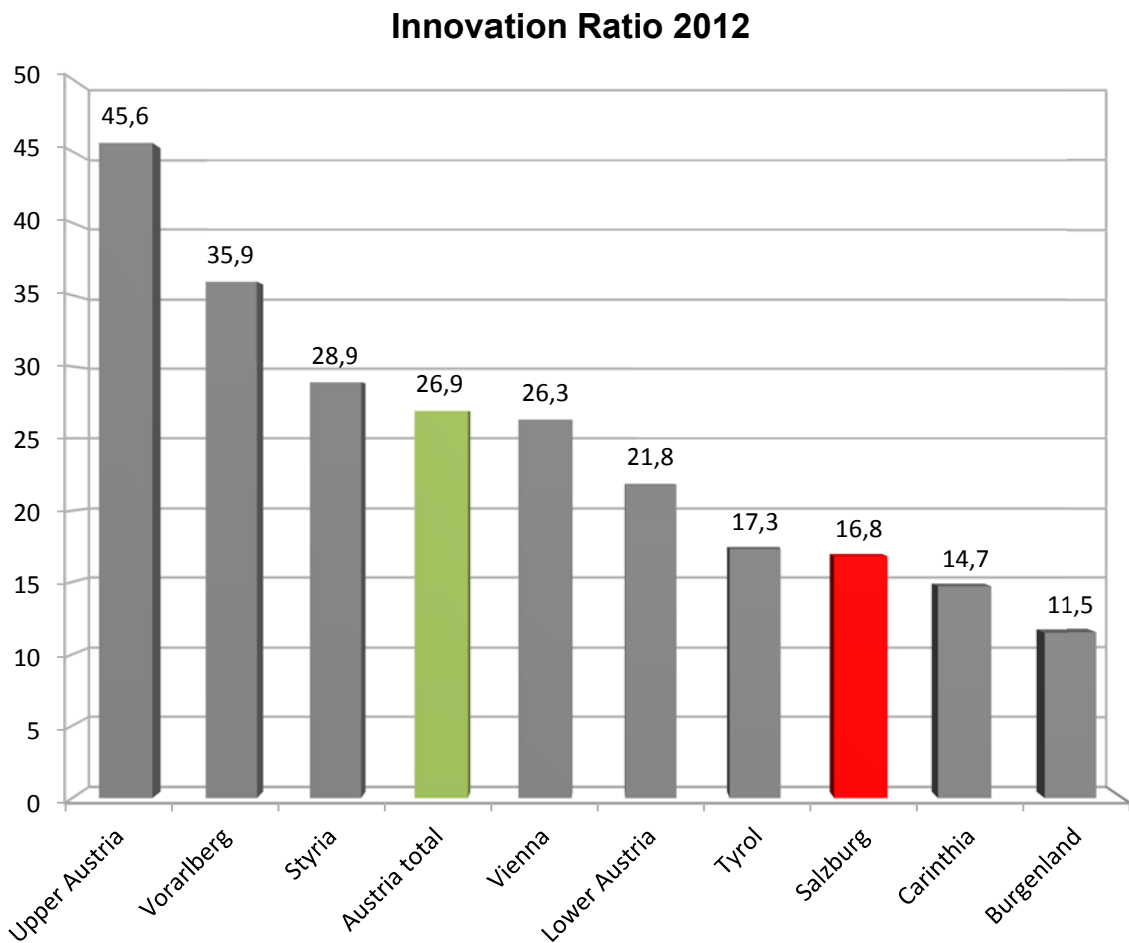
Figure 4.2-r: Importance of IP & Intangible Assets,

Source: <http://www.oceantomo.com/productsandservices/investments/intangible-market-value>



Patents are an indicator for the innovative activity of a region despite the fact that only a limited number of Start-Ups are eligible to apply for intellectual property rights. If we compare the Austrian regions with each other, we can see an unequally distributed picture of IPR activity demonstrated as the Innovation Ratio as shown in [Figure 4.2-s].

Figure 4.2-s: Patents per 100.000 Inhabitants 2012



Patents per 100.000 inhabitants in Salzburg are a little more than half the average of Austria. The reasons for the low performance are manifold. On the one hand the knowledge base of the individual and institutional actors in the regions is not used properly for a variety of reasons and on the other hand there is a low number of companies in the industry production sector that would be the major driver of generating a fertile soil for patents.

This analysis would suggest that the patent activity does not really change over time because the use of knowledge is a cultural and therefore a long-lasting parameter. The industry structure also changes quite slowly over time. If we go into detail and compare applications and filings of patents in the development of the last 20 years, we can prove these assumptions in [Figure 4.2-t] and [Figure 4.2-u] with a wavelike curve for most of the regions.

Figure 4.2-t: Patent Applications 1998-2013, Source: Austrian Patent Office

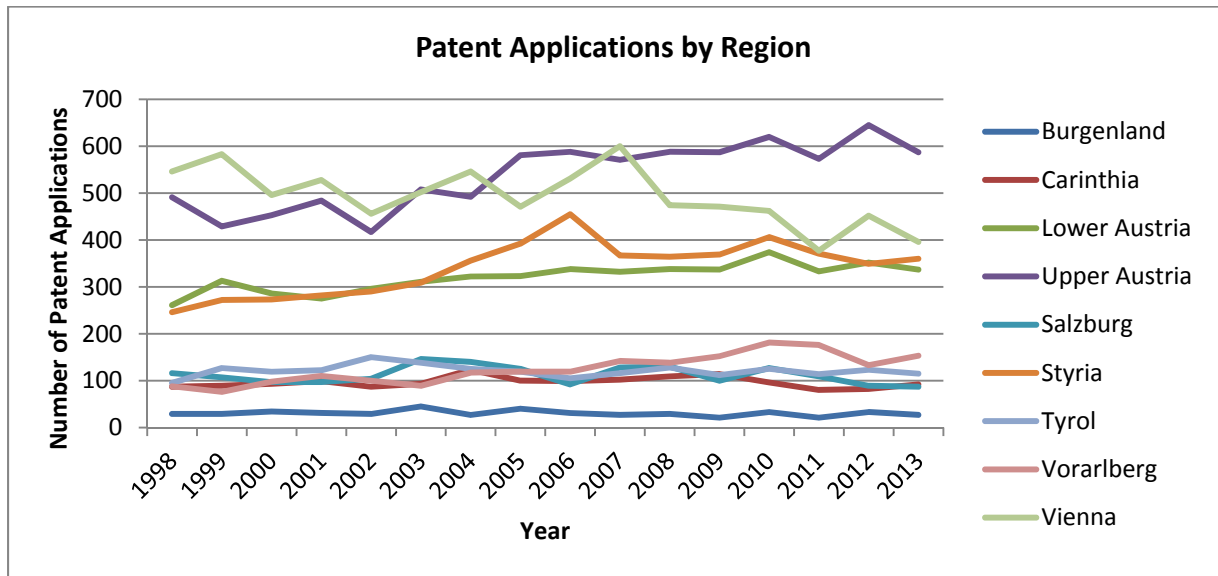
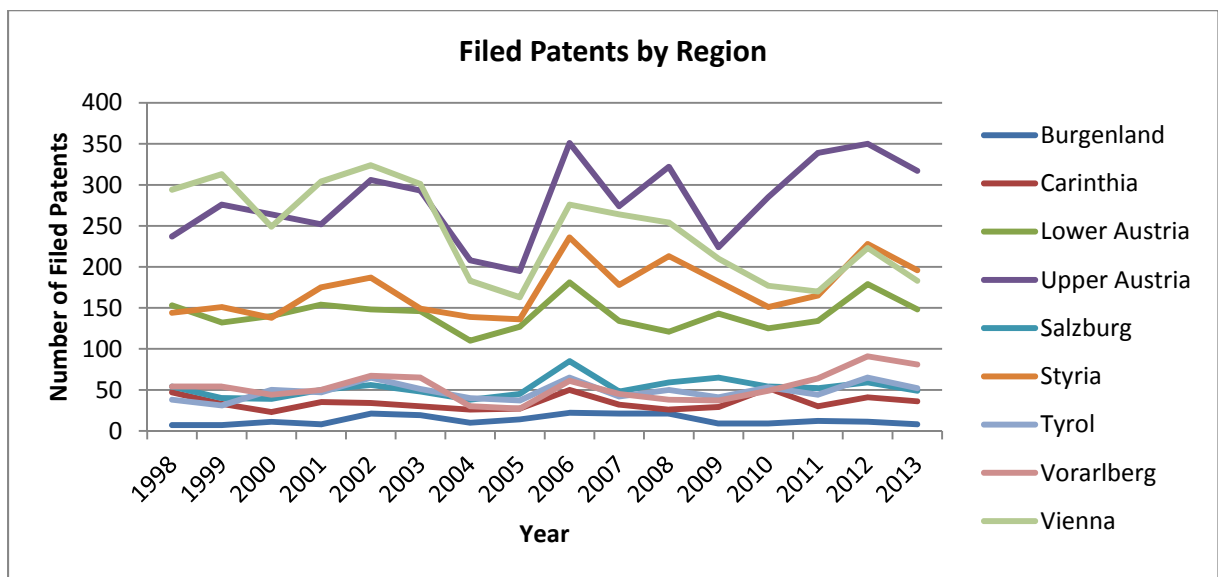
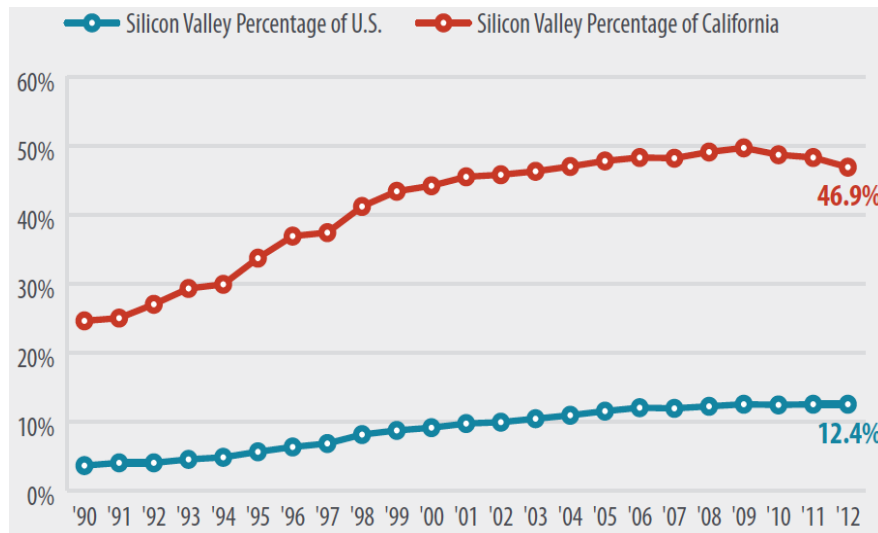


Figure 4.2-u: Patent Filings 1998-2013, Source: Austrian Patent Office



The level of patents has been stable over the last 15 years, which proves the assumptions above and also the evidence of Azoulay et.al. (2009) described in [Chapter 2] regarding the social imprints that are forwarded from one generation of researchers to the next. If compared with other regions this means that if a region manages to get fresh human capital input from outside, the dynamics of patenting will reflect the permanent renewal of the system. An example is shown in [Figure 4.2-v] with data from Silicon Valley.

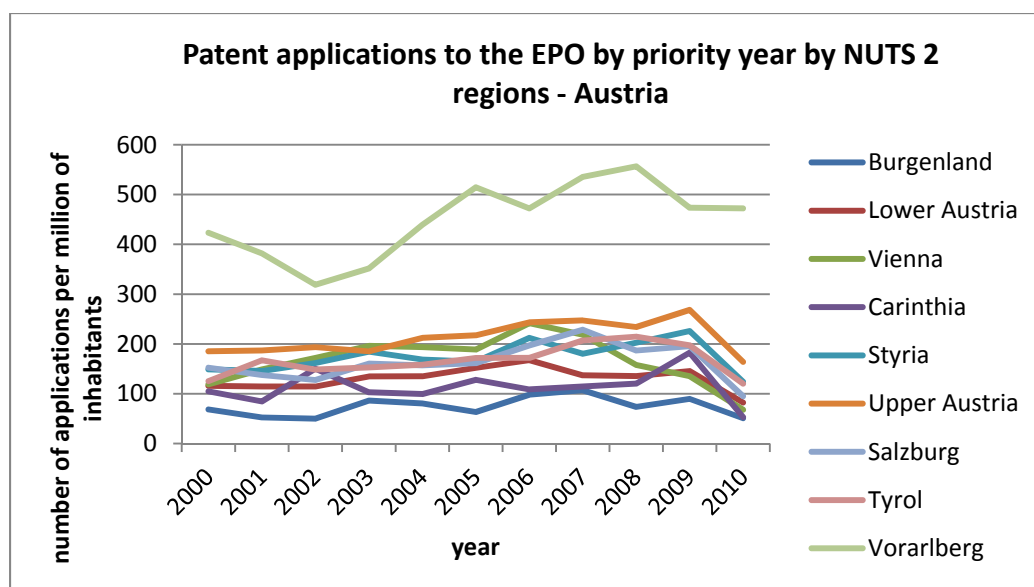
Figure 4.2-v: Filed Patents in Silicon Valley as a percentage of Californian and US national patent numbers, Source: USPTO, Silicon Valley Institute for Regional Studies



Silicon Valley managed to roughly double the numbers of their patenting activities in the last 25 years thanks to migration and innovation dynamics. This is due to the fact that Silicon Valley is a founders migration region. About 80 % of people founding a new company were not born in the region. They come to Silicon Valley for entrepreneurial activity.

Of growing importance are the applications that are requested at the European Patent Office in Munich, where most of the global actors among Austrian companies apply. [Figure 4.2-w] shows that number of applications to the EPO.

Figure 4.2-w: Number of Austrian Patent Applications to the EPO, Source: Eurostat



Vorarlberg is among the top regions for patent numbers to the European Patent Office. Salzburg shows up in the average of the other regions with a stable number during the last 10 years. There is a downturn in most of the regions after 2009. This should be observed carefully when data of the following years will be available. We have to take into account that first Salzburg is geographically very close to Munich and that second there is a large number of German students and employees in Salzburg who have their roots in the Bavarian region and tend more than others to file their patents in Munich.

The analysis shows the importance of IPR to the region compared with other regions. For an institution like a university this is however difficult because it is not a major task for a university to file patents. It is not even a major source of revenue for institutions of tertiary education and research. As was mentioned in [Chapter 2], there is evidence in the literature that the role of IPR in universities is normally a source of debt. It has been made clear in [Astebro et.al. 2009, p.33] that “universities are not likely to earn any money on promoting the commercialization of their research. Only the top two producers of disclosures in the US, Stanford and MIT, are likely to avoid prolonged periods of losses for managing their IP”.

4.3 The Consensus Space

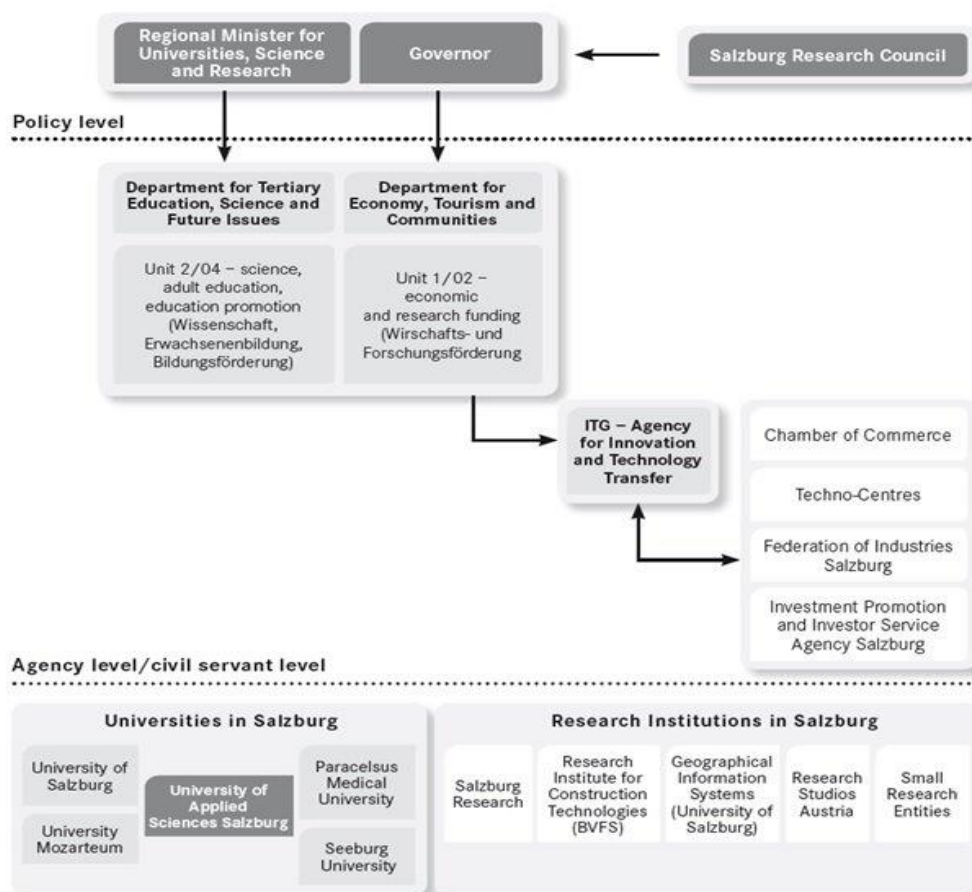
This section describes the Consensus Space in terms of:

- a. 4.3.1. Key governance actors at national and regional level
- b. 4.3.2. Legal framework and most relevant policies and instruments for research and innovation

4.3.1 Key governance actors

The governance of research and innovation in Austria is performed at national and regional levels. At both levels, there is a ministerial level, a civil servants level, and an agency level. The status of the employees is a critical aspect because it more or less defines the flexibility and the potential of management control. The organizational chart is shown in [Figure 4.3-a].

Figure 4.3-a: Regional Administration Salzburg - Organizational Chart, Source: Own Graph



The institutional setting in public administration requires a closer look at the levels of administration and their required and actual allocation of tasks. We define the following task sharing as worthwhile:

- Policy Level: Policy decisions and Transregional Negotiations
- Civil Servants Level: Strategy-Based on the Policy Requirements
- Agency Level: Implementation Process and One-Stop-Shop for Research Level

There is a principle of subsidiarity within all these levels, hence there should be no extra cycles in between.

The situation in Salzburg before the last regional elections in May 2013 could be described as an administrative chasm. Through all the three different levels there was an apparent lack of communication between research-oriented activities and economy-oriented innovation activities. To start with, there were two regional ministers responsible for research and innovation with one focused on basic research (Socialist Party „SPÖ“) and the other on applied orientation (People´s Party „ÖVP“). The chasm went down all the way from the political level through the civil servants level down to the agency level where there was a clearly defined ownership by either of them. The consequence is a very complex setting for transregional cooperation.

After the elections 2013 a different picture emerged. Most people at the civil servants and agency level are still the same, but the political assignments changed dramatically. Another aspect is the fact that before 2013 there had been a coalition of two quite equal parties, while currently there is a coalition of three parties with one leading party and two smaller coalition partners. No matter if the decisions made at the political level are better or not, they are now implemented within the whole administrative system and not just within one side of the chasm. Therefore we can assume that a political change can be the catalyst for a positive and future oriented change in the governance system.

4.3.2 Legal framework and most relevant policies and instruments for research and innovation

The legal situation in Salzburg is in line with all other regions regarding policies and instruments providing a legal framework from the European, national and regional level. This is important because there are different opportunities how to influence the framework conditions from the perspective of a region. European competition law is to be regarded as a fixed framework that has to be taken as a fixed setting.

Policies and guidelines can be influenced through the formal and informal lines of communication between the national and regional level. In this regard it is important to take into account the share of funding between regional and national level in R&D, which is about 10% at the regional and 90% at national level. Therefore national policies are expected to be decided predominantly at the national level. They will predominantly answer the needs of the regions which have a higher share of regional R&D expenditure. As an example we can see that programmes like AplusB [Figure 4.2-g] do not fit equally well for all regions, and centers in Vienna and Styria are better off with the existing framework than regions with a smaller amount of R&D funding.

The priorities of the regional policy level are stated (on the website http://www.salzburg.gv.at/themen/bildungsforschung/obtree_allgemein-forschungswissenschaft.htm) to be gender topics, transparency and strengthening of competition.

4.3.2.1 Legal framework conditions

Public University Law

University Law has been in a permanent process of change since the second world war. But there are three major milestones where legal regulation changed the framework conditions to a larger extent. The first occurred in 1975 when it was intended to provide access to universities for all levels of society because back then mainly children of wealthy parents were able to afford to study at a university. That goal has not been fulfilled satisfactorily till today because still the level of education is to a large extent inherited through the social status of the parents.

The second major change in university law happened in 1993 when terms like efficiency, management and evaluation marked the discussion and the main lines of today's governance model were established. The last major change of university law occurred in 2002 when the autonomy of university organisation and management as well as their financial independence implemented via performance contracts with a duration of three years were set forth.

Despite the change of settings in the legal framework, the competition and flexibility between the universities has not changed for a simple reason. The percentage of money provided to every single institution in the university system did not really change. When a new performance contract is negotiated the bigger part of financing is already pre-fixed. Nobody on the federal level wants to really take up the discussion about moving large portions of money from one university to another and therefore a region like Salzburg is tied to its financial framework. Therefore also the motivation to be more competitive than the others is limited. Even the Science Fund (FWF) [Figure 4.1-j] cannot solve this challenge because on the hand its financial volume is low compared with the basic funding and success rates are on the other hand low so that the motivation of university personnel to apply for grants is limited as well.

Private University Law

Private Universities have had a short history in Austria. The respective law was had been adopted in 1999. Since then every person in Austria has been able to apply for the foundation of a private university and has had to go through the admission process of the Council for Accreditation. The level of competition can be judged on the success rate of application which is just around 15%. Private universities are an opportunity for regions to establish additional education and R&D capacity without having to rely on national funding. As stated in [Chapter 4.1.1.1] it is not possible for private universities to get national basic funding for education purposes. Since 2007 they have been allowed to get national funding for R&D. Salzburg, too, has planned to establish a faculty for medicine at the public university since its refoundation in the 1960s and managed to do so in form of a private university in 2003 (Paracelsus Medical University, PMU). By the end of 2014 there are 24 private universities established all over Austria. Some of them were established in regions that have limited access to public universities and therefore fill a regional gap in supply of tertiary education. It has to be stated that most of these private universities focus on education and have no or just limited capacity of R&D.

There is one major difference - except the financing regime - between public and private universities that shall be stressed in the context of this discussion. Private universities can decide upon the admission rules and enrollment fees of their students. Public universities cannot do that. This is to the qualitative (selection of the best students) and quantitative (financial autonomy) disadvantage of public universities.

Bankruptcy Law

Bankruptcy law in Austria is in line with similar regulations among European Union member states. In countries like Japan this entry barrier to start-up founders has been modified to the favor of founders in the end of the 1990s. Some years later start-up numbers went up significantly as introduced in [Chapter 2]. The legal issue is one of the consequences of bankruptcy law but there is an even stronger issue of social stigma that is connected to bankruptcy. As cultural issues are important barriers to founders in Austria, this aspect could have a larger impact than in other countries. In fact Japan has a similar cultural aspect of social stigma if somebody fails in their career. Therefore we take bankruptcy law as one of the drivers for cultural change. In the Prediki prediction market in [Chapter 5.1] we will see that bankruptcy is not seen as the most important barrier by the potential founders themselves. As introduced in [Chapter 2] Armour and Cumming (2004) discussed the stimulation of entrepreneurial activity via temperate bankruptcy laws. They show further that “more severe personal bankruptcy laws, measured by reference to the number of years before a bankrupt individual would obtain a fresh start, and controlling for countries in which no fresh start is available, have significantly lower demand for venture capital and private equity” (p.5). There is a lot of room for further research on the topic.

4.3.2.2 Policies and the societal and cultural framework conditions for policy options

The recent economic strategy was published in 2011. It replaced the „General Economic Orientation“ dated from 2003. (<http://www.salzburg.gv.at/ssz-wipro2020.pdf>)

Societal and Cultural Policy Options

Policy decisions have to take into account the attitudes and values of the society that should be the beneficiaries of a positive impact coming from these decisions. Moreover policies can also change the attitudes and values over medium and long-term periods. Cultures and traditions tend to be stable over generations. If politicians want to influence and change the cultural framework, they have to put forth a lot of political energy. We are interested in the intentions derived from these attitudes of society towards entrepreneurship in order to estimate the potential for innovative activities in the future. There is no data available, we therefore perform a survey and in addition test a tool that is well established for the preparation of decisions in the consumer market, the prediction market.

The Survey

The survey consists of a set of 12 questions that will be addressed in this chapter. They were brought forth to different groups of respondents. At first two representative groups of persons from the region of Salzburg and from other Austrian regions, both being a representative sample from all levels of society, were asked. Then we asked two peer groups to compare the results with special communities. The first peer group is derived from the largest R&D institution in Salzburg, the University of Salzburg, with a number of about 1800 persons in charge of scientific tasks. The last group can be best described as R&D professionals who work in an institution that is involved in R&D

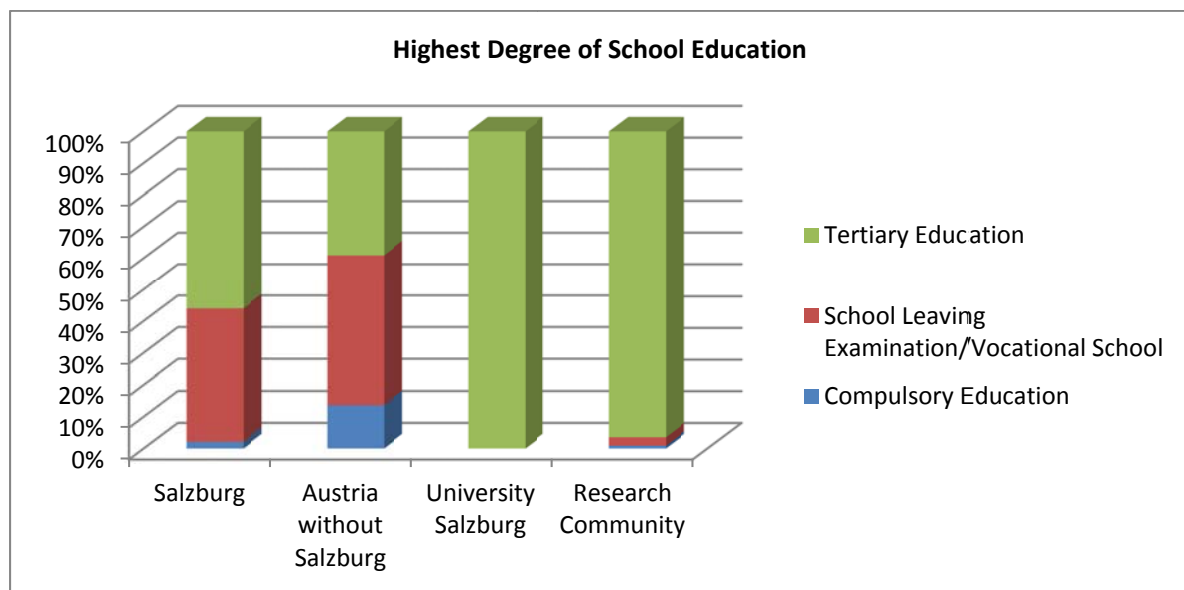
or innovation itself or in an institution that administrates R&D programmes. We will call them „Research Community“. [Figure 4.3-b] shows the number of respondents in the four different groups.

Figure 4.3-b: Number and Education Level of Respondents for the Survey of Potential for Entrepreneurship, Source: Meinungsraum

Number of respondents

Salzburg	Austria without Salzburg	University of Salzburg	Research Community
141	353	49	113

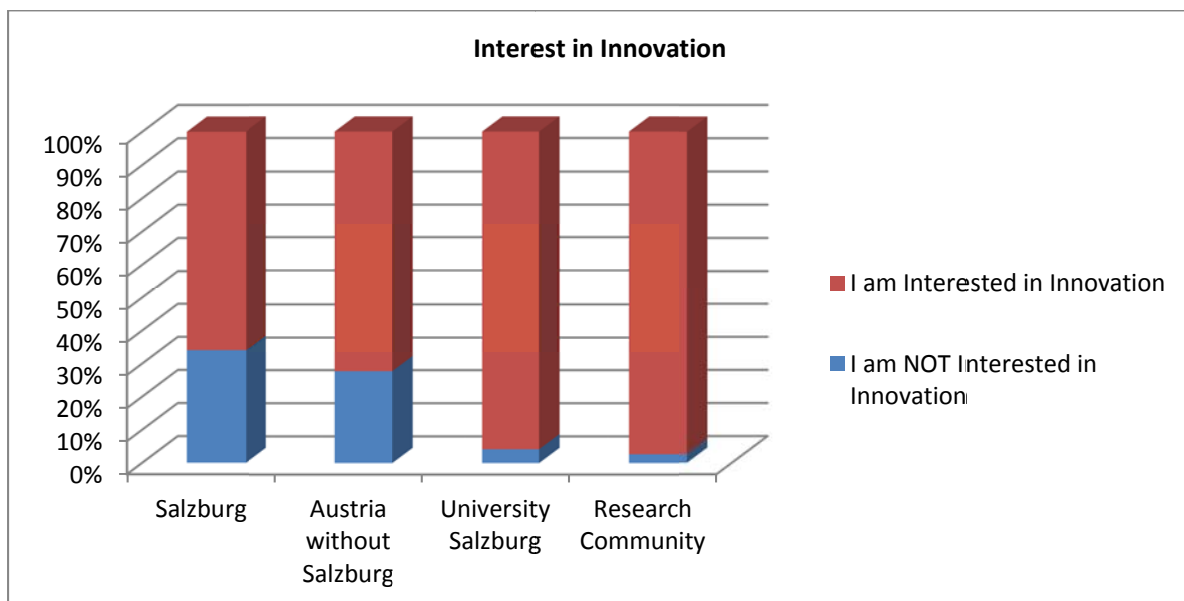
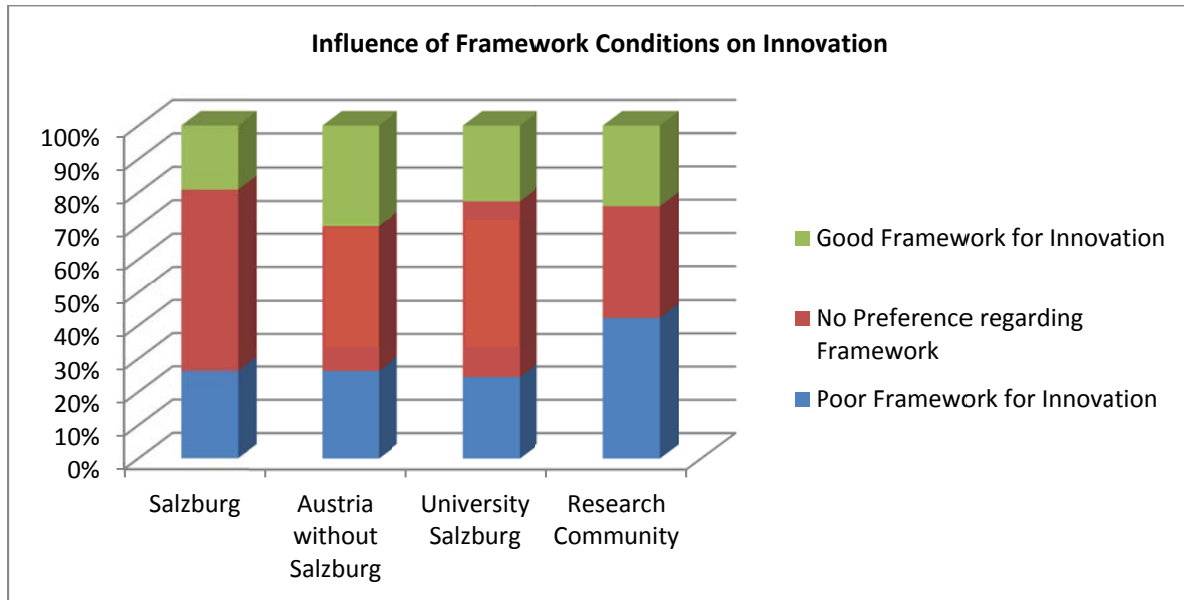
Education Level



The main units for all four groups are eligible for the discussion. The number of 1800 persons that received the invitation at the University of Salzburg to participate was about the same at the Research Community. Whereas from the professionals group there were as a whole 113 answered questionnaires, it was less than half the number (49) at the university.

With the first question we would like to get a clearer picture of are the framework conditions and the interest of the respondents in the topic of innovation. [Figure 4.3-c] shows the results for the four groups.

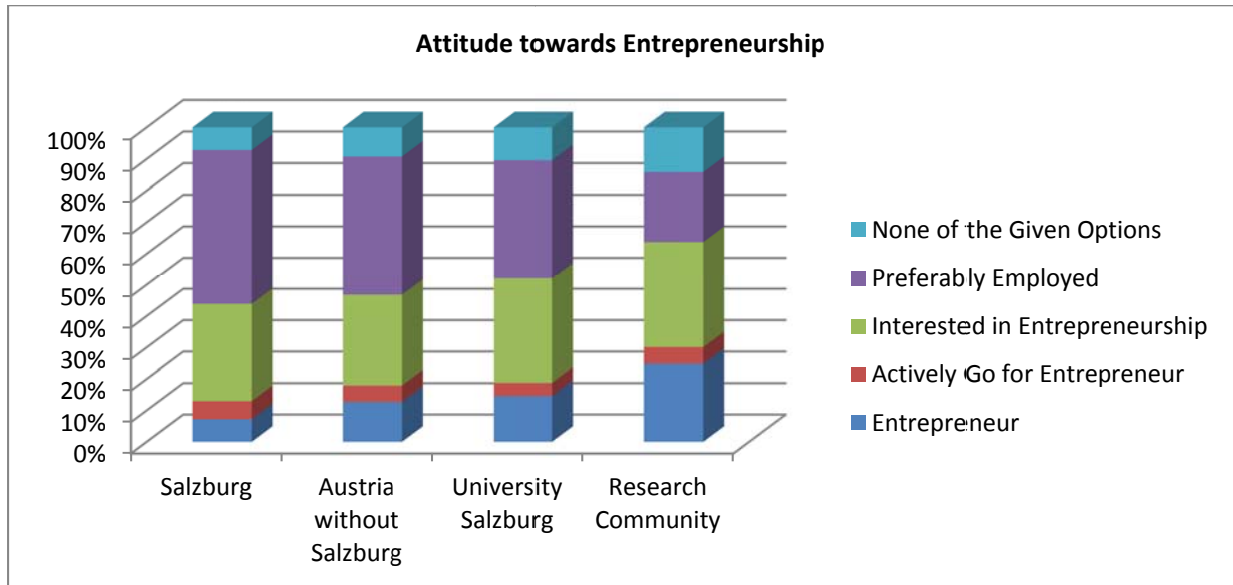
Figure 4.3-c: Influence of Framework Conditions and Interest in Innovation, Source: Meinungsraum



Within the answers to the question of the framework conditions there are two interesting facts discernible from the graph. First, there is a group about 10% larger of non-Salzburg respondents who judge the framework as positive. Second, the research community shows a significantly higher amount of persons with a poor opinion on the framework conditions. This is all the more important due to the fact that the interest in innovation is highest in the two groups who are confronted with research and innovation in their daily professional life.

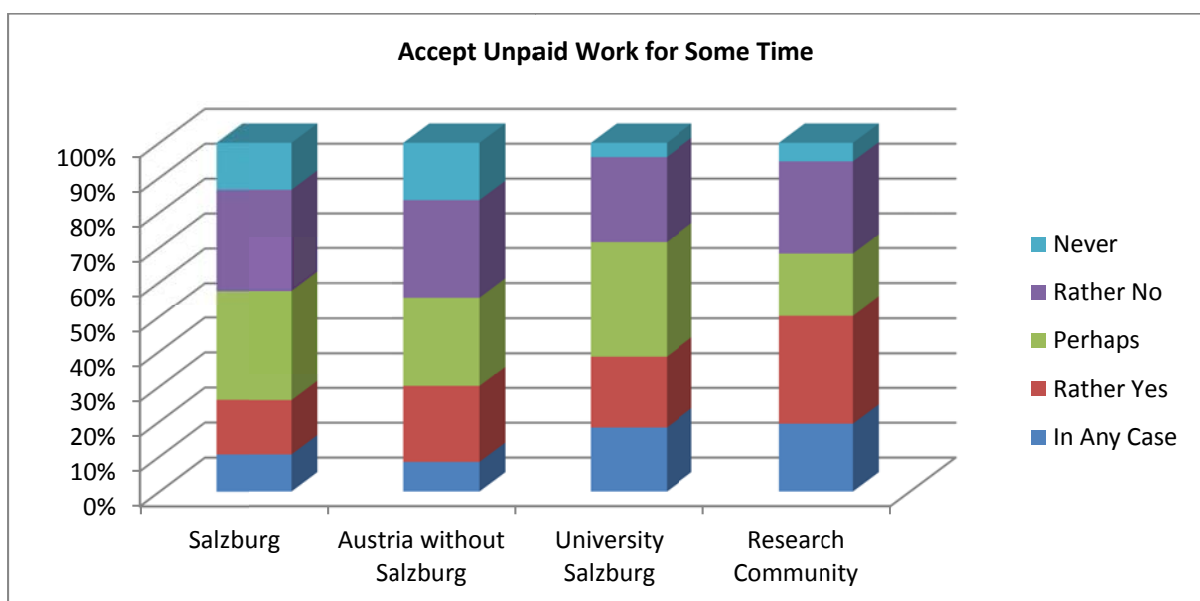
We want to know if the interest in innovation is also in line with the attitude to entrepreneurship. [Figure 4.3-d] shows the results for this.

Figure 4.3-d: Attitude towards Entrepreneurship, Source: Meinungsraum



There are some signs of a higher number of entrepreneurs in the research community than in the broader society. But much more interesting seems to be the fact that there would be at least about one third in all the groups with some interest to go for independence in employment. But the group that will actively work on that goal is only comparatively small. One reason can be that people fear the risk of losing their societal status in case of a failure. We test this hypothesis with a direct question on the attitude to unpaid work in [Figure 4.3-e].

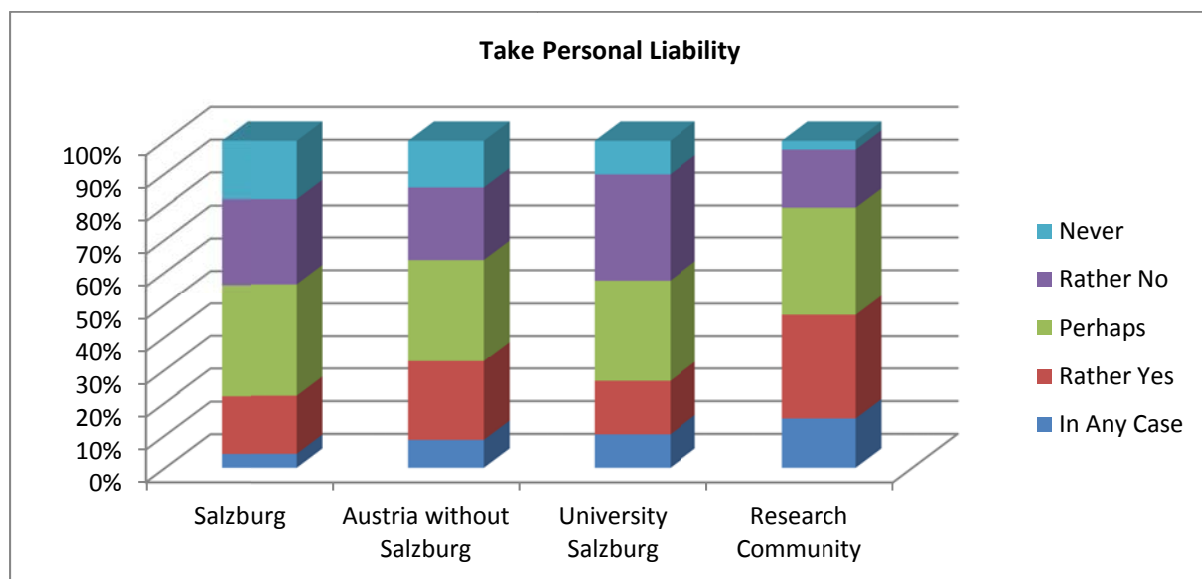
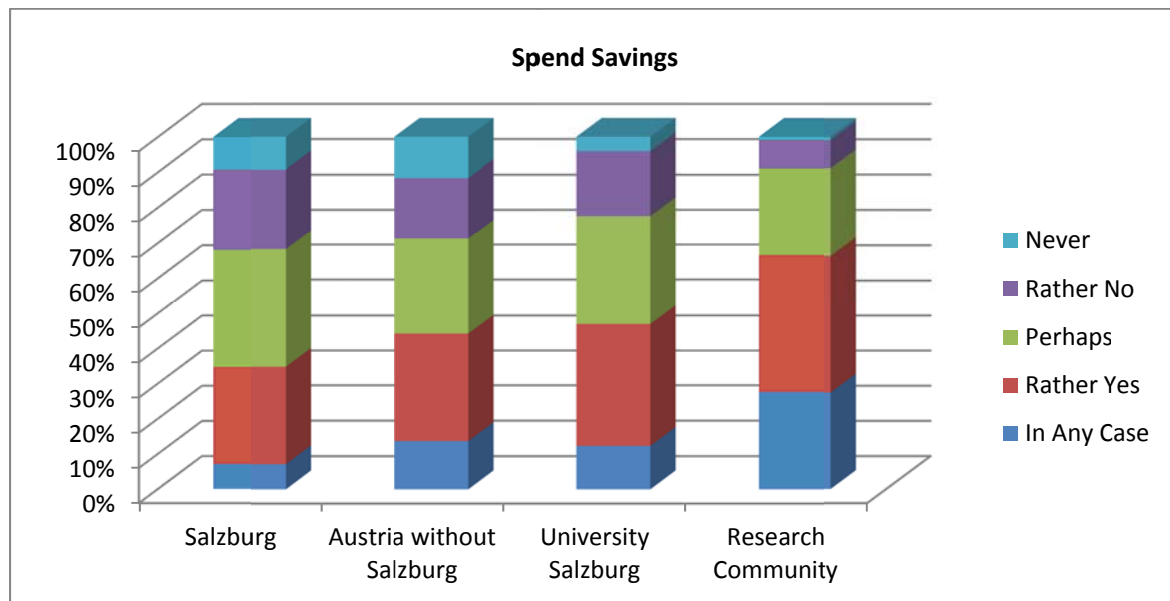
Figure 4.3-e: Acceptance Level of Unpaid Work, Source: Meinungsraum

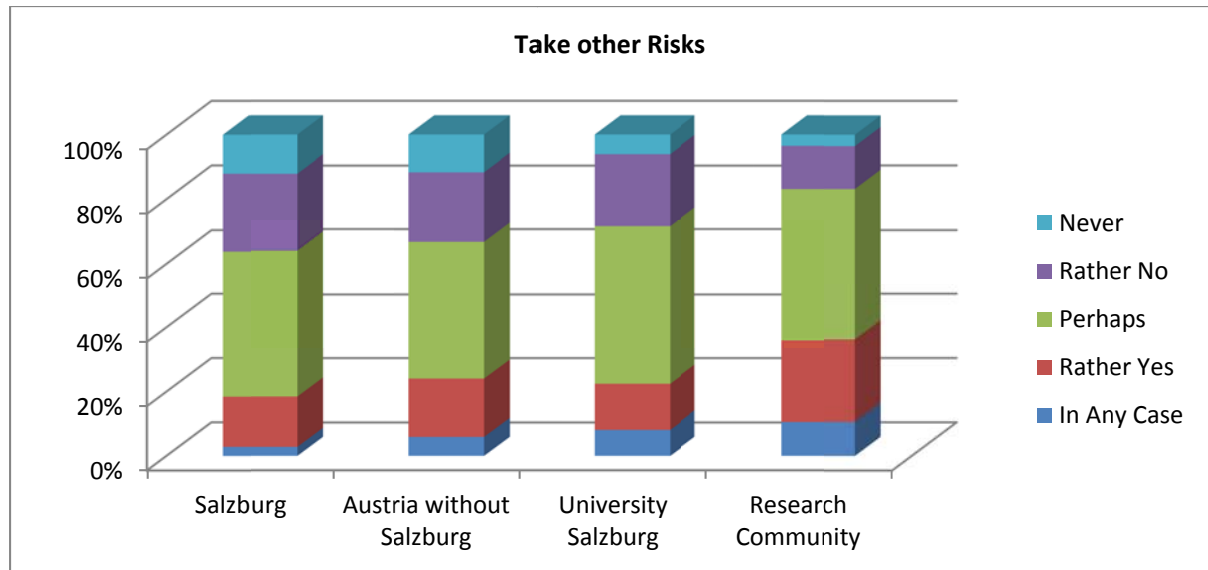


In the society pictured by the first two groups there is a bigger number of respondents fearing the scenario of having no income for some time. In groups three and four, where the mean education level is higher, the number of respondents who completely refuse such an idea is getting smaller and the number of respondents who can imagine such a scenario reaches about 40 %.

The question of risk aversion seems to be dependent on the level of education and working position, but is it also dependent on the region? We will ask for three different parameters and include an overall question about the general willingness to take some risk. [Figure 4.3-f] shows the results for the three different questions.

Figure 4.3-f: Attitude to Risk, Source: Meinungsraum

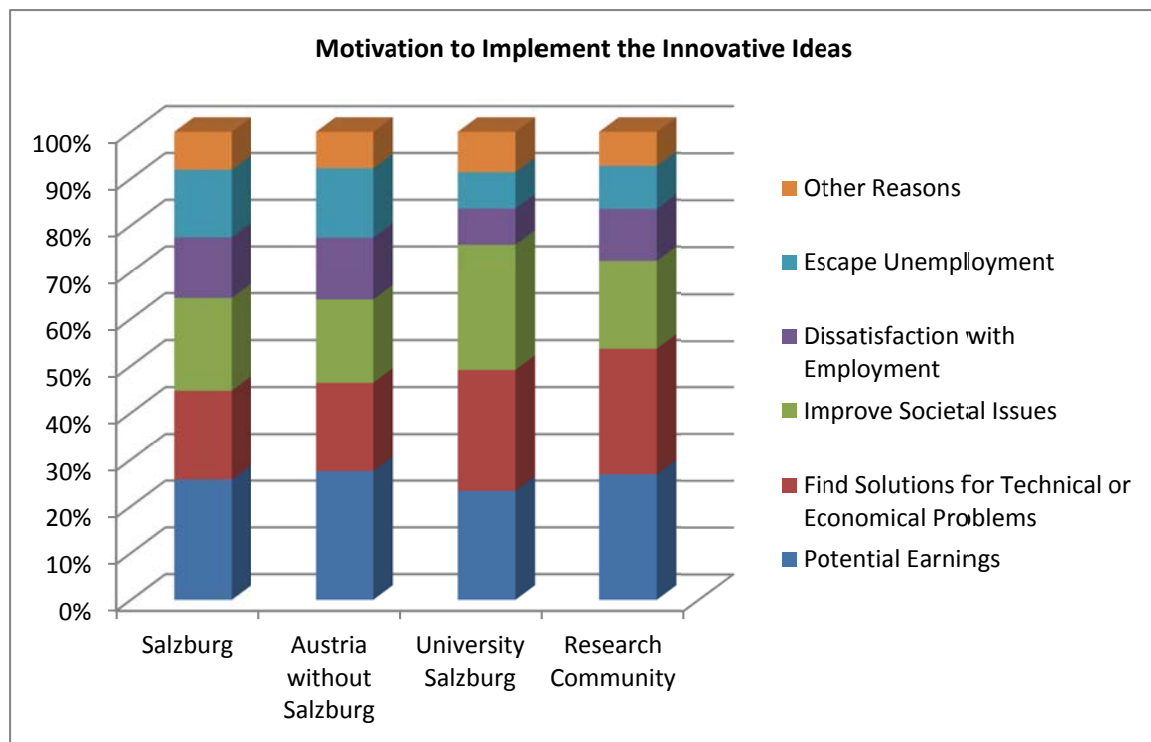




Within these three graphs we first compare the first group in Salzburg with the research community that includes the largest number of existing entrepreneurs. In all three parameters the answers for „in any case“ or „rather yes“ is about twice the number in the research community. Risk aversion thus drops down if the education level is higher and if respondents have been confronted with research in their working life. In a second question we compare the overall Austrian research community with an institution in Salzburg, the University of Salzburg. The gap in numbers is not as wide as in the broader society but still there is a significant gap in the „take other risks“ group which amounts to about 15 %. The University thus does not manage to emancipate their personnel from the overall risk aversion in the region that it is situated in.

As shown in [Figure 4.3-d] there is some potential of entrepreneurs who have to be motivated to take that step. To get to know what this motivation could be we ask for different options of a road to self-employment in [Figure 4.3-g].

Figure 4.3-g: Motivation to Implement the Innovative Ideas, Source: Meinungsraum



There are different motivations without a clear predominance of one of them. Given the numbers in [Figure 1.2-a] there is an indication of a significant portion of persons that could be motivated to put more energy into potential entrepreneurship while it seems to be difficult to decide for the best way to address them. As introduced in [Chapter 2] we could use the findings of Keuschnigg (2003, p.39) who states that “the supply of entrepreneurs depends on the willingness of inventive persons to give up alternative career opportunities“. Having fewer opportunities people are expected to eventually choose the option of entrepreneurship.

The Prediction Market

The second step to get an impression about the policy framework is to conduct a prediction market with the same groups respectively and to ask the respondents of the survey if they are willing to participate in the prediction market. The methodical difference between the survey and the prediction market is simply that the survey asks about what the respondents themselves think and *what should be* the case in the future whereas the prediction market asks the respondents on their opinion about what others think and *what will be*. Whereas we need a socio-economically significant number of respondents in the case of the survey, we just need a minimum of 16 traders in the case of the prediction market according to [Chapter 2 „Prediction Markets“]. As stated in Luckner et.al. (2012) „Prediction markets help to aggregate information and gain a better understanding of the future by collecting knowledge of as many people as possible. The real difference is that a survey is a one-way communication with the incentive only to mark the questionnaire and that within the prediction market there is a lot of interactive agitation with a clear incentive to be supported by the others during the process. There is also a clear disadvantage as the complexity and effort to

understand the process is much higher in the prediction market. Therefore fewer people were motivated to take this effort, we motivated 102 traders in total who performed 641 trades and posted 1447 opinions. Nevertheless, in every single question group the minimum of trades that is necessary for a valid discussion has been achieved.

In the prediction market five main questions were dealt with:

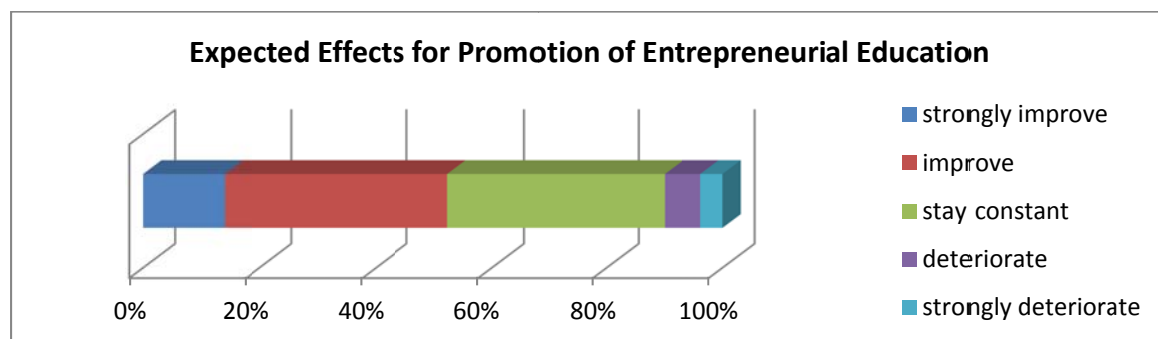
- Promotion of entrepreneurial education
- Support for patenting
- Enhancement of support services for start-ups
- Tax benefits for innovations
- Reduction of burden in case of bankruptcy

These main questions were followed by three cross section topics that were tested within the trading community:

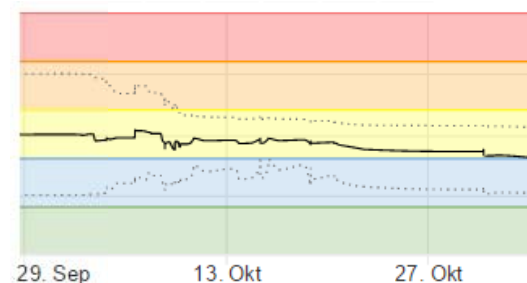
- Risk acceptance for entrepreneurs
- Interest in founding a company
- Political energy for implementation of measures

The first question that was addressed is the promotion of entrepreneurial education. [Figure 4.3-h] shows the results and the market movement after about one month of trading.

Figure 4.3-h: Expected Effects for Promotion of Entrepreneurial Education, Source: Prediki



[Market Movement]

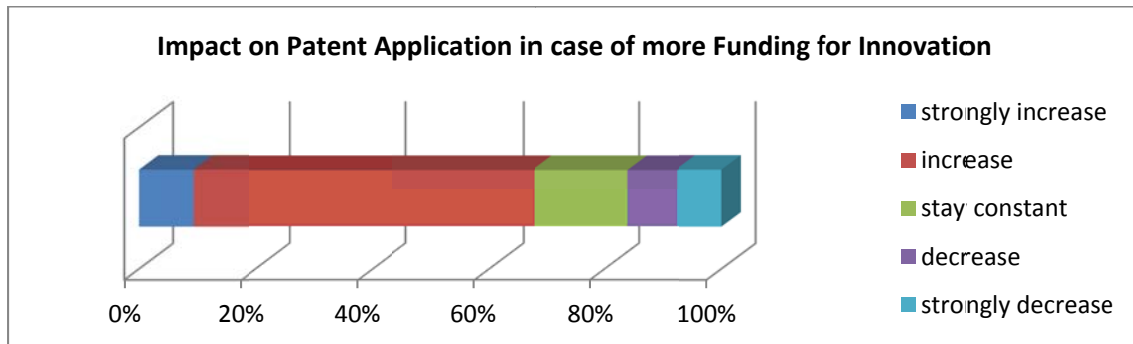


There was a high number of trades connected with that question, which shows the interest of the community in the topic. The market had been moving steadily and ended up in a slightly positive

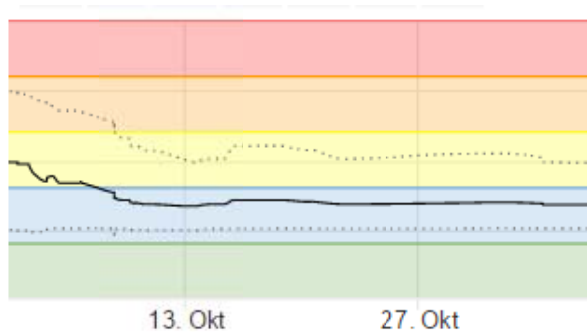
effect of about 5 % of expected growth of start-ups by 2020. In this question, we could record a high number of traders from university. Despite the predominance of the opinion of a constant scenario there is a clear sign that positive expectations prevail. Nevertheless a further question could be asked: At what stage of education should this happen?

The second question for the development of patent applications is shown in [Figure 4.3-i].

Figure 4.3-i: Impact on Patent Application in case of more Funding for Innovation, Source: Prediki



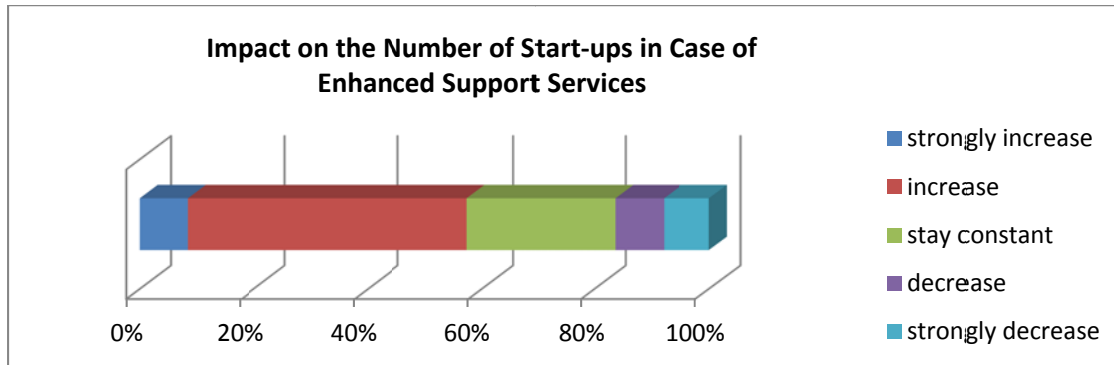
[Market Movement]



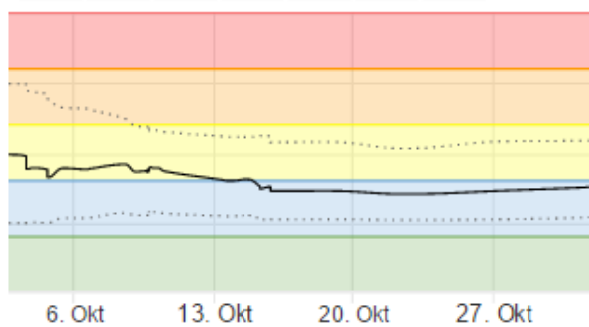
Just a few days after starting the trading, the market rate went into a quasi equilibrium with hardly any contrary action. The opinion of the community is clearly visible as the additional funding of innovations would result in a higher number of patent applications. In the case of the discussion at hand, this would be an 8 % growth by 2020. The slight contrary movement and the equilibrium between the “strong” effect point to a lack of a clear opinion that could also be interpreted as a lack of insight and information about the topic. This is confirmed by the fact pointed out in Litzka (2014) that there is hardly any effect of patents on start-ups, if not a negative correlation.

The third topic is dedicated to the support services and to what extent they are capable of moving forward the number of start-ups. [Figure 4.3-j] provides the results and the market movements.

Figure 4.3-j: Impact on the Number of Start-Ups in Case of Enhanced Support Services, Source: Prediki



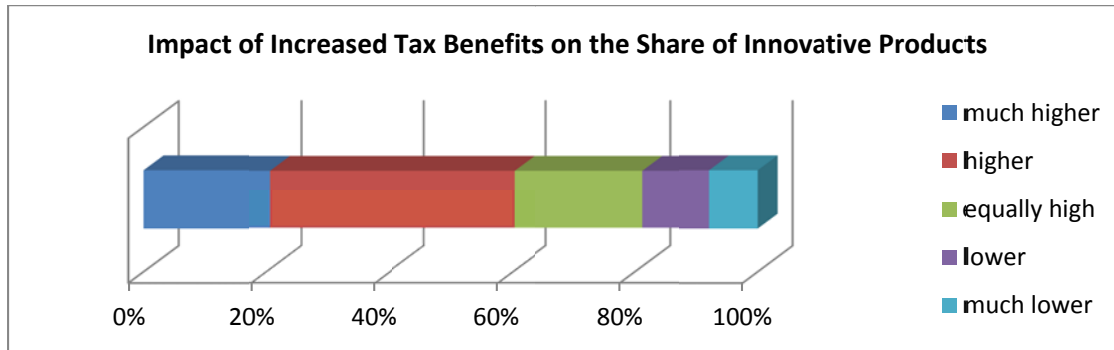
[Market Movement]



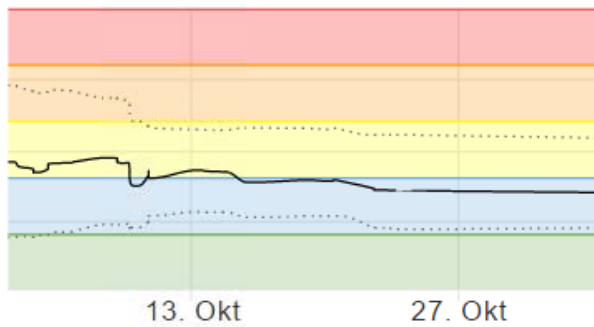
The panel of traders showed dissent in their actions as there was a contrary movement to the first trend in the second week of trading. In the midst of the discussion there was a positive movement that was corrected to a certain extent until the end of the trading phase. In a nutshell, we can summarize that respecting the dissent there is an expectation of about 6.5 % growth of start-ups for 2020 if the support services are expanded. The opinion in the “strong” section is equally positive as negative but the “increase” section prevails over the “decrease” section.

The next question addresses the matter if the increase of tax benefits influences the share of innovative products of innovative companies. [Figure 4.3-k] provides the results.

Figure 4.3-k: Impact of Increased Tax Benefits on the Share of Innovative Products, Source: Prediki



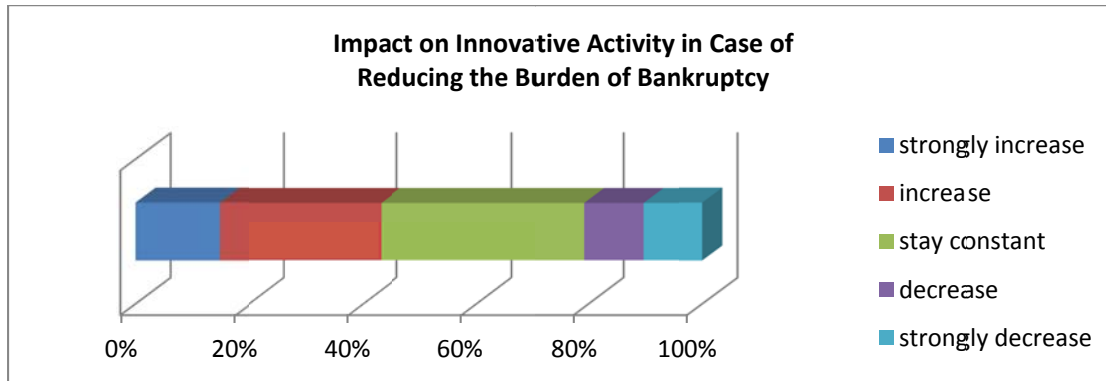
[Market Movement]



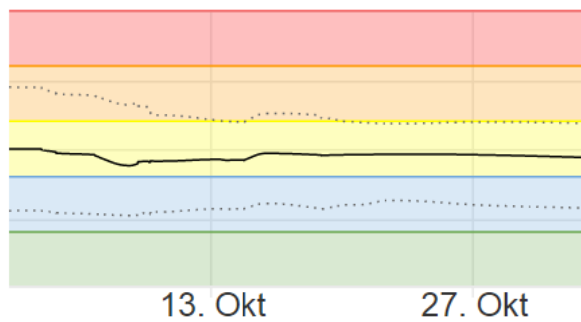
This question proved to be quite demanding for the traders. The hidden message of the trading process was not only that there is a very high amount of very positive expectations but also that the question is „how“ these measures are implemented. These results from the quartils that get tighter in the middle of trading and broaden again in the end, which is not typical for a trading process. So for the consensus there would be more information necessary about what these measures could be. Bearing that in mind, we can expect a positive impact on the share of innovative products if tax regulations are changed to a more favorable situation for start-ups.

At last, the question about the impact on innovative activity in case of reduced burdens in case of bankruptcies will be discussed in [Figure 4.3-I].

Figure 4.3-I: Impact on Innovative Activity in Case of Reducing the Burden of Bankruptcy, Source: Prediki



[Market Movement]



The results of the trading process on the one hand show a consensus indicated by minimal amplitudes and a small contrary action to a first trend. They show the smallest expected growth rate of the four trading scenarios. The lowest rate of PageViews implies the smallest interest of the trading community in the topic. This could also mean that the level of information on the topic is low and that the community was not ready to get involved more deeply. However, the demand for political action is regarded lowest amongst by the trading community.

After the expectation analysis in the five main topics we will address two of the three cross sectional issues of risk acceptance and the interest to be an entrepreneur in [Figure 4.3-m] and [Figure 4.3-n].

Figure 4.3-m: Risk Acceptance, Source: Prediki

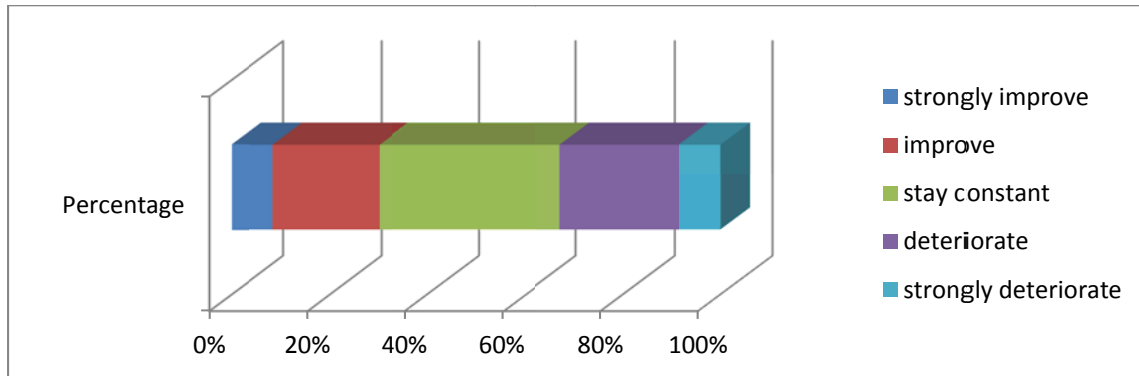
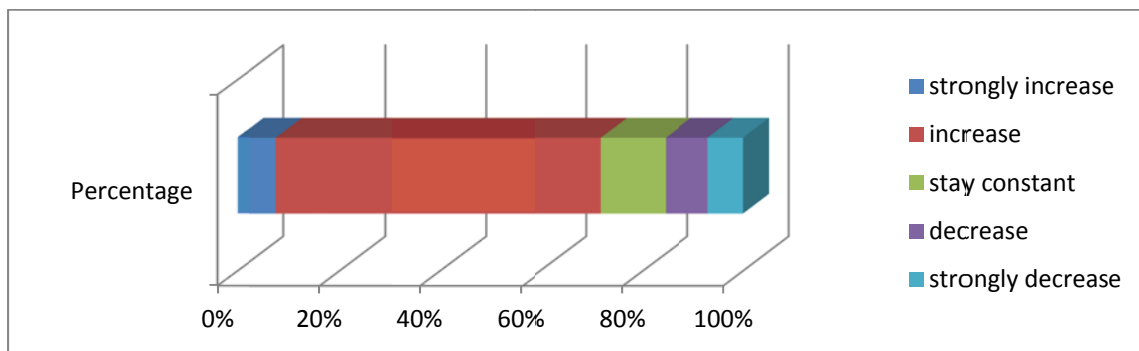


Figure 4.3-n: Interest in Entrepreneurial Activity, Source: Prediki



The risk acceptance is expected to stay at the same level in the coming years. Regarding the long-term stability of cultural framework conditions, this is comprehensible. Despite the expected stability of risk acceptance, interest to found one’s own company is expected to rise to a quite large extent of about 9 %. If we cumulate the numbers of probability for growth and strong growth, we end up at an amount of over 70%. This scenario is regarded to be very likely in the view of the traders.

This concludes the analysis of the prediction market with a basis for discussion of a research question that contains political implications and options for action which will be performed in [Chapter 5.1].

4.3.2.3 *Instruments, Measures and Programmes*

Regional Programmes for R&D and Innovation

As stated in [Chapter 4.3.2.1] there is a legal framework for regional R&D and innovation support programmes. We have to keep in mind that R&D support is legally based on the national level while the regional function is to facilitate the specific regional characteristics of the R&D landscape. The number of programmes is manifold and can be viewed on the website of the regional ministries: (http://www.salzburg.gv.at/foerderung_beratung) for science and research and (<http://www.salzburg.gv.at/themen/wt/forschung-unternehmensbezogen.htm>) for innovation and economic support. There is a clear distinction between the two areas of R&D and innovation, which will be discussed in [Chapter 5.1].

Salzburg Council of Science and Research

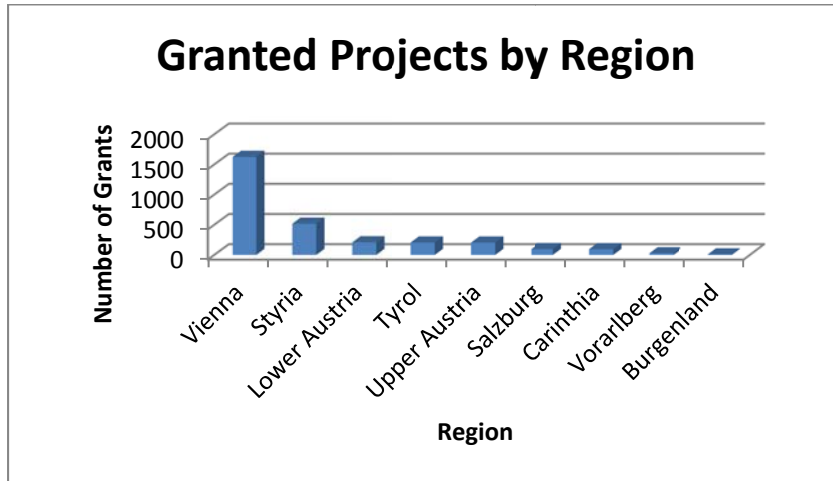
The Council for Science and Research in Salzburg was established by regional law in 2002 and was therefore the first regional advisory body of the regions in Austria. It was followed by similar bodies in Upper Austria in 2003, in Styria in 2005 and in Burgenland in 2014. The statutes include the overall objectives to support the development of the region of Salzburg in all respects of science, research and economic development.

The mixture of the 14 Council members (<http://www.salzburg.gv.at/wfr-mitglieder.pdf>) would enable the committee to generate a broad view of research and innovation aspects and to draw conclusions about the strengths and weaknesses of the region.. The reasons why this did not happen in an appropriate way can be manifold. One major issue is that recommendations are not published and therefore no public discussion about backgrounds and consequences took place. Until 2013 the Council had taken up about 120 recommendations in 36 meetings. The Council members hold influential positions in most of the relevant R&D institutions in the region such as the university, the university of applied sciences or the research institutions. The question rises whether they take a critical view on the work of these institutions or whether they rather represent the interests of these institutions in the Council.

Smart Specialisation Strategy

The Smart Specialisation Strategy is part of the regional plan to find its focus areas and to place it into the strategy for participation at an European level. Planning has been in course in autumn 2014 and should be finished during the year 2015. In order to compare the history of granted projects we use the analysis of Proviso provided in the year 2013, combining all the projects accomplished in the period of the 7th Framework Programme (2007-2013). [Figure 4.3-o] shows the total number of grants for each Austrian region.

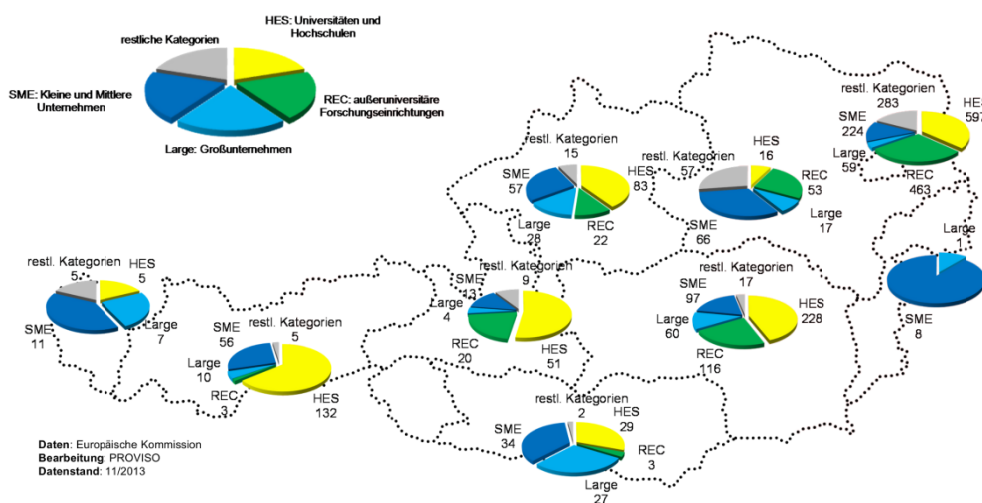
Figure 4.3-o: Number of Projects granted to Austrian Institutions in the 7th Framework Programme 2007-2013, Source: European Commission, Proviso, Austrian Research Promotion Agency



Salzburg with a number of 97 grants is in the lower area of regions. As we are interested in where the deficits are, we will look more deeply into the distribution between the sectors in [Figure 4.3-p] which shows the number of projects granted in the different sectors compared with all Austrian regions.

Figure 4.3-p: Number of Projects granted to Austrian Institutions in the 7th Framework Programme 2007-2013, Source: European Commission, Proviso

HES...Higher Education System
 REC...Research Organisations
 Large...Non SME Companies
 SME...Small and Medium Enterprises
 Restliche Katogrien...Remaining Categories



The Higher Education Sector and the respective research organisation cover nearly three quarters of all the institutions participating. There is a very low rate of participation by Salzburg companies, only one other region, Burgenland, shows a number even lower. A comparable region in population like Carinthia generates more than half the number of participation by SMEs or large companies.

Cooperation Initiatives

The institutional landscape in a region is connected through different lines of communication. There are many initiatives in Salzburg that bring forward the information exchange. These initiatives are to a large amount managed by the political level, especially by civil servants and special interest groups. The situation is quite similar to other regions. We therefore focus on a critical issue that is important for the interplay between different sectors and disciplines: Cross institutional communication. The Chamber of Commerce serves its members very well. So does the department of Science in the regional government which also serves the institutions where it is holding shares very well. But cross institutional communication seems to be rather weak. The implication of the individualism of institutions will be further discussed in [Chapter 5.3.4].

5 Discussion

Discussion shall be structured in three parts. First the two major issues of the Regional Innovation System in Salzburg will be addressed and then in the third part there will be a discussion of other issues that will have an impact on a prosperous development of the region of Salzburg, including cross references to other regions in the world.

5.1. Discussion of the Spaces regarding Policy Issues

Research Question 1: *What can we learn from the analysis of the Spaces in [Chapter 4] as to how government can promote a successful innovation culture in the region (e.g. entrepreneurial spirit, knowledge spillovers, risk tolerance)?*

5.2. Discussion of the Impact of Demand within the Innovation Culture in Salzburg

Research Question 2: *How important is the demand side of the innovation system for the development of a Regional Innovation System and how could the impact of the innovation culture on the demand be discussed?*

5.3. Discussion of other Issues regarding the Salzburg Regional Innovation System

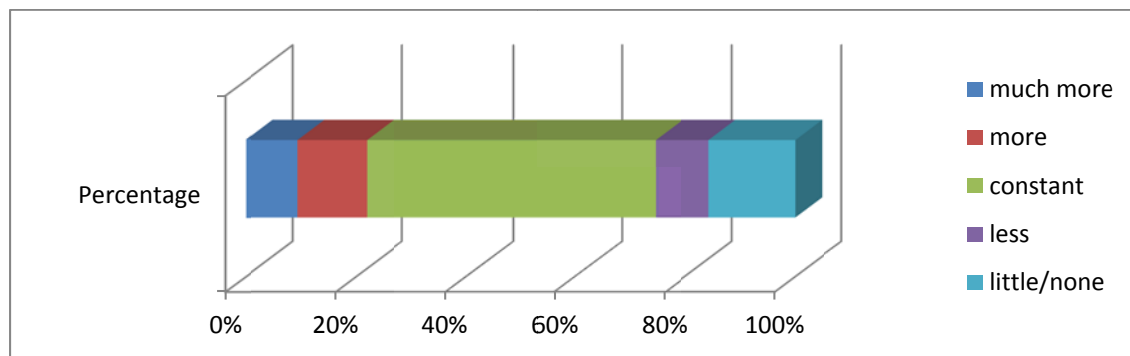
Research Question 3: *What are further options for improvement in the Regional Innovation System Salzburg and how could they be discussed?*

5.1 Research Question 1 (RQ1): What can we learn from the analysis of the Spaces in [Chapter 4] as to how government can promote a successful innovation culture in the region (e.g. entrepreneurial spirit, knowledge spillovers, risk tolerance) ?

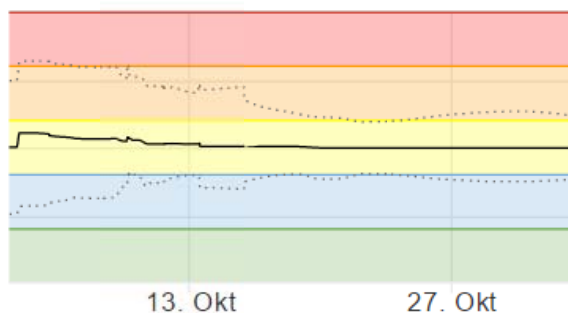
5.1.1 RQ1 a) Challenge: Expectations for Political Activity before and after Elections

In [Chapter 4.3.2.2] we analysed the attitudes and values of different groups using a survey and a prediction market. Now we want to search for the implications on policy and options for action. To establish a viable connection with the prediction market we ask the question if there is an expectation of political action in the next years. The trading for that topic is shown in [Figure 5.1-a].

Figure 5.1-a Expectations for Political Energy to Improve the Framework Conditions of the Regional Innovation System, Source: Prediki

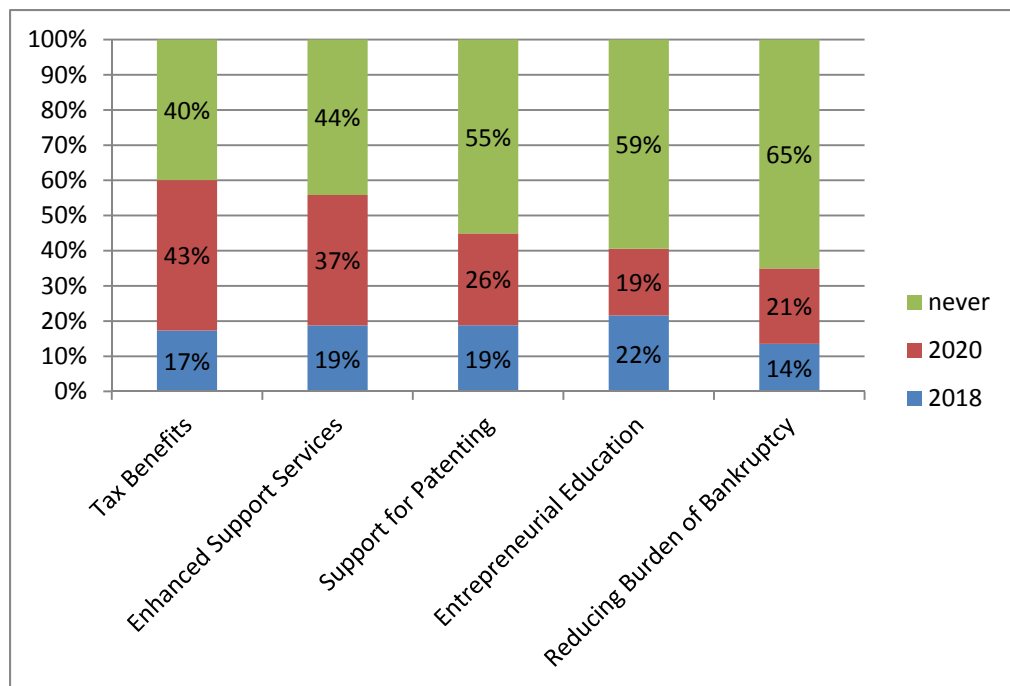


[Market Movement]



In the beginning of trading there is a slightly negative amplitude, then the movement goes for neutral. In the graph we can see not only the largest „constant“ section with about 52 % of all the tradings but also the second largest „strong negative“ section with about 15 %. In short, traders expect no political action and if they are sceptical they tend towards a “no go”.

We even want to get a deeper knowledge about the background of this result and thus we ask whether this skepticism is due to a lack of confidence in the current government or is it the political system itself that does not push for change expectations. On the one hand traders have to judge on the likelihood of political action until 2018, and additionally they are told that in 2018 there will be elections and then the question arises what the expectations of political activity would after that event. [Figure 5.1-b] compares the results for these two scenarios.

Figure 5.1-b Expectations for Political Activity in 2018 and 2020, Source: Prediki

Traders believe in the transformation energy of elections. There are two topics that are expected to be addressed by political action, which is tax benefits and the enhancement of support services for founders. Yet within both areas the expectation that the existing government will generate enough energy to do so is much lower than for the new government period.

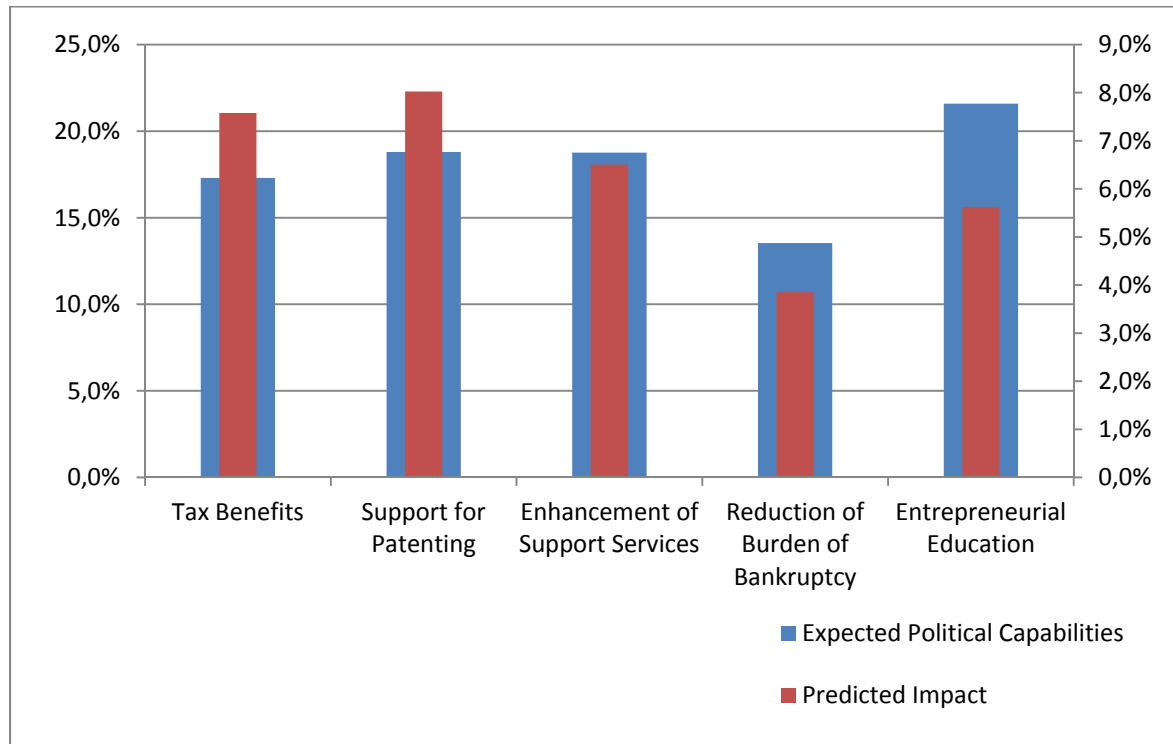
As introduced in [Chapter 2] Didero (2008, p.5) described the four dimensions of national culture based on the model of Hofstede (2001), which are on the one hand “power distance” and “uncertainty avoidance” which will be referred to in [Chapter 5.2], and “masculinity” and “individualism” on the other. Later on, a fifth dimension was developed that was called “long-term versus short-term orientation”. This dimension has to be taken into account when discussing expectations for change in different time intervals.

There is another consequence from this data concerning stability and planning reliability. Especially for tax benefits respondents expect changing framework conditions in the aftermath of elections. As introduced in [Chapter 2] Guellec and v. Pottelsberghe (2000, p.3) discussed the impact of public R&D expenditure on business R&D and found that “direct funding as well as tax incentives are more effective when they are stable over time: firms do not invest in additional R&D if they are uncertain of the durability of the government support”. Uncertain future framework conditions reduce effectiveness of government programs in Salzburg, especially regarding tax benefits. An even broader view on the effects of tax policy on entrepreneurship and financing is provided by Keuschnigg and Nielsen (2004, p.198) who state that “progressive taxation, however, that uses a proportional (consumption based) income tax to pay for uniform per capita transfers, retards entrepreneurship and the expansion of innovative industries. Output and investment subsidies to start-up firms both stimulate entrepreneurial activity”. So it is very important which parts of tax policy are addressed for different expected effects.

5.1.1. RQ1 a) Options for Action: Comparison of Predicted Impact and Expected Political Capabilities

The discussion about the expectations of political activity above fuels interest in the comparison of the predicted impact of topics with the associated expectations of political energy connected with these topics. [Figure 5.1-c] connects the two spheres.

Figure 5.1-c: Comparison of Predicted Impact and Expected Political Capabilities, Source: Prediki



The comparison shows a deficit in the congruence between the predicted impact and the expected political action in the areas. The political representatives could be more precise in addressing topics that have or are expected to have an impact on the system.

With this knowledge in mind we aim to find out first what changes in the framework conditions could be made to improve the system and second how much political energy this would require, and, in the end, how likely this is to happen. Instead of a reactive policy by politicians there is need of active policy making, therefore the ability of the government system to innovate by itself is of crucial importance. The next point of discussion will be about the best way to implement political measures for support of the Regional Innovation System. As stated in [Chapter 2] the practice to simply implement government-industry R&D programs has to be evaluated for its effects because Wallsten (2000, p.82) found that there is a good chance for crowding out private investments through public R&D funding.

5.1.2 RQ1 b) Challenge: Replace parts of basic funding of research institutions through competitive funding with an international peer review system.

Projects performed within Basic Research should be evaluated through a qualitative international peer review system. The big gap between the numbers of institutional and competitive funding in [Figure 4.1-k] and the negative trend of the last five years regarding basic research shown in [Figure 4.1-j] lead to the assumption that too many members of faculty in Salzburg are not motivated to prove their scientific quality by means of international evaluation. This does not mean that their work is not of high quality but it definitely means that it is hard to judge on the level of quality that they are in.

RQ1 b) Options for Action Salzburg

The institutional funding of the University of Salzburg was mainly defined by its share of the partitioning of the General University Fund (GUF). In order to expand the field of activity of the regional university landscape, the Paracelsus Medical University (PMU) was founded in 2003. As stated in [Chapter 4.3.2] this is a private university with no claim for national funding regarding education. As the funding is provided by the regional government and some private donations the question is whether the regional administration managed to provide for an international quality dimension for the research projects performed at PMU and whether there is an impact of the founding of PMU on the position of Salzburg compared to other regions.

We will look at this aspect especially with regards to the dynamics of the discipline that PMU is focused on, which is medicine and biotech. The number of publications and patents oscillate a little from year to year, so we take a time period of five years to allow for certain balancing and we take the years from 2005 onwards to allow for establishment of the university which was built from scratch and connected to the regional medical hospital.

Neither the granted Life Science budget shown in [Figure 4.1-m] nor the funds allocated in that field within the 7th framework programme in [Figure 4.1-o] provide reference that there is a higher amount of projects or higher quality and therefore more competition than before the founding of PMU. Also, the share of Salzburg institutions regarding projects in basic research [Figure 1.2-a] is not rising after the founding of PMU. Rather, it has even been decreasing for about five years.

The overall number of grants approved by FFG has risen in the last ten years to bring Salzburg in the 5th position with respect to non-university research institutions [Figure 4.1-u]. The cultural and absorptive capacity did not develop in the same dimension, so Salzburg still lags behind most other regions regarding innovation ratio [Figure 4.2-s] and the number of start-ups [Figure 1.2-a]. For better understanding we choose two other regions, Vorarlberg and Upper Austria, to discuss the issue.

Vorarlberg is not only very low in non-university research grants but also hosts no university. But innovation ratio there is second highest in Austria. As the transregional mobility is expected to be low - as in all Austrian regions - the knowledge should have its origin in the industry sector. This assumption is proven with the low number of start-ups because the established companies do well at hosting and using their knowledge which leaves no need and room for new companies. From a different viewpoint we could state that the available stream of well-educated human resources is collected by the established companies, which leaves fewer resources for potential start-ups. But as

even a vital scene of established innovative companies cannot replace the dynamism released by start-ups, a political option for a region in the situation of Vorarlberg could be to work on the „Welcome-Culture“ and develop into an immigration start-up region like Silicon Valley where 80 % of founders were not born in the region [Chapter 5.3.4].

The second region to compare with is Upper Austria, which is number 3 in Austria for grants of non-university research and holds the same position regarding start-ups. The difference to Salzburg is the leading position in terms of innovation ratio. Upper Austria manages to use the gained knowledge in a very efficient way and might choose to improve its non-university research sector.

The option for Salzburg is to dedicate its public regional funds in a much more efficient way. The regional government should team up with the responsible ministries and agencies on national level to improve the quality and in the end to increase the budgets for research institutions in Salzburg. The way to do so is to replace institutional with competitive funding via two steps. First a part of the institutional funding for Salzburg institutions will be earmarked but not disbursed. In a second step the established peer review of projects at national agency level proves the quality. Then the funds are transferred and restocked with regional funds in order to open the opportunity for the institutions to gain more funding than they would have had with just institutional funding. If management representatives of Salzburg research organisations are convinced that their faculty contains a high level of quality, there is no reason to argue against competition.

5.1.3 RQ1 c) Challenge: Reorient the activities of applied research according to the regional and local needs.

The more market-oriented research and innovation, the more it is to be reoriented following the needs of the market that it should be addressed to. There are several dimensions that can influence the ability of a regional system to fulfil these needs:

- Existence and substance of an Economic Development Strategy
- Cooperation Agreement with national funding bodies
- Focus of political influence on topics of societal need

RQ1 c) Options for Action Salzburg

- The existence of a regional economic strategy as mentioned in [Chapter 4.3.2.2] can be crucial for investment decisions of international companies. As the development of this strategy dates from before the political change in Salzburg in 2013, it has to be questioned if it is still viable. The reason we can answer this question in the affirmative is the fact that the political decision maker back then who created the strategy during his term is now the governor of Salzburg and is in his function responsible for the implementation of his former strategy roadmap.
- The cooperation agreement with the Austrian Research Promotion Agency (FFG) was signed in 2008 and is said to work quite well. The corresponding data is published every year in the economic report of the regional administration.
- The economic strategy in Salzburg focuses on the support processes of the implementation. With regards to contents, the needs of industry can be met.

5.2 Research Question 2: How important is the demand side of the innovation system for the development of a Regional Innovation System and how could the impact of the innovation culture on the demand be discussed?

According to literature [Chapter 2] demand is a major driver in any regional and national innovation system. Due to the lack of policies, discussions and measures, which can be also seen in the lack of data on the topic [Chapter 4.2.1.6], impact and outcome of demand-oriented policies especially in comparison with supply side policies cannot be provided.

The discussion does not start with the precise role of public demand in the system, it rather begins with the fundamental ignorance of the impact that innovative public procurement can have as well as the innovation impulses that come out of society the moment they understand the use of new products and demand them.

Following Edler et al. (2007) as referred to in [Chapter 2], demand-side policies can be seen in four groups: systemic policies, regulation, public procurement and stimulation of private demand. They stated that “data in general is very poor”, which we have seen in the lack of the topic in policy documents [Chapter 4.3.2.2] and in the availability of data just at national and not at regional level [Chapter 4.2.1.6].

For the discussion in this paper the size of the potentially procured market matters. On the one hand Salzburg is not a big market, neither judging from the number of procurement projects nor from the number of potential providers of innovative solutions. Next to the size of the market it is the nature of the tenders that in many cases prevents new ideas from being established in a procurement process.

Public procurement is not a topic of political discussion in Salzburg. The question is how Salzburg can derive innovative capacity out of its rich cultural tradition. The way forward can be to step out of a museum of cultural traditions and opt for a future-oriented demand for innovations in the cultural business. Therefore it will be necessary to find management capacity that has technological background and is ready to enter the culture business. Nowadays appointment processes focus predominantly on the cultural background.

The second and even more important aspect of demand are the consumers themselves as stated in [Chapter 2]. They drive innovation through their perceived use of new products and services. Awareness measures and the forced discussion between potential innovation suppliers and society push innovative capacity. Work has to be done on both sides. Researchers have to be encouraged to open their laboratories for a deeper understanding of their work, whilst public and private initiatives for outreach of innovation should be promoted.

It has to be understood that demand side policy is not an instrument itself but an important element of innovation culture with significance for society and economy. The parameters shown in the Innovation Space at national level [Chapter 4.2.1.6] are an indicator of how much energy will be needed to introduce this element into the system. Evidence suggests that the development has been going the wrong way in the last five years and that time is ready for a turnaround because the longer it takes, the more energy is needed.

The answer as to where and how to insert more demand side orientation into the system can be settled with the following proposals of Edler (2009, p.28): "Strategy intelligence in demand based approaches must support:

- formulating policy rationales and intervention logics
- understanding and measuring effects and support in learning
- understanding of bottlenecks on the demand side and thus rationale for intervention
- technology and market intelligence, not to pick winners, but to understand how functional requirements can potentially be met by suppliers
- the organisation of communication between user and the potential supplying firms
- the articulation of demand"

Demand has to be to a much larger extent part of the discussion on the development of the Regional Innovation System. In Salzburg more than elsewhere the mainstream discussions about tourism and classic music will have to be overcome. These are very valuable ingredients for a prospering society indeed but energy should be invested into other topics like education, research and innovation.

It has already been stated that innovation culture is a major force for demand and other framework conditions. In [Chapter 2] we referred to Hofstede (2001) to understand the influence and consequences of innovation culture on a national or regional innovation system. Now we discuss the connecting elements between cultural framework and the Regional Innovation System.

In the discussion of values and resulting behaviors in Hofstede (2001, p.385) we find a reference to Freud and his role as a „founding father“ of motivation theory. It is assumed that there is a reason for the fact that an Austrian came up with these ideas - the cultural profile of Austria. With a reference to Freud's superego based in the early socialisation of children by their parents Hofstede draws the conclusion that "Austrian culture is characterized by the combination of small power distance (Power Distance Index, PDI) with strong uncertainty avoidance (Uncertainty Avoidance Index, UAI)". In a hint about the durability of the cultural framework he argues that "it is likely that power distance all over Europe was higher in the days when Freud grew up (second half of the 19th century). However even then Austrian power distances must have been relatively low, as culture patterns shift only slowly" (p. 417).

In order to discuss the meaning and consequences of the UAI and PDI data, we compare the situation with a neighboring country, Germany, and with macro-economically similar countries of the Nordic area, Denmark, Finland and Sweden. For Austria the UAI according to Hofstede (2001, p.187) is 70. The average of the above mentioned comparison group is 44. This high number for Austria is in line with the analysis in [Chapter 2] where Business Decision Limited (2003) found a number one (75%) obstacle for innovations to reach the market in the "uncertainty of customers about security and quality of innovations". The high UAI in Austria on its own would not be a reason to worry a lot about because there are many countries, especially in southern Europe, that show even higher numbers.

The real issue is the combination with a low PDI. High UAIs combined with high PDIs as they show up in the Mediterranean area Hofstede (2001, p.127) mean that uncertainty is compensated and taken away by a powerful superior. The PDI number for Austria is 11 whilst the comparison group shows an average of 29. But not only the average is significantly different but every single country out of the comparison group is lower in UAI and higher in PDI than Austria. Nobody it seems is there to reduce the uncertainty in Austria. The consequence is that even a small deviance triggers an avalanche of uncertainty and there is no barrier to hold it back. The direct impact on demand, private and public alike, is the sticking to well-known structures and elements while avoiding new options.

The small PDI could as well be discussed in the light of the positions of regional and national governments in Austria. According to a survey in Salzburg (<http://www.meinbezirk.at/wals-siezenheim/politik/regierung-agiert-an-salzburgern-vorbei-d124411.html>), 92% of respondents argued that they have not perceived any decisions by the government that could have an impact on their personal lives. Furthermore many surveys all over Austria show that people have little perception about the work of a superior power and they have no idea who fulfills these functions, which results in the feeling that the region or country could as well do without a government.

When we proceed one step further to the corporate culture that evolves within the innovation culture frame of a region, we find evidence in Tellis et.al. (2009, p.15) that especially the “internal corporate culture is an important driver of radical innovation“. This sort of innovation is crucial for international competitiveness of the company and of the region itself. The challenge is that “corporate culture is a factor that is unique, intangible, sticky and difficult to change“. This is even more important because “radical innovations translate into financial value to the firm“. Interpreting this framework for the situation in Salzburg we find only a small portion of companies active in industry production in [Figure 4.1-bb], resulting in limited ability to establish a culture of radical innovation in the region.

The discussion regarding demand and innovation culture shall be continued with one part of the “Creative Index“ by Florida (2012, p.2), the Gay Index, which is defined as „a reasonable proxy for an area’s openness to different kinds of people and ideas“. It is directly connected to the uncertainty avoidance described above. There is an interesting coincidence between the region that is regarded as one of the most innovative one worldwide, Silicon Valley, and the gay capital of the world, inhabiting the largest percentage of homosexual people worldwide, San Francisco. If we try to find lessons learned for Austria, it is definitely not to copy Silicon Valley’s ecosystem but to be open-minded. The rest will come by itself. In [Chapter 2] we also introduced Lee et.al. (2004, p.14), who accompanied Richard Florida in the group of authors. They stated that “new firm formation is associated with creativity“.

Change innovation culture in a long-term view

Embedded in the overall cultural landscape there is innovation culture based on the values and traditions of the region described in [Chapter 2] and analyzed in [Chapter 4.2.1] within the Innovation Space. For deriving options for policy action in that field, we can refer to Gee et.al. (2008, p. 59) with the hint that “governments can promote certain attitudes and values; they can create the scope for new behaviours and ultimately cultural change“.

The longest trip starts with the first step. Cultural traditions change over generations. And they change only if there is energy or pressure to do so. The expectations for active change according to [Figure 5.1-a] are low. But there is still hope for future governments to have a higher impact on change processes. This can be understood as a mission for the political decision-makers to act and to communicate their action in the Regional Innovation System to the research community and interested parts of society. This could well lead to enhanced motivation to move into start-ups on the part of the community that is interested in entrepreneurship but lacking in energy and motivation to act as shown in [Figure 4.3-d].

5.3 Research Question 3: What are further options for improvement in the Regional Innovation System Salzburg and how should they be discussed ?

The questions to be addressed will be organized following the structure of the Spaces and discussed using data from the analysis and/or via benchmarks of other international Innovation Regions.

5.3.1 RQ3 a) Strengthening the Knowledge Space: Availability of human capital in the Region, Quality of education regarding the students-faculty relation

The number of students in Salzburg starting and finishing tertiary education seems to be sufficient regarding quantity, also proven by [Figure 4.1-f], which leaves the number of graduates within the Austrian average. Therefore the discussion should be focused on two dimensions. On the one hand the quality of education and the faculty-students relation and the ability of the region to provide attractive opportunities for graduates on the other.

RQ3 a) Challenge: Students-Faculty Relation

According to [Figure 4.1-i], the position of the University of Salzburg in international rankings is beyond the best 500 in the world. To be very clear - whatever the pros and cons of such rankings - this is not sufficient for a region in a country with the world's 14th highest GDP per capita (World Bank 2011-2013). This is also proven through the fact that other Austrian universities are not in the top-ranking positions either but still some hundred positions ahead. [Figure 4.1-h] analyses the respective numbers with the result that they are about double regarding comparable institutions in the US.

RQ3 a) Options for Action: Students-Faculty Relation

Legal framework for universities in Austria [Chapter 4.3.2.1] provides a set of options for university management. Only a few of them are really used, mainly for historical reasons. University management could however use the existing options within their autonomy much more, it has the responsibility and duty to implement its strategic issues much more than it did in the past.

As introduced in [Chapter 2] Uyarra (2008, p.15) discuss the evolution of universities from education and research to institutions contributing to the "economic well-being of countries and regions" in many dimensions. This evolution demands management capacity that is ready and open for alternative thinking and changes to past traditions.

5.3.2 RQ3 b) Strengthening the Knowledge Space: Human Capital from Migration

RQ3 b) Challenge: Opportunities for the best in class

There are differences in education levels regarding incoming and outgoing migrants according to [Chapter 4.1.1.4 “Migration”]. The geographical position of Salzburg generates the challenge to motivate especially German students to stay in the region and use their acquired knowledge. This is according to [Figure 4.1-g] essentially applicable for a high percentage of students of German origins who enroll at the University of Salzburg. The region and Austria as a whole shall appreciate these knowledge workers. Due to demographic reasons they will be needed to fill the gap of low birth rates in Austria.

RQ3 b) Options for Action: Opportunities for the best in class

Motivation to stay in the region has to start well before the end of studies. Special mentors from research institutions and industry have to establish contact with the students and provide insight into the opportunities present in the region. The start of this initiative could be made in the disciplines of natural sciences and engineering.

5.3.3 RQ3 c) Strengthening the Innovation Space: Human Capital

As described in the analysis in [Chapter 4.2], in European regions as a whole the Innovation Space needs lots of attention and various kinds of actions that should be implemented. This paper concentrates on the main ingredient, which is human capital.

Why do people innovate? Out of economic pressure? Sometimes indeed, but it is more likely that they feel the passion to change the world. Their passion is filled with curiosity and the willingness to take risks for the expected outcomes. It can also be characterized through entrepreneurial spirit. Everybody has got a talent. The education as well as the attitudes and values passed on by socialization decide about the dimension of the possible conversion of talent into passion.

RQ3 c) Challenge: Design of the education system in order to ignite the entrepreneurial spirit in pupils

As we look at the ratio of new companies compared to existing companies in [Figure 4.2-b], we see Salzburg in a fairly weak position. The same can be seen within the start-up intensity with Salzburg being as well in the lowest third of regions in Austria. This is amazing regarding the fact that according to [Figure 4.1-s] Salzburg has got the highest rate of self-employment in Austria. We have to draw the conclusion that the rate today is high but that number of the following generation of the self-employed will be much smaller. This fact can be proven through [Figure 4.2-e] where the slowdown of the number of foundations between 2001 and 2006 is clearly shown.

Entrepreneurship is determined by different sources of influence, amongst which the innovation culture described in [Chapter 5.2 RQ2] or the education system. The education system in a developed nation is not built up from scratch. The development and the change in the system mainly addressed as “reform” need a lot of energy from all the institutions involved. That is why it is a real challenge to bring in new design.

RQ3 c) Options for Action: Education in entrepreneurship

The Gaming research provides a lot of promising results for the inclusion of education within all different sorts of games. Playing is the most important issue for children. And the learning curve is highest when children play. Teachers of all grades in school should be trained to include games of entrepreneurship into their curriculum.

RQ3 c) Lessons Learned from the U.S.A. (University of Maryland)

The University of Maryland runs two tech accelerators that try to implement all the ideas and inventions of the faculty and alumni into the market. It also has an „Academy for Innovation and Entrepreneurship“ (<http://innovation.umd.edu/>). In the late 1990s the university initiated different programs to motivate young people to engage themselves in entrepreneurial matters. Following the timeline one can see that the program changed roughly every five years and addressed with each change a younger cohort of students. It began with alumni and CEOs in 1999 and had its latest turning point with pre-college programs in 2010.

- Hinman CEOs Program (Est. 1999): Nation’s first living-learning entrepreneurship programme
- Hillman Entrepreneurs Program (Est. 2006): Entrepreneurial initiative for students
- Entrepreneurship & Innovation Program (Est. 2010): 150 entrepreneurially-minded freshmen

5.3.4 RQ3 d) Strengthening the Consensus Space: Framework Conditions

The Consensus Space in the Austrian regions that was analyzed in [Chapter 4.3] lacks communication lines between the major actors in the process of the transfer of knowledge into innovation. As there are some regions in the world that have developed very well with regards to the innovation portfolio, we will look at possibilities to strengthen the ties between knowledge and innovation. In Europe the Knowledge Space dominates whereas in regions like Silicon Valley the Innovation Space outweighs the Knowledge Space. One important reason is that trade is a major driver of business in Salzburg, shown in [Figure 4.1-bb], whereas trade had never been a big topic in the historical development of Silicon Valley.

RQ3 d) Challenge: Provide framework conditions to support innovation out of the knowledge

One important part of innovation diffusion is the ability of a region to recognize new opportunities, mobilize resources to bring them into existence and to use the business model behind. This is more

than just a spin-off. The most critical period in the life of a company is the first year and the weeks before it has even been founded. The whole framework of registration, legal questions, recruiting, accounting, marketing, protection of IPR and many other issues can lead to a premature death of a promising idea. There is evidence from other regions in the world that the suppliers of the framework services mentioned have to think as entrepreneurially as the founders of the company themselves. If there is a legal advice from an attorney who is just interested in his rate of the very same day or a civil servant who tries to act as a venture capitalist but have a risk averse political system behind them, the best ideas cannot evolve beyond a certain degree.

RQ3 d) Lessons Learned from Silicon Valley

Newly founded companies need a competitive environment to be able to challenge the established players in the market. But in their partnerships they need institutions that are able and willing to share the risks. One could either call it those the “second row of the founders” or also the embedment of an emerging company. Young companies often lack experience with legal systems, accounting issues, intellectual property rights or even with sales activities to get to know their future customers. These services demand a high amount of upfront investment before one even can think of having revenues. In Europe a start-up basically has to pay for these services like established companies. In Silicon Valley there are different ways of providing these services. Either the fees can be deferred to a later “revenue stage” of the company, or it can be combined with the level and timing of funding so there is no danger of running out of cash. And there is another way, which seems to be the most appropriate one - the risk sharing model. All these service providers share the start-up risk by taking equity or profit shares instead of cash. The big advantage will be the motivation by all of them to bring up the business as properly and as fast as possible because their salary is also dependent on the success of the company.

As addressed in [Chapter 2] there is evidence in the literature that there is social influence from one generation of researchers to the next. Therefore such framework conditions do not change without exogenous energy. Azoulay et.al. (2009) confirmed the social influence between the generations of researchers with the consequence that it should be possible to place some core of a different innovation culture into a system which thus will be marked in turn by some of the new attributes.

RQ3e) Options for Action

The Consensus Space of the respective Austrian region has to develop means for communication between the needs of the founders and the service providers. This room for dialogue and discussion can be an incubator or accelerator that has to finance itself through the revenues or exits from start-ups it is providing services to. The involvement of public funding in the start-up itself kills the ambitions of all the other players to be competitive. Young companies do not need public support to find out their viability. Indeed, they could be kept alive despite clear signs that there is no market or that the timing has gone wrong.

As pointed out in the analysis of [Chapter 4.3.2.3] there is an important criterion in cooperation activities between institutions. Questions that come up are the following: Where is the platform that could provide a better understanding for the University of Applied Sciences about future planning of

the University of Salzburg? How can one elaborate a complex application for the COMET program if the university does not know details about the needs of industry? Everybody can perform a great job in his or her field but the Consensus is missing. The result can be seen in the COMET funding history in [Chapter 4.2.1.5]. In the last two years after establishing the new government in May 2013, measures have been taken that have the potential to overcome some of these deficiencies. Stuart and Sorensen (2007, p.211) as introduced in [Chapter 2] also discuss the strategic importance of social networks within the question of spill-overs and entrepreneurial action. If there are weak communication lines between different actors in the region, the network effects cannot unfurl their energy. This fact directly affects the number of newly founded firms because "when investors and entrepreneurs share overlapping social networks, the investor can, through mutual acquaintances or through direct observation of prior conduct, acquire information about an entrepreneur, including assessments of the entrepreneurs reliability" (p.215), information that would otherwise be difficult to disclose.

5.3.5 RQ3 e) Strengthen the Innovation Space: Quality in Entrepreneurship

The ability of a regional innovation system to evolve the Knowledge into Innovation (or in other words to transfer knowledge into money), depends on different framework conditions. One major basis is the person who owns the knowledge. What we know from [Chapter 2] is that not only the number of potential entrepreneurs counts but even more so the question who this entrepreneur is. Furthermore we find in Eesley (2009, p.1) that "when institutional change reduces the barriers to the growth of entrepreneurial firms, individuals with higher human capital tend to become entrepreneurs", with the important addition that "firms created by such individuals have higher productivity and are more innovative". If the entry and exit barriers are reduced, this will affect mainly the quality of persons who found a new business. If people have good opportunities and high wages in other potential jobs they are less likely to prefer the independence of their own venture.

RQ3 e) Challenge: Quality in entrepreneurship

How many brains are there and what opportunities do they have? Nowhere less important for the ability to transform knowledge into innovation are the supporting institutions for entrepreneurs as stated in [Chapter 5.3.4 RQ 3d]. Entrepreneurs have to take risks. The same applies to their supporters in the starting phase such as lawyers, venture capitalists, infrastructure providers and many more who are involved in the founding process. Also, the more these organizations are willing to share risks, the more likely it is that the venture will be successful. There is an obvious cultural difference between the regions. There is also a discussion about the composition of incubation teams. And there is an obvious geographical question coming with that. Companies founded within a limited distance from the investors' offices face a higher chance that the investing persons take functions in the board of the company. This will positively influence the successful development of the company. Incubation is not just a regional topic, it is a local topic.

As Baumol (2004, p.5) argues there is a distinction between the roles of established businesses of more than 500 employees and entrepreneurs. For the large business firms he states that they "have tended to follow relatively routine goals, slanted toward incremental improvements rather than revolutionary ideas" whereas for entrepreneurs he claims that they "have tended to account for most of the true, fundamentally novel innovations". While entrepreneurs contribute the breakthroughs, the larger firms take it up and complement them with continuous incremental innovation. The consequence that can be discerned from this observation is the drying shrinkage of breakthroughs or in other words declining numbers of radical innovation if there are scarce numbers of entrepreneurs.

RQ 3e) Options for Action: Quality in entrepreneurship

Concerning options for the region of Salzburg to improve quality in entrepreneurship, we will concentrate on two issues out of a series of possible measures.

First there is highly skilled human capital available within the region that is attracted by established firms, most of them in the trade sector. 62% of the alumnis of the University of Salzburg choose regular employment according to [Figure 4.1-r]. The intention of the firms is to keep being up to date within changing framework conditions. The goal of regional innovation policy is to motivate human capital in these companies to be as innovative as possible. As stated in [Chapter 2] institutional characteristics form the quantity and quality of entrepreneurship and they also influence the level of success of start-ups. One option is to motivate companies in Salzburg to generate Corporate Venture Funds within the region in order to improve the competitive position and to provide an opportunity for employees to act as an entrepreneur without leaving the perceived security of their job framework.

The other promising option is to include predetermined breaking points into the career channels of the public personnel so as to give them the opportunity to change back and forth between public service and companies or entrepreneurship. Today civil servants often spend their whole working lifetime, from the moment they finished their studies until retirement, in public service, often even in the same job profile. In countries with a high UAI (Uncertainty Avoidance Index) as is the case in Austria according to [Chapter 5.2 RQ2], more energy has to be put into motivating people to changes in their career planning.

6 Conclusions

The historical development of Salzburg has made it into a region with a rich cultural heritage that has remained fresh and active until these days. This cultural nucleus is a chance and a burden at the same time.

What are the major findings in the status quo in Salzburg why the cultural history and framework is a burden?

- ⊖ The majority stream of human capital getting available each year flows into career models that are risk averse and do not call for entrepreneurship. On the one hand these are disciplines like humanities and social and cultural sciences but on the other hand also macroeconomic consumption areas like tourism.
- ⊖ The major responsibility for the lack of innovation out of the knowledge in the region is within the management of those organisations that contain most of the well-educated human capital. Entrepreneurial spirit is inherited and transferred top-down. If there is neither motivation nor will for innovative activity in the management of an organization, there is no way how to give the staff any reasons to do so. These organisations provide perfect opportunities not to go for competition and the implementation of new ideas.
- ⊖ The confidence of the community in the ability of the political level to improve the situation is limited. This is among other reasons due to the fact that the expected political capabilities are not in line with the predicted impact of the topics addressed.

What are the major opportunities for a positive change of the situation for future prosperity?

- ☺ The cultural setting and its representatives contain an enormous amount of creative potential. If that potential is married with entrepreneurial spirit and technological skills, this would result in a lively community bringing out many new and successful ventures.
- ☺ The survey and the prognosis market show a disbalance between a large group with an interest in entrepreneurship and a diminishing number of people effectively realizing their entrepreneurial ambitions. This implies a significant amount of potential for future entrepreneurial activity if once motivated.
- ☺ There is a lot of room for improvement in the Consensus Space with the positive aspect that the required institutional landscape is already in place. The room for improvement is embedded in the kind of communication and interaction between these actors. It is not sufficient that people know each other. A successful cross institutional communication means that interests are merged and converted into common actions.

The analysis of the Triple Helix in Salzburg reveals an overwhelming Knowledge Space and a hardly visible Innovation Space with a floating Consensus Space. The dominance of one of the Spaces implies the need for political action because the self-adjusting energy inherent to the system brought it there where we find it today. Political energy is needed for change and to design a Regional Innovation System that is capable to cope with future challenges.

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