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## The regional research policy of the Austrian federal states

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### Abstract

This research focuses on the regional research policy of the federal states. The paper analyses the existing academic research sources of the regional research policies and answers questions of the regions's analysis.

The methodology uses specific working papers essential for the European region's and sources of the Austrian public administration. Concerning the empirical part, this paper uses qualitatively focussed structured guideline surveys. The research will facilitate discussions on aspects of methodological approaches to research, data capture and analysis, perceived research outcomes and contributions to the body of knowledge.

Essential is the separation of subvention policy, which means the matter of distinct locational competition and it occurs the establishment of co-production within the regions to present itself mutual externally to persist in the global contest.

The findings indicate that even through this concept for success is highly influenced by funding's that are not very controllable by the regions, such as the federal states, and it is a positive prototype for prospective similar cases.

### Keywords

Universities | Federal States | Regional Factors | Subvention | Funding, Institutions

### JEL Codes

I22, R11, H83

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## 1 Introduction

This essay aims to be an attempt to present a view of the science and research sectors in the regional context of Austria. This complex area with many cross-connections and overlapping competencies on the part of politics poses a certain challenge in order to be able to conduct a critical analysis. It is intended to provide an insight into the regional research policy of the Austrian federal states, and to present an overview of the fields of action, as well as the measures and challenges for optimising the research policy. The topic brings the relevant literature and sources into discourse with each other and enables a treatment and discussion from a critical point of view. Furthermore, it enables to identify the possible improvements in the area mentioned.

The reference to sources refers in the broadest sense to a period of the past 5 years in the area of "Research & Development".

### 1.1 Topic and relevance

The development of the locations in the common research area and their framework conditions are of importance for universities and non-university institutions of higher education regarding incentives for their optimisation. The potentials and aspects arising in the regional research sector are mentioned by the perspectives of human capital and the funding situation in the regions or federal states. The paper also points out the importance of cooperation in the science sector. The strengthening of the higher education sector, especially in the regional area, and the resulting research output and its positive effects represent a research area that will become increasingly important in the future.

### 1.2 Conceptual delimitations

When mentioning the term "higher education institution(s)", it refers equally to universities and

universities of applied sciences and also to both as a superordinate attribution category. The terms “science and research” are used in a broader sense as working terms for the analysis of an overview and in the broadest sense, synonymously. In the case of clear demarcations, this is explicitly pointed out. In Chapter 2, there is a differentiation of the terms “science” and “research”. This refers to the clarification that science is more closely related to the promotion of university institutions and research with non-university institutions. The terms “regions” and “federal states” are not explicitly considered to be differentiated in the following. As it is not always possible to make a clear distinction between the research areas within the boundaries of the *Länder*, the term federal state is used primarily in the context of funding.

Science is the pursuit of objective knowledge. Science is seen as an activity, the aim of which is that it should lead to a result. Science is therefore much more than the mere accumulation of knowledge. It is also an activity that is concerned with the methodical control of theories. Thus, the concept of science presupposes a foundation of theory and methodology.<sup>1</sup>

Science comprises “research and teaching”. This can be concluded from the demands of gaining and preserving knowledge. According to Humboldt, scientists and their institutions should “research and teach”. For students, teaching is considered “learning”, whereas studying itself is considered *de facto* “researching learning”. Since Wilhelm von Humboldt, the unity of research and teaching has been essential for science in Germany.<sup>2</sup>

Science can also be understood almost identically as “scientific research”. This is assumed in the mainstream of theories of science. In general social discourse, the term thus stands for an abbreviation of scientific research. Science is what drives people at universities. Research is rather what drives the research institutions within the framework of the economy.<sup>3</sup>

In the following chapters, the term “funding” is largely based on the economic term, which does not use a uniform term for funding (subsidy term). Thus, it is used relatively synonymously with “subsidy” and “grants”.<sup>4</sup>

For the sake of simplicity, approximate or rounded figures are used for the respective data sources, percentages and/or euro amounts.

### 1.3 Research analysis

Important thoughts regarding the overview to be established and the attempt to analyse are how the framework conditions for regional research policy in the Austrian federal states are shaped.

The main question is denoted thus: Which framework conditions can be identified in the field of science and research in a regional sense in Austria?

#### 1.3.1 Underlying questions

- What conditions underlie the science and research system?
- What benefits or instruments are set within monetary and other dimensions?
- What measures and challenges arise in the development and formation of regional locations?

## 2 Austrian science and research system

The Austrian science and research system is characterised by a high number of political, financial and legal measures taken by the federal government, the federal states and private actors (companies, foundations) that provide steering impulses for research funding.

Through research and education and the promotion of people and their qualifications, such a system strengthens the ability to compete with institutions and companies. The science and research system is of central importance for the development and sustainable maintenance of the prosperity of a state.<sup>5</sup>

In addition to an overview and the contribution of individual regions of the research landscape, this chapter will highlight and take a closer look at the exemplary federal states of Styria, Vienna and Lower

<sup>1</sup> Cf. Lehmann (2012).

<sup>2</sup> See also Wilhelm von Humboldt.

<sup>3</sup> Cf. Lehmann (2012).

<sup>4</sup> See also Schittengruber (2017).

<sup>5</sup> Cf. Radzyner et al. (2012) p. 14.

Austria as the “largest research locations”, measured by the number of research institutions (including universities) existing there.

## 2.1 The importance of research in the regional context

### 2.1.1 Regional research quota

An important performance indicator of the research and development (R&D) expenditure to determine the importance of research in regions is the research quota in a national or regional context. In other words, it shows gross regional expenditure on R&D in relation to gross regional product. The regional research quota is a key figure for the research activity of a region. It can be explained as the expenditure on R&D compared with the regional value added.

R&D expenditure includes financing in the public (federal government, Austrian Science Fund [FWF], Austrian Research Promotion Agency [FFG], state, municipalities, European Union [EU]) and economic sectors (private non-profit, companies, foreign countries) and also the higher education sector. Companies and the federal government account for the largest share, followed by funding agencies and municipalities. By far the largest share of expenditure is spent on applied research and contract research in the business enterprise sector. The share in the area of basic research is much smaller.

At the turn of the millennium, the R&D ratio in the federal states was still at an average of just below 2%. At that time, Vienna was clearly in the lead (with over 3%), followed by Styria (2.5%) and Tyrol (around 1.5%). In the middle range were Upper Austria and Carinthia (both at around 1%). In the weaker third the provinces of Vorarlberg, Salzburg and Lower Austria followed (all below 1%). Clearly at the bottom was Burgenland, with a value of less than 0.5 percentage points.<sup>6</sup>

For about two decades, the R&D rate of Austria's federal states shows the following picture in comparison.

The R&D value of expenditure throughout Austria is around 3.00 percentage points. The provinces of

Styria (at approx. 4.5%), Vienna (just under 4%), Upper Austria (approx. 3.40%) and Carinthia (approx. 3.20%) are above the nationwide value of R&D expenditure and are in the top third. Tyrol, at approximately 2.80%, is just below the nationwide expenditure value. The provinces of Vorarlberg (approx. 1.70%), Salzburg and Lower Austria (both approx. 1.80%) still show a need to catch up. Burgenland is still considered to be at the bottom of the league with a value of less than 1.00 percentage points.<sup>7</sup>

The example of Lower Austria shows that investments in science and research lead to a positive development in the research quota (6% increase in about a decade).<sup>8</sup>

Investments in research and development are also an essential focus of a future partnership in Styria. According to a survey by Statistik Austria for 2015, Styria, for example, has managed to increase its R&D quota to as much as 5.16% of the gross regional product. In comparison with 276 EU regions, Styria is in the lead. It is followed by the British region “East Anglia” (4.98%) and in the third place by the German state of Baden-Württemberg (4.94%).<sup>9</sup>

### 2.1.2 Universities as “regional lead institutions”

Universities are regarded as high-ranking and central institutions of the national and international education and research system. They influence the attractiveness of the location in terms of its infrastructure and high-quality services.<sup>10</sup>

In the context of knowledge transfer, the cooperation between universities and companies, which is made relevant by contract research, is also important.

In order to become “regional lead institutions”, universities aim to become involved in the development of their own location concepts and by integrating them into existing regional strategies. Each university should present its strategic cooperation and networks with other research institutions, with companies and also with society in a delimited environment. In this catchment area, university networks are formed in order to cooperate with companies in their respective

<sup>7</sup> Cf. Standortpolitik für Wissenschaft & Forschung/ BMBWF (2020).

<sup>8</sup> Cf. NÖ Wissenschaftsbericht (2018) s. 13.

<sup>9</sup> Cf. Amt der steiermärkischen Landesregierung (2019).

<sup>10</sup> Cf. Musil/Eder (2013) p. 16.

<sup>6</sup> See also Forschungsstrategie Steiermark (2005) p. 9 ff.

regions. In this way, universities and universities of applied sciences support the emergence of strategic research priorities in the federal states with their research as future “regional lead institutions”.<sup>11</sup>

Universities can be regarded as globally networked knowledge bases, which in a broader sense also act as drivers of innovation. They are becoming increasingly important sources of power in the environment of innovation systems, which are regarded as educational institutions and as figureheads for people with high innovation potential. Strengthening at a single location is about different universities from different fields working together and becoming interdisciplinary.

For the universities, the increasing influence of well thought-out strategies throughout Europe means an opportunity to stand out as science location and, aware of their importance as drivers of structural change, to actively participate in the development of a “regional profile”.<sup>12</sup>

Knowledge creates value and it is essential that this value, which is generated by universities, is also valued. This is why universities are considered to be leading and guiding institutions in their respective regions.

The different levels of investment at the state level result in regionally varying levels of efficiency. Effects that universities have on the regional economy are GDP/capita, unemployment rate and patent volume.

Typical university cities can be expected to have a greater impact on the location than the more rural areas with, for example, “only” one university of applied sciences.

Networks and cooperations have a positive effect on the regional economy in the medium to longer term. This can be seen, for example, in the successful acquisition of third-party funds from the universities. A strong university location also helps to reduce unemployment in the longer term.<sup>13</sup>

## 2.2 Science in the federal states

In the field of higher education, it is mainly the universities that are associated with this. The regions

have now recognised the need for an independent science policy for themselves. Significant investments in science structures are often already supported by public–private partnerships.

The measures taken for a science location must be coordinated among the federal states. The Court of Auditors has noted in this regard over-regulation, confusion of competences and fragmentation in research funding. Effect-oriented coordination should increasingly involve a shift from input control to goal-based output control. In its regular recommendations and statements, the Council of Science and Humanities calls for increased state coordination.<sup>14</sup>

Universities can change the innovative capacity of a region through their excellent contribution to science. Especially when they cooperate with the local economy, they are magnets for high-tech companies or the R&D units of multinational corporations. The innovation capability covered by universities ranges from their central importance for basic research to application-oriented research and support services in the innovation sector such as development, certification, monitoring or measurement.<sup>15</sup>

Important major research funding agencies in Austria are the FWF and the FFG and these agencies act on behalf of the federal government. The FWF finances basic research while the FFG focuses on funding-applied research associated with industry.

Basic research at universities in the field of science is largely financed by the FWF.

The FWF’s annual report for 2018 shows a total of EUR 230.8 million allocated for basic research activities throughout Austria. Vienna is the clear frontrunner in this area, receiving approximately four times as much funding as Styria. Tyrol received about EUR 25 million of this amount. The provinces of Upper Austria, Salzburg and Lower Austria each received approximately EUR 10 million. In the bottom third are Carinthia, Vorarlberg and Burgenland, with less than EUR 2.5 million each.<sup>16</sup>

In total, the FWF has approved of new projects in Styria amounting to EUR 27.3 million each year from 2015 to 2017. This corresponds to a share of around 15% compared to the entire funding amount of the FWF for universities in Austria. As expected,

<sup>11</sup> See also Österreichischer Forschungs- und Technologiebericht (2015).

<sup>12</sup> Cf. Europäische Union (2010a). COM(2010) und Europäische Union (2010b). SEC (2010).

<sup>13</sup> Cf. Schubert/Kroll (2013) p. 23 ff.

<sup>14</sup> Cf. Wissenschaftsrat (2018) p. 33.

<sup>15</sup> See also Standortpolitik/BMBWF (2020).

<sup>16</sup> Cf. NÖ Wissenschaftsbericht NÖ (2018) p. 13 ff.

the majority of Styrian FWF funds were allocated to universities (94%).<sup>17</sup>

With the highest number of universities and approximately 30% of all Austrian research institutions, Vienna is clearly in the lead in terms of FWF funding. Vienna's universities are able to gain an increasing share of the growing funding volume, which is an expression of the competitiveness of the location within the Austrian university landscape.<sup>18</sup>

In addition to the direct funding of numerous individual scientific projects and research institutions, Vienna has several of its own science promotion funds. These funds support research work in various scientific disciplines with topic-specific calls.<sup>19</sup> Relevant, for instance, is the WWTF (Viennese science, research and technology fund) and two major funds named "Hochschuljubiläumsstiftung" (college jubilee foundation) and "Viennese anniversary fund for the Austrian Academy of Sciences" by the city of Vienna, whose calls for proposals are aimed at all Viennese research institutions.

Investing in the scientific infrastructure is important for countries to remain internationally competitive. This creates a basis for knowledge to emerge and develop.<sup>20</sup>

In some provinces, such as Vienna, Tyrol, Salzburg and Styria, an enormous focus on the scientific sector can be observed. Universities continue to have above-average importance in the share of Austria-wide research expenditure.<sup>21</sup>

### 3 Benefiting the regional level

The thematic field of the knowledge, research and innovation base is particularly important for structured conditions of value-added processes in a regional context. The small- and medium-sized enterprises located in the regions are essential for growth, employment and innovation. Here, politics has provided framework conditions for the scientific sector. The following section explains the essential and important monetary and non-monetary measures that have been or are being taken here.

## 3.1 Grants and subsidies

### 3.1.1 Framework conditions of the research area

In general, it should be noted that the term "cooperation" refers to voluntary associations of legally and economically independent institutions. These may be temporary or permanent. There are various forms of cooperation, either verbal or formal.

Within the framework of the EU 2020 Strategy, the development concepts for regions are to ensure "intelligent and sustainable" growth. The consideration of regional potentials forms a basis for the efficient allocation of public funds in research infrastructures, such as in the current period 2014–2020 by the European Regional Development Fund (ERDF).<sup>22</sup>

In the field of education, a solid foundation can be identified. The federal states all have a large number of university educational institutions. The level of education in Austria can be observed to be rising among women. About 6% of all women complete a university degree.<sup>23</sup> For people with a lower level of education, this means measures to improve their own skills. For older generations of people, the focus is on health, prevention and lifelong learning.<sup>34</sup>

In the case of universities, as they are basically the responsibility of the federal government and the respective region, hence they exhibit less competence and responsibility. However, this applies primarily to state universities and not to universities of applied sciences and private ones. There are of course many ways for the "host region" to support these universities. For example, cities can make a contribution in the area of construction and transport infrastructure with a friendly administrative and service culture that focuses on simplicity. Through "conventional" research funding, the environment of the universities can be positively shaped.<sup>24</sup>

There is a trend in the funding of universities in the German-speaking world. Here, it is important to note that the total amount of funding is increasing and, especially in the case of the universities of applied sciences, the share of third-party funding is rising, which can be interpreted as an expression of the emerging competitiveness, but also financial pressure. The competitive orientation of higher education

<sup>17</sup> Cf. Wissenschaftsbericht Steiermark (2017) p. 22.

<sup>18</sup> Cf. Musil/Eder (2013) p. 28.

<sup>19</sup> Cf. Wissenschaftsbericht Wien (2018) p. 36.

<sup>20</sup> See also NÖ Wissenschaftsbericht (2018) p. 12 ff.

<sup>21</sup> See also Forschungsstrategiebericht Steiermark.

<sup>22</sup> See also Standortpolitik/BMBWF (2020).

<sup>23</sup> Cf. Buchinger et al. (2007) p. 9 ff.

<sup>34</sup> Cf. Frank et al. (2012) p. 101

<sup>24</sup> Cf. Musil/Eder (2013) p. 5 ff.

funding is ultimately also expressed by the increasing budgets of the funding institutions.<sup>25</sup>

In the area of top-level research (“excellence”), strengthening of the research and science location and rapid implementation of a programme of excellence is needed; this has already opened up new avenues for research in other European countries. The goal of such an excellence programme is that Austria, in view of the intensifying competition, will become an internationally highly recognised, attractive research area for excellent minds, innovative research ideas and researching companies. The design of an excellence programme is based on international experience. Two programme lines can be proposed here: a cluster of excellence and future professorships as well as corresponding calls for proposals, a defined endowment, duration and number of Austrian conditions. Statements and recommendations are provided by the Austrian Science Council.<sup>26</sup>

Two factors are decisive for research and development expenses: on the one hand the implementation and on the other hand the financing of the activities. The former refers to the question of where research is effectively carried out. The second is how the research is financed.

In the R&D sector, the sectors of implementation can be distinguished at the regional level into “higher education”, government, private non-profit sector and the corporate sector. Universities have an above-average share of Austria’s total research expenditure. The corporate sector has been growing relatively strongly since the turn of the millennium. This sector generally acts as a “motor of innovation” in the regional area.<sup>27</sup>

In terms of financing, a distinction has to be made between the corporate sector, the private non-profit and public sectors (federal, state) and foreign countries (mainly EU and others). The public sector remains relatively important for the financing of research expenditure(s).

In Styria, for example, foreign sources of funding play a role similar to that in Vienna, although EU funds were not taken into account here.

The federal states also confirmed a high importance of contracts as a source of financing for research activities. This also applies to the higher

education sector, which includes universities and the Austrian Academy of Sciences. In the higher education sector, a small share (approx. 2%) is financed by the federal states themselves. The majority of research funding in the higher education sector is financed by the federal government. In the case of research funds in the corporate sector, about half of these funds are provided by this sector itself. The rest is financed by foreign companies. The “public sector” (mainly hospitals) is financed by the federal states. Other public institutions, such as the FWF (mainly higher education sector) and FFG (mainly business enterprise sector), finance university research and the business enterprise sector.<sup>28</sup>

The example of Styria shows that approximately 40% of the federal state’s funds in the past 10 years were allocated to science and research, of which 10% was spent on further funding in the R&D sector.<sup>29</sup>

As far as the somewhat application-oriented research sector is concerned, it can be stipulated that in the area of business-oriented research at the federal level, the Austrian FFG appears to be important for research institutions and companies in raising funds. In 2018, Styria (around EUR 174 million), Vienna (around EUR 143 million), Upper Austria (EUR 136 million) and Lower Austria (around EUR 53 million) received the highest funding for application-oriented research activities among the federal states. Carinthia (approx. EUR 31 million) and Tyrol (approx. EUR 30 million) were in the middle range. The federal states of Salzburg (approx. EUR 19 million) and Vorarlberg (approx. EUR 17 million) ranked at the bottom. The federal state of Burgenland came last with EUR 6 million. Of the total funding provided by the FFG, around EUR 9 million was also used abroad.<sup>30,31</sup>

Between 2015 and 2017, around EUR 112 million of FFG funding flowed into Styria every year. This already put Styria at the top of the federal state ranking in the previous period.<sup>32</sup> In the area of entrepreneurial contract research, the Austrian value of R&D third-party funding from universities, which comes from companies, amounts to about 25%.<sup>33</sup>

<sup>25</sup> Cf. Musil/Eder (2013) p. 28.

<sup>26</sup> Cf. Wissenschaftsrat (2018) p. 32.

<sup>27</sup> See also Statistik Austria.

<sup>28</sup> Cf. Forschungsstrategie Steiermark (2005) S. 8 ff.

<sup>29</sup> Cf. Wissenschaftsbericht Steiermark (2017) S. 28.

<sup>30</sup> Cf. NÖ Wissenschaftsbericht (2018) p. 14.

<sup>31</sup> See also Österreichische Forschungsförderungsgesellschaft (FFG): Österreich im 7. EU-Rahmenprogramm. Enderbericht auf Basis des Datenstandes vom November 2015.

<sup>32</sup> Cf. Wissenschaftsbericht Steiermark (2017) p. 22 f.

<sup>33</sup> Cf. Wissenschaftsbericht Steiermark (2017) p. 28.

In sum, the most important areas of coordinated infrastructure development are transport, research and development, technology exchange and training in the research area. In the case of infrastructure in the scientific sense, there are favourable factors such as orientation towards economic clusters and regional economies.<sup>34</sup>

### 3.1.2 Support mechanisms

From a basic theoretical point of view, “subsidies” are a possible form of financing-like transactions, because they cannot be clearly assigned as internal or external financing. These financial resources represent state subsidies that are granted for specific purposes. National and supranational institutions can act as funding providers. Such funds have a direct financing effect for the recipient. Of course, the conditions for granting such funds must be met. A well-known important area is the promotion of structurally weak regions.<sup>35</sup>

In terms of the type of financing, this approach primarily concerns “subsidies” over the past 5 years. However, a number of different types and designations are used for this purpose, the broadest being economic.

In the administrative law sense, the term “subsidy” is used as follows.

The term “subsidy” refers to a grant from public funds, whereby the “recipient of the subsidy” agrees to engage in certain behaviour in the public interest. In general, it is a transfer expenditure for a payment in kind by the federal government without directly receiving an appropriate payment in return.<sup>36</sup>

A distinction is made between direct (subdivisions of the departments) and indirect (tax relief or deductions) support. In the 2017 Funding Report, for example, the presentation of the national accounts lists research bonuses, contract research and the higher education sector as direct funding regarding federal subsidies.<sup>37</sup>

Within the framework of results-oriented administration at the federal level, an implementation exists of an impact orientation process focusing on defined impact goals. The guiding principles of impact

orientation lead to a change in the steering culture of politics and administration. A key objective of the Ministry of Science and Research is denoted by the “creation of a nationally coordinated, internationally competitive research area in teaching and research”. Through its assigned measures, this aims to improve the conditions for the mobility of students and teachers, a higher education plan or the initiation of university cooperation. The narrative assessment of this objective shows, in addition to the coordination of the Austrian higher education landscape, the internationalisation of the science actors in Austria. Other objectives of public funding in the research field are “awareness raising, basic research, gender equality and raising the level of education”.<sup>38</sup>

Conversion from the federal government to the federal states takes the form of financial allocations and special-purpose grants. The highest grants have been made in connection with the transfer of tasks to the federal states. In 2018, the total volume distributed to the federal states amounted to approximately EUR 2,170 million.<sup>39</sup>

From the tax revenues (approx. EUR 85 million per year), the financial resources of the state are allocated to the individual local authorities (federal, state and local authorities) using financial equalisation. This financial instrument coordinates the expenditure and tasks between the levels. The partners in this process are the federal government (Finance Ministry), the federal states, the Association of Towns and Cities and the Association of Local Authorities. The currently valid Fiscal Equalization Act 2017 (FAG 2017) regulates fiscal equalisation for the years 2017–2021.<sup>40</sup>

The transparency portal provides an overview of general research funding by the federal states and basic subsidies as well as services for non-profit organisations. Here, you will find a list of the cash benefits financed by the public sector. In the area of “Science and Research” (category/topic: R&D) there are services/funding for companies, non-profit organisations and public institutions.<sup>41</sup>

For companies, this includes subsidies such as “Academic jobs in Carinthia” (Province of Carinthia), “General research promotion” (Province of Upper Austria), “General science promotion” (Province of

<sup>34</sup> Cf. Tödting/Trippl (2008) p. 11

<sup>35</sup> Cf. Schultz (2011) p. 159 ff.

<sup>36</sup> Cf. Schittengruber (2017) p. 5 ff.

<sup>37</sup> See also Förderbericht (2018).

<sup>38</sup> See also Wirkungsmonitoring des Bundes (2018).

<sup>39</sup> See also Transfers an Länder und Gemeinden/BMF.

<sup>40</sup> See also Finanzausgleichsgesetz 2017 – FAG 2017 ([www.ris.bka.gv.at](http://www.ris.bka.gv.at)).

<sup>41</sup> See also Transparenzportal (2020).



Lower Austria) and “Basic financing of the Salzburg Research Forschungsgesellschaft mbH” (Province of Salzburg), as well as funding programmes of the Ministry of Transport, Science and Economics. With non-profit organisations, there are overlaps with the business sector as well as services such as “Follow-up funding FWF” (Province of Styria) or “Funding from the Road Safety Fund” (Province of Burgenland). In the case of public institutions, there is also an overlap with the predecessor areas of the companies and non-profit organisations as well as services such as the “Basic Subsidies State Companies” (Province of Styria) or “Cooperation between the Federal Government and the Federal States” (Province of Styria).

In the area of “Science and Research”, there are also other categories/topics such as education, universities or scholarships.<sup>42</sup> The City of Vienna’s most important funding channel is the WWTF. Its calls for proposals are aimed at all Viennese research institutions. However, the majority of research funds are allocated to universities.<sup>43</sup>

Alternative or more “modern” additional forms of financing could offer the possibility of strengthening “crowdfunding”, which is already widespread among commercial enterprises in the area of young firms or start-ups.

In order to optimise the coordination of funding instruments, the major funding agencies at the FFG and FWF conduct evaluations at regular intervals.<sup>44</sup>

According to the data in the Subsidies Report 2018, federal subsidies to companies (subsidies and capital transfers) amounted to EUR 5.3 billion.

A total of 66 indirect funding schemes were reported with a funding volume of around EUR 15.5 billion. Compared with 2017, this represents an increase of EUR 456 million or around 3%. The research bonus rose by EUR 127 million.

Utilising the transparency database, payments by the federal government in 2018 were recorded in the amount of approximately EUR 10.2 billion.<sup>45</sup>

Third-party funds are a central source of funding for the universities. These financing patterns vary considerably from university to university, which are explained by the different orientation of the institutions. The universities’ third-party funds with

a high economic relevance are mainly derived from contract research by companies. For the universities themselves, FWF is the number one source of external funding.<sup>46</sup>

Despite the diversity of research institutions in the rural regions, it is apparent that the internal mechanisms of coordination are still not sufficiently coordinated. There is room for improvement in the sustainability of coordination, both within the state and with the federal government.<sup>47</sup>

## 3.2 Location development

### 3.2.1 Value chains and regional factors

Locations have a new meaning in the globalised reality. The question that often arises today is less of the availability of knowledge; what is more relevant is the capacity to absorb retrievable knowledge, its application and implementation in strategic decisions. Regional proximity plays a key role here, as does cooperation and mutual complementarity between leading companies and institutions at the location. A functioning joint labour market at the regional level is important for the creation of high-quality jobs. The large number of universities, the upward trend in the education sector, a general increase in the level of education as well as a high level of qualification among both women and men are essential conditions for positive development. In the domestic technology sector, highly qualified workforce is available. The joint coordination of infrastructure measures enables economic sustainability and, from a strategic point of view, a reduction in production costs. The framework conditions of the research area represent a part of the location. The “regional factor” forms a location category.<sup>48</sup>

Location itself is theoretically understood as the “geographical settlement” of research institutions and commercial enterprises. The respective location factors, such as procurement market, sales market and governmental framework conditions, are to be seen as positive in every respect, since the “location advantage” is given. The location categories are a combination of the following three factors: regional, national and international.<sup>49</sup>

<sup>42</sup> Cf. Musil/Eder (2013) p. 29.

<sup>43</sup> Cf. Musil/Eder (2013) p. 29.

<sup>44</sup> Cf. Leitbetriebe Standortstrategie (2015) p. 24.

<sup>45</sup> Cf. Förderungsbericht (2018).

<sup>46</sup> Cf. Wissenschaftsbericht Steiermark (2017) p. 22.

<sup>47</sup> Cf. Forschungsstrategie Steiermark (2005) p. 19 ff.

<sup>48</sup> Cf. Schultz (2011) p.20 ff.

<sup>49</sup> Cf. Schultz (2011) p. 20 ff.

The research areas at the regional level produce a certain amount of added value for the location. This is expressed through primary and secondary effects. The primary effects result from the primary role of the universities as educational and research institutions, from which knowledge emanates to the regional economy, for example, through the training of highly qualified workers for the labour market or patents to increase innovative capacity.<sup>50</sup> The secondary effects concern the existence of the “company” or “institution university”. The effects on salaries resulting from investments and the income of employees must be mentioned here. The difference between universities offers a relatively “rigid” and long-term component for a location, whereas the universities of applied sciences can act more flexibly and are usually spread over several locations. Universities of applied sciences are also a growth factor and make a significant contribution to value creation in regional terms.<sup>51</sup>

Universities increasingly see themselves as “nodes” in regional and supra-regional knowledge networks. Data have shown that the large metropolitan urban areas produce the highest share of innovation. The more rural areas have to catch up here. This is relevant so that they too can strengthen the location through their innovation and competition function, that is, through their potential to produce and publicise economic, social and cultural innovations.<sup>52</sup>

Universities have a dual function as high-ranking nodes in knowledge networks: On the one hand, they are “locally embedded actors” and, on the other, they also bring knowledge to the location through their global networking of their networks.<sup>53</sup>

Secondary or demand-side effects for cities and regions of higher education on the location are the expenditures of the institutions through which regional demand can be increased.<sup>54</sup>

In addition to consolidating existing strengths of the location, value chains across regions are to be defined in a global context. This is done via the allocation of public funds, especially where regional, national and European funds are pooled in order to promote locations in a targeted manner.<sup>55</sup>

In view of the well-established regional development and cooperation between science and business, Austria can at best learn from the most innovative regions in Europe. Intelligent specialisations can often build on existing regional strategies, successful cluster, excellence, competence and knowledge transfer activities. What is needed here is a critical self-assessment of the location and successful communication of its profile.

Intelligent specialisation is an approach to regional location policy that is becoming increasingly important. This enables dynamic growth and a linking of the regional profile formation with the location. Knowledge intensity and innovation potential are intended as the guiding criteria for bundling scarce resources in a limited number of internationally competitive areas.<sup>56</sup>

New, less temporary and stable forms of funding should be considered and secured in conjunction with research and innovation instruments along the entire value chain.<sup>57</sup>

In view of the well-established regional development and cooperation between science and business, Austria can in any case learn from Europe’s most innovative regions. Intelligent specialisations can often build on existing regional strategies, on successful cluster, excellence, competence and knowledge transfer activities.<sup>58</sup>

The culture of cooperation between the science sector and the economy is essential for the development of a “strong” regional location. Cooperative research provides universities with up-to-date information on research topics or projects and provides companies with information on the use and bundling of joint resources, such as facilitated or extended access to joint research infrastructures. Cooperation networks of universities are becoming increasingly important in the industrial sector. Cooperation with innovative companies can lead to marketable products and additional services. In addition, mobility and visibility are promoted, which helps to sharpen a profile and, through exchange, enliven the location in the region.<sup>59</sup>

Value creation should not be equated to appreciation (social knowledge transfer). Even if value creation is certainly related to performance, services

**50** See also “Kerne lokaler Wissenskomplexe” Kunzmann (2004)/Seifert et al. (2010).

**51** Cf. Musil/Eder (2013) p. 17 f.

**52** See also Schamp (2001) und Blotevogel (2010).

**53** See also Power/Malmberg (2008).

**54** Cf. Musil/Eder (2013) p. 13 ff.

**55** See also Österreichischer Forschungs- und Technologiebericht (2015).

**56** Cf. auch Europäische Union (2010a). COM(2010) und Europäische Union (2010b). SEC (2010).

**57** Cf. Leitbetriebe Standortstrategie (2015) p. 24.

**58** See also Clusterplattform Österreich/BMDW (2020).

**59** Cf. Wissenschaftsbericht Steiermark (2017) p. 22 ff.

for the location should by no means be viewed purely in financial terms.<sup>60</sup>

### 3.2.2 Performance and analysis

Regarding the development of the location, it is important to promote the potential and qualifications of people and to attract the requirements. This is an essential aspect concerning which factors such as knowledge of the language, culture and markets within a region are important.<sup>61</sup> The potential of the labour force in the Austrian sense of the term can certainly be identified as a constant and optimal element in terms of development. One indicator of human potential, for example, is the “graduate ratio”. Geographically, it is important to note that the ratio is the highest in larger cities.<sup>62</sup>

Within this framework, “research output” is a key indicator for the assessment of performance. In the case of universities in particular, it is relevant that the transfer of knowledge from university achievements to the central office is achieved by training highly qualified graduates at their respective locations and by taking over contract research and publication activities.<sup>63</sup>

Its importance for the federal states shows that activities emanating from universities must always be considered in the long term in order to determine effects on, for example, GDP/capita. The formation of new universities only becomes noticeable over a longer period of time.<sup>64</sup>

From the perspective of a region, universities are an essential factor for the performance of a location. On the one hand, as a “department store of valuable goods”<sup>65</sup> in the knowledge society, but on the other hand also as a kind of enterprise which influences the regional economic performance in a positive sense.<sup>66</sup>

With regard to universities, value creation means that the budget of a university is passed on into the region through different channels.<sup>67</sup>

According to the last relevant full data collection from 2017, the regional analysis of the provinces shows that R&D expenditures, measured by the main location, account for about 32% of all activities in Vienna. Styria and Upper Austria follow with around 19%, Tyrol with around 9%, Lower Austria with around 8%, Carinthia with around 6%, Salzburg with around 4%, Vorarlberg with around 3% and Burgenland with around 1%.<sup>68</sup>

In terms of performance, the publication activities, regional distribution of patent applications and the intensity of patents in the vicinity of the locations are relevant. In addition, the unemployment rate, income or GDP per capita in the region must also be taken into account.<sup>69</sup>

When comparing the federal states in the context of “research output”, illustrative differences can certainly be found. When measuring the basic research output, the value of publications in a region is the decisive factor. When comparing the period 2012–2017, it can be seen that the highest number of publications was in the field of medicine and health. The field of natural sciences comes in the second place. The life sciences are particularly active in Vienna, Styria and Tyrol. Materials sciences are strongly developed in the provinces of Styria, Tyrol, Upper Austria and Vienna. The patent and utility model applications of a region are important as a second indicator for measuring the performance of application-oriented research. The technical sciences are most strongly represented among the patent applications. In the second place, the field of material sciences follows. The amount of patents in the life science sector is low because these are often assigned to medicine and health. It can be assumed that the more an industrial sector is present in a federal state, the more patents result from this sector.<sup>70</sup>

With regard to spatial economic structures and their change as well as regional economic monitoring, an analysis of the economic structure, structural change and regional growth reveals the drivers of regional structural change and spatial competition. These are diversity, network effects and digitisation, which must be taken into account in analyses and the associated performance of countries. Neighbouring fields of competence, such as regulation, financing or human capital, allow the analysis of efficiency and

60 Cf. Musil/Eder (2013) p. 6 ff.

61 Cf. Trippel et al. (2007) p. 5 ff.

62 Cf. Mayerhofer/Palme (2001) p. 97 f.

<sup>36</sup> Cf. Huber/Mayerhofer (2006) p. 91

63 See also Österreichischer Forschungs- und Technologiebericht (2015).

64 Cf. Schubert/Kroll (2013) p. 23 ff.

65 See also Van der Wusten.

66 Cf. Musil/Eder (2013) p. 17.

67 See also Maier et al.

68 Cf. BMBWF Homepage und see also Globalschätzung Statistik Austria 2019.

69 Cf. Schubert/Kroll (2013) p. 49 ff.

70 Cf. Forschung in Österreich/BMBWF (2020).

effectiveness. In general, the long-term trend towards combining innovative activities in the sectors of science in the entrepreneurial sense can be observed here.<sup>71</sup>

WIFO studies in recent years have shown how employment and the supply of labour in the economic regions are developing. A tendency has become apparent: large cities, medium-sized towns, human capital-intensive and industrial regions have the highest levels of dependent employment. Labour supply is the highest in the metropolitan areas, human capital-intensive regions and large cities.<sup>72</sup>

The local labour market is influenced by effects on income and employment resulting from a significant expenditure on the purchasing power of students and university staff.<sup>73</sup>

It is important to develop a country-specific strategy in the field of research in order to give orientation to the actors in politics, science, administration and economy, to coordinate their actions within the framework of a regional research policy. Such a holistic research strategy focuses on the different areas and includes the institutions funded by the state which carry out research independently or in networks with companies.<sup>74</sup>

The Austrian Research Infrastructure Database also offers potential for optimising coordination between the federal and provincial governments. The platform is undergoing continuous development, with not only federal institutions but also those research institutions that are under the influence of the federal states contributing to their research infrastructure. Currently, 109 research institutions are listed there on a voluntary basis.<sup>75</sup>

In the field of digitisation, it is apparent that cities in a region have a high number of employees in areas such as sensor technology, data analysis and their fusion into powerful applications, leading national ICT research centres, which also increase international visibility.<sup>76</sup>

In 2017, Styria saw itself as the “most research-intensive region in Austria”. The R&D expenditures

amounted to over EUR 2 billion. At 5.12%, the R&D ratio exceeded the 5% mark for the first time.<sup>77</sup>

The “strong” result in obtaining “ERC Grants” (ERC – European Research Council) attests to the research landscape a certain degree of top-level research (“Austria is a rising star in research”).<sup>78</sup> With 232 grants, research has reached the ninth place within the EU in 2018 from a nationwide perspective.<sup>79</sup>

## 4 Conclusion

Strengthening and improving the framework conditions at the locations is crucial for competitiveness in the knowledge, research and innovation sectors. The guidelines apply to both the university and non-university sectors and to research in the economic enterprises of the regions. A certain trend towards privatisation in the allocation of public funding in the field of research can be seen in recent years. It was already undisputed by the public sector since 2015 that private R&D expenditure in particular should be increased. However, public measures may be necessary. This happens in the broadest sense in the area of business and contract research. The companies that use the most funding for the “best research” have a significant advantage over smaller companies. This creates a contradiction with “equal” research, which is also associated with the term “science”.

Differences between the federal states are still immense. The western regions still have a lot of catching up to do compared to the eastern provinces. Some federal states have in turn established their own research councils at the regional level. More uniformity with the federal government would be an advantage here. The benefit this would bring at the regional level remains to be seen critically, as there are already separate councils at the federal state level. Some federal states publish very comprehensive and detailed scientific reports at regular intervals. Others publish such reports rarely or hardly at all, and the differences in form, period and detail as well as information and figures are enormous. For this reason, it is relatively difficult to analyse performance. There should be more concrete nationwide guidelines, so that all federal states publish transparently in the same form and at the same intervals. Such reports

<sup>71</sup> See also WIFO Forschungsbereiche (2020).

<sup>72</sup> Cf. Huber (2016) p. 10.

<sup>73</sup> Cf. Musil/Eder (2013) p. 18 f.

<sup>74</sup> Cf. Forschungsstrategie Steiermark (2005) p. 3.

<sup>75</sup> See also Forschungsinfrastruktur-Datenbank (2020).

<sup>76</sup> Cf. Wissenschaftsbericht Steiermark (2017) p.

<sup>77</sup> Cf. Wissenschaftsbericht Steiermark (2017) p. 11

<sup>78</sup> See also Nature-Index (2018).

<sup>79</sup> Cf. Forschung in Österreich/BMBWF (2020).

could thus be more than mere publicity and provide a basis for a comprehensive performance analysis as well as fields of action and challenges.

Additional forms of financing and investments in “science and research” are needed to achieve further positive development of the R&D rate. This is important because it is an essential prerequisite for economic growth and new jobs.

Current challenges for future improvements within the framework of regional research policy include a further increase in R&D activities in order to stabilise the knowledge base of the economy and society, which is increasingly in demand. Regions should focus “intensively” on their respective research competencies and expand them. The strength of innovation in the R&D sector should be increased through dissemination in companies in order to revitalise the location. Greater visibility as a regional research location can be achieved by increasing the density of research infrastructures and by giving them a more concrete profile. Greater optimisation in coordination between the federal states and the federal government should be strategically promoted. In addition, cooperation between regional locations would have to be increased in order to achieve more effective independent research funding at the regional level. In the case of publications and patents, the “smaller” research areas still have some catching up to do.

The increased interest in the regional economic importance of universities is, on the one hand, an expression of a rethink in regional policy, but on the other hand also a result of the pressure to justify the use of public funds.

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