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What innovation policy mix does matter for which countries?

Patterns emerging from multidimensional analysis on STIP Compass platform

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What innovation policy mix does matter for which countries? Patterns emerging from multidimensional analyses on STIP Compass platform

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Abstract

An increasing consensus is shared among scholars on the relevance of policy mix in supporting innovation processes. An essential support for a comparative analysis of innovation policies is provided by STIP Compass. As a joint initiative of the European Commission and OECD, STIP Compass contains taxonomies of policies, databases, monitoring tools, and links between various data sources.

The paper addresses two research questions: the first one concerns the way to single out a pattern of innovation policy mix. The second one specifically focuses on the dimensions in the narratives adopted to describe the current policy issues. The paper refers to the STIP Compass database downloaded on 24th August 2019. Results can be browsed by using the navigation on Tableau Public.

Being aware that the potential of STIP Compass relies on the quality of information that is entered by the countries, this paper aims at enhancing the awareness of both scholars and policy makers involved in the innovation policy field by suggesting its use to outline patterns of policy mix across countries. Although the database is incomplete and currently under revision, the exercise undertaken in this paper outlines methods for text analysis that will be applied to the new updated edition of STIP Compass, when available.

One urgent message is drawn from the analysis undertaken in this paper: aiming at providing an effective analytical framework a tools for innovation policies in Europe, the European Commission cannot overlook that subnational policies need to be entered in STIP Compass, and this could be done in a straightforward way, by using information on regional innovation policies already available in the DG Regio.

Keywords: innovation policies; STIP Compass, multidimensional analysis, textual analysis, Taltac2; Gephi

JEL classification 03, 038, Z13

Aknowledgments

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1. A comparative framework for innovation policies

An essential support for innovation policies is the reference to an analytical framework to assess the impact of the various instruments in order to design more effective policies (Cunningham, Edler, Flanagan, & Larédo, 2013; Edler, Cunningham, Gök, & Shapira, 2016; Edler & Fagerberg, 2017; Guimón & Paunov, 2019). In such perspective, the comparative framework, across countries and different policy tools, provided by STIP Compass deserves special attention. It is a joint initiative of the European Commission and OECD. Officially launched on April 2018 in Brussels,STIP Compass is the portal that hosts and provides access to the EC/OECD international database on Science, Technology and Innovation Policy (STIP). Publicly available online[1], STIP Compass collects quantitative and qualitative data on countries' STI policies. Its history can be traced back 20 years to the start of biennial OECD surveys of countries' STI policies in support of the OECD STI Outlook. Today,STIP Compass aims at supporting the continuous monitoring and analysis of countries' STI policies and aims to become, a central platform for policy research and advice supporting government officials, analysts and scholars[2]. Data is freely accessible following the FAIR principles (Findable, Accessible, Interoperable, and Re-usable). At present, STIP Compass contains taxonomies of policies, databases, monitoring tools, and links between various sources data, and it is expected that both the OECD and the European Commission will refer to the Compass for information on policies in support of innovation.

As recently stated in the debate within the OECD-Working Party on Technology and Innovation Policy (TIP), STIP Compass will be essential in supporting the ongoing project on "Co-creation between science and industry and the role of intermediaries". In particular, building on the information available in STIP Compass, the OECD is elaborating a digital tool to analyse and compare innovation policies with regard to themes, policy instruments, target groups. A general goal is to examine the policy mix and the interactions between policies[3]. The toolkit aims to produce descriptive analyses by policy area, using semantic analysis and network analysis tools. It will be possible to create a catalogue that provides information on policies, produces a guided navigation on the various phases of design, implementation, evaluation, and significant statements on science and technology, grounded on STIP database and other database.

The need for substantial improvement of STIP Compass has produced a new version for the consultation of the information, published in Spring 2019. Referring to a common framework in comparing innovation policy instruments will be of utmost importance, but from a preliminary browsing of the data currently available inconsistencies still appear relevant.

Being aware that the potential of this tool relies on the quality of information that is entered by the countries, this note aims at enhancing the awareness of both scholars and policy makers involved in the innovation policy field by suggesting its use to outline patterns of policy mix across countries. The analysis aims at pointing out specific suggestions for improvements of STIP Compass and its use in policy analysis that emerge from an in-depth analysis about STIP Compass in general, and from the analysis of coded information on the classification of policy instruments, target groups and themes. Although the database is incomplete, the exercise undertaken in this paper outlines methods for text analysis that will be applied to the new updated edition of STIP Compass when available.

1 https://STIP.OECD.org/STIP.html

2 http://www.OECD.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/STP(2019)10&docLanguage=En

3 The policy mix analysis is at the core of the recent analyses undertaken at Oecd (Guimón and Paunov, 2019) and addressed in an evaluation perspective.

The remainder of the paper is structured as follows. Section 2 presents the research questions referring to the literature on policy mix. Building on the possibility of downloading and analysing the entire dataset, Section 3 presents STIP Compass database, download on 24th August 2019, and describes the methods adopted to implement a multidimensional analysis of coded information on policy instruments, target groups and theme areas that are available in the dataset, and on free texts providing the countries' overviews on their current debate issues. Section 4 presents the results on the innovation policy mix that characterize the various policy instruments targeting various groups of beneficiaries, in a variety of theme areas. The main patterns of mix policy initiatives associated to the territorial entities in the database are described. Results refer to both coded texts and free texts. Section 5 concludes by focusing on the implications emerging from the analysis, with suggestions for making STIP Compass more effective for the analysis of innovation policies at subnational and national level. Annex presents supplementary materials. A selection of tables and figures in the text and in Annex (marked with the symbol ❄) can be browsed by using the navigation on Tableau Public, available at https://www.poliinnovazione.unimore.it/supplementary159/.

2. Research questions

In their overview on public policies, Edler & Fagerberg (2017) focus on innovation policies, presenting the theoretical frames (the linear model of innovation, the national system of innovation and the evolutionary perspectives) and the practices in which they emerged. Embracing a wide set of policies (labelled also as industrial policy or technology policy), Edler & Fagerberg (2017) analyse policies as processes. Building on Edler, Cunningham, Gök, & Shapira (2016) they outline a taxonomy of the 15 policy instruments adopted to support innovation. Their relevance is referred to the overall orientation (supply, demand) and the goals of the policy (increase R&D, skills, access to expertise, improvement of the systemic capabilities, enhancement of innovation, improvement of framework, improvement of discourse). Using the taxonomy outlined by Cunningham et al. (2016), Edler e Fagerberg review the empirical analyses that focus on the various instruments and conclude that evidence on policy impacts at national level shows the adoption of a variety of policy instruments across countries. With regard to impact of the various policy instruments, they highlight the issue of interaction among instruments and conclude "that a holistic - or systemic - perspective in policy is important (Fagerberg 2016a), that sensitivity to context is essential (Flanagan and Uyarra, 2016), and that mechanical transfer of policy practice from one national system to another (without concern for contextual factors) is highly problematic" (p.14). Governance is another dimension that varies across countries, with an increasing involvement of specialized agencies, but also of multiple governmental bodies (as the various ministries that address the many challenges under their domains of action by supporting innovation), subnational administrative bodies and also an array of stakeholders. Co-ordination is scarce and potential impact of the policy initiatives is not fully exploited. A conclusion emerging from the survey outlined by Edler & Fagerberg (2017) is that innovation policy analysis is still in its infancy.

Other contributions have specifically addressed the analysis of policy mix, as a feature characterizing innovation policies in many countries. Cunningham, Edler, Flanagan, & Larédo (2013) analyse the characterizing dimensions of policy mix, building on previous studies on innovation (INNO-Policy Trendchart, Cunningham et al., 2008; Edler et al. 2010; and Edler and Georghiou; 2007) and on the availability of evidence. More recently, Guimón & Paunov (2019) have started a systematic analysis using also information collected in STIP Compass.

Although comparable evidence is not yet available, because of incompleteness of the present STIP Compass dataset, while waiting to access data that will be available in the new edition (available in 2020, as described in EC/OECD DSTI/STP(2019)17 unclassified, 2019), this paper address two main research questions that have not yet been addressed in the literature. The first one concerns the way to single out a pattern of policy mix that can be observed by analysing innovation policies. The second one specifically focuses on the dimensions in the narratives adopted to describe the current policy issues.

Both questions are addressed by using multidimensional text analysis. One method is the network analysis of co-occurrences among graphic forms (codes or lemmas), similarity matrices have been created and clustering of dimensions and topics have been identified by using the modularity class algorithm, implemented by Gephi. In this way, we aim at identifying the dimensions characterizing the policy mix, and their specific multidimensional interrelations. A second method implements a correspondence analysis on the graphic forms (codes or lemmas), detects the clusters of countries (by using a hierarchical clustering) and highlights the graphic forms characterizing each cluster. In this way, we aim at identifying which pattern of policy mix characterise which countries.

In order to implement such analyses, we have created two corpora. A first corpus is made of the codes entered to describe each of the policy initiatives in STIP Compass with regard to the type of the policy instrument, the target groups and the theme areas. The second corpus has been created by using the descriptions of the "current main issues of debate", presented in the overview section of STIP Compass with information by country.

3. Data and methods

Available data on innovation policy: STIP Compass

STIP Compass provides data on policy themes, policy instruments, responsible organisations, budget ranges, key trends, and policy target groups of 53 countries, according to the information gathered by the EC/OECD STIP Survey on the 36 OECD member countries, and the other 17 non-member countries (some of which are going to become members). Information about the policy initiatives are entered by each country: the national contact points are responsible for entering information on initiatives, updating data, monitoring the quality of the data already entered. Some categories of information – categorization of theme areas and narrative of overview of national policies - are entered by the Oecd staff. In what follows, the database is presented, with comments on the input data, when relevant[4].

The “Download Data” section contains data about 6,212 initiatives[5]. The following types of fields are in the database: *country* name; *id* (Policy Initiative ID, Policy Instrument ID); url (Public access URL, Evaluation URL); *Boolean information* ("Is evaluated ?"); *temporal information* (Start date, End date of the policy); quantitative information (Budget, Yearly budget range); *free text format* (English name, Original name(s), Acronym, Description, Background, Objective(s), Policy instrument name, Policy instrument description(s), Policy instrument note(s), Policy instrument mini-field(s)); *textual information in codes* (Responsible organisation(s), Theme area(s),

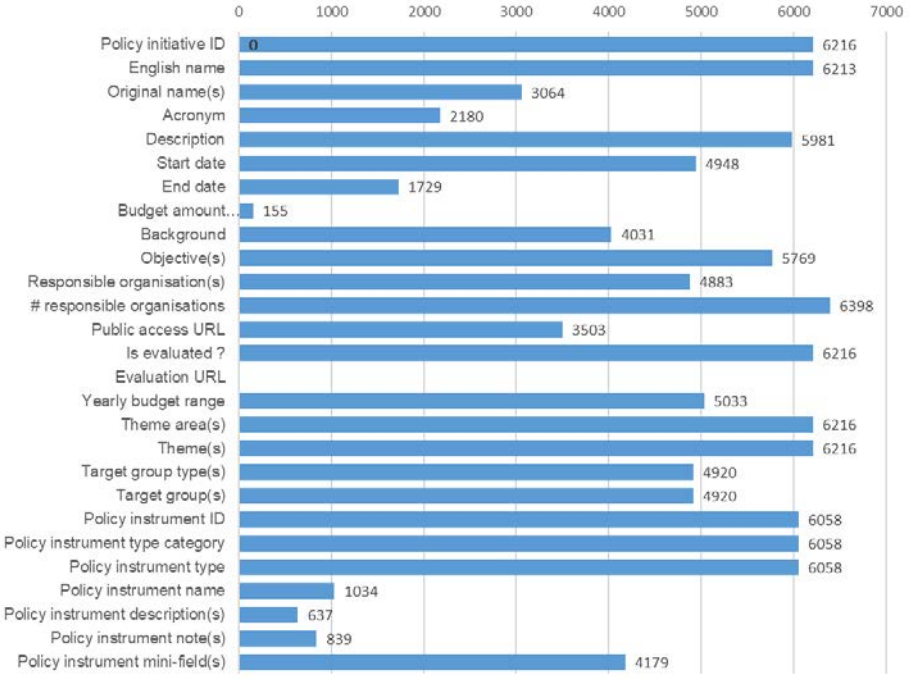
[4] A brief description of the users' view is presented in Annex 1. Information on current developments of the STIP Compass platform is discussed in OECD, 2019.

[5] Information retrieved by using the STIP Compass database, downloaded in CSV format, on 24/08/2019. According to the STIP Compass Query Builder, the policy initiatives are 5,352.

Theme(s), Target group type(s), Target group(s), Policy instrument type category, Policy instrument type). Themes are entered by the Oecd staff. In each field of the database with the codes, the various modalities separated by a "|".

From Figure 1, showing the information available in the database downloaded on 24/08/2019, it appears clearly that not all the fields have the same degree of completeness. In particular, one information is completely absent (Evaluation url), and one is largely missing (information on "Budget" is available only for 2.5% of the policy initiatives in the data base)[6].

Figure 1 - Information available in STIP Compass, by field



Source: authors' elaboration on STIP Compass [download 24.08.2019]

The database analysed in this paper is STIP Compass downloaded on 24th August 2019. It is made of 6,216 records describing information on policy instruments associated to 59 territorial entities.

A complementary database has been created by the authors downloading the information available as free texts in the field “Current main issues of debate” that reports the answers given by each country to questions on STIP Compass surveys about the main policy debates around a specific theme[7]. Each question provides a guidance to the answer, and only National contact points can answer the questions about policy debate. The survey’s interface is structured by eight domains: Governance, Public research system, Innovation in firms and innovative entrepreneurship, Public-private knowledge transfers and linkages, Human resources for research and innovation, Research and innovation for society, Digitalisation, ERA-related initiatives. Each field contains answers to the “current main issues of debate” of that domain.

Changes have been announced in EC/OECD DSTI/STP (2019) and will be made available in the new edition of STIP Compass in 2020.

6 A list of detailed comments and suggestions has been shared with STIP Compass developers

7 https://community.oecd.org/thread/25331

Methods

In order to detect patterns of policy mix that characterize the innovation policies, we analyse in which ways the several dimensions that characterize the policy initiatives are combined in the descriptions presented in STIP Compass web platform. Both coded information and free text are analysed.

Texts of coded information on policy instruments, theme areas and target groups are preliminary treated to create a matrix in which, for each policy initiative, all the modalities are displayed. The resulting matrix has 6,216 rows (the policy initiatives) and 134 columns (the country name; 8 Category_Theme, with 54 types; 8 Category_Target group, with 32 types; 5 Category_Policy Instrument, with 26 types).

The analysis of patterns of policy mix is preliminarily explored by using graph theory tools to implement a co-occurrence analysis. The goal of such analysis is to single out which are the dimensions structuring the innovation policy mixes implemented by the countries.

First of all, three matrices of co-occurrences of codes (respectively, the categories and types of policy instruments, of target groups and of theme areas) have been created to single out the multiple association of codes in each of the three domains and to weight the policy mix features characterising the policy interventions. In such analysis, the modularity algorithm is applied to the matrix of co-occurrences elaborated by using Taltac2. The analysis return the actual combinations enacted in the various countries, in this way it provides a more comprehensive taxonomy than the ones so far elaborated in the literature on policy mix (as in Edler & Fagerberg, 2017).

The algorithm of modularity class identifies sub-networks of codes within the corpus and outlines the patterns of innovation policy mixes. The semantic communities (generated by the modularity algorithm) represent the complete list of multiple interconnections occurring among categories and types (of policy instruments, of target groups and of theme areas) in the ambit of the same policy initiative.

The graphical representation of semantic communities is elaborated with Gephi (Bastian et al., 2009), using the Fruchterman-Reingold optimization algorithm for visualizing the graph and attributing a colour to each semantic sub-network, identified through the modularity class algorithm.

The multiple interconnections emerging in the semantic analysis provide a taxonomy to characterise innovation policy mix, but it does not reveal how it unfolds in the various countries nor which countries present a similar pattern in policy mix. Such multidimensional analysis is addressed by using a Correspondence Analysis to highlight the variability among countries. A cluster analysis implemented on the results of the Correspondence Analysis allows the identification of both the countries showing similar policy mixes and the codes of policy instruments, target groups and themes that characterize them.[8]

[8] The position of Codes on the factorial plan is a function of the association of their occurrences in the description of the policy intervention, thus expressing their similarity or diversity: two codes are close because they are present together in the records. Through a correspondence analysis (CA), the row and column elements of the matrix are mathematically formalized as vectors, and the above profiles are represented by points in a multidimensional space. The distances between the lexical profiles are measured using a weighted Euclidean metric (chi-square metric). The complex multidimensional space of the variables (codes, in our case) is then reduced to a few key factors that can represent, on dimensions named "factorial axes", the relationships between the elements of the data matrix. CA produces the best simultaneous representation of row profiles vs. column profiles in each factorial plan, and on each of its axes (Bolasco, 2012). By treating this matrix in the classic sequence of multidimensional statistical analysis (correspondence analysis and cluster analysis), it has been obtained a partition in K groups of policy countries, homogeneous within them and heterogeneous among them. The semantic field of expression of this homogeneity can be visualized by the proximity of the corresponding terms on the factorial plan (Bolasco & Pavone, 2010).

A complementary analysis has been performed on free text describing the current issues of debate. The corpus created with the free texts is composed of 33 documents, one for each of the countries that entered those pieces of information in STIP Compass. By using Taltac2 software, the text information is structured within a Document Warehouse, consisting of the Vocabulary DB (lexical units of analysis) and the Documents DB (textual units of analysis). After this preliminary step, the Corpus Description ends up being constituted by 4,763 different words for a total dimension of 39,010 occurrences. in order to avoid the fragmentation of the lexical units, the analysis is carried out on the lemmatized corpus. Furthermore, through the grammatical annotation of the graphical forms of the Vocabulary and the application of a lexical-textual model (Bolasco & Pavone, 2010), it was possible to identify multiword expressions (MWEs) through the search for syntactic structures (Pavone, 2010; 2018). 130 MWEs with at least 5 occurrences have been recognized and selected for the automatic text analysis.

Aiming at identifying the topics that characterized the various countries, all graphic forms (lemmas and MWEs) classified as nouns and adjectives - at the threshold of five occurrences - were selected as active units of lexical analysis. Accordingly, 743 lemmas and MWEs were selected and used to define the textual matrix Records × Active lexical units (33×743), to be processed through a factor analysis. Analogous to the clustering of codes, the results of correspondence analysis are treated in a cluster analysis to obtain a partition in J groups of policy countries.

Results emerging from clustering of countries according codes and free texts are compared.

4. Results

In what follows we focus on the results emerging from the analysis of codes of categories (and types) that refer to policy initiative, target groups and theme areas (section 3.1), and on the results of the analysis of free texts describing the current debate issue (3.2).

4.1 Categories and types of policy instruments, target groups and theme areas

Elaboration of information on these codes has been made possible by separating the multiple codes entered in each cell, structuring the corpus under analysis (Table 1).

Table 1 – Summary of the number of codes and their occurrences, by category and type

Field name in STIP db	Label	Number of codes	Total Occurrences in the DB
Policy instrument type category	Category_Policy Instrument	5	6058
Policy instrument type	Type_Policy Instrument	26	6058
Target group type (s)	Category_Target group	8	11400
Target group (s)	Type_Target group	32	18262
Theme area(s)	Category_Theme	8*	9152
Theme (s)	Type_Theme	54*	11551

* For each policy initiative, this information is entered in the database by the OECD staff
Source: authors' elaboration on STIP Compass [download 24.08.2019]

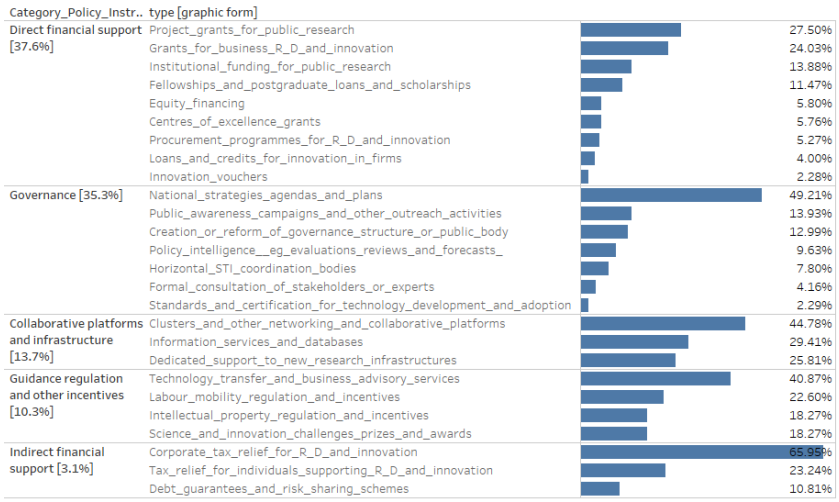
The average number of codes entered by policy initiative ranges from 3.3 to 15.4. Figure A2 lists countries in descending order of the number of policy initiatives (records) entered in the database (left panel); the central panel shows the total number of occurrences of codes, by territorial entity: the two sets are largely related.

Codes by category and type

The results on occurrences of categories and types of policy instruments, target groups and theme areas are presented, respectively, in Figures 2, 3 and 4. Information is listed in decreasing order of the category and types in the category.

With regard to policy instruments (Figure 2), the analysis of occurrences in the description of policy initiatives entered in STIP Compass returns that the most used policy instruments are "Direct financial support" (37,6% of occurrences), mainly implemented as "project grants for public research" (in 27.5%) and "grants for business R&D and innovation" (respectively 27.5& and 24.0% of the occurrences in that category). "National strategies agendas and plans" account for the most common level of "Governance". About 13.7% of policy initiatives are recorded as "Collaborative platforms and infrastructure", distributed in three main types: collaborative platforms information, "information services and databases" and "dedicated support to new research infrastructures" (respectively, 44.8%, 29.4% and 25.8% of the occurrences in that category). Guidance regulation and other incentives account for about 10.3% of the five categories of policy instruments, with a main share of interventions characterized as "Technology transfer and business advisory services" (about 41%), and other three types occurring in the database: "Labour mobility regulation and incentives", "Intellectual property regulation and incentives", "Science and innovation challenges prizes and awards" (respectively, 22.6%, 18.3% and 18.3% of the category). The least occurring category is "Indirect financial support" (about 3.1% of records) is mainly "Corporate tax relief for R&D and innovation".

Figure 2 - Policy instruments: categories and types



Source: authors' elaboration on STIP Compass [download 24.08.2019]

The most occurring category of target group of the innovation policy initiative (Figure 3) are "Researchers students and teachers" (26.8%), mainly established researchers, post-doctoral researchers and PhD students, but also undergraduate and master students, and teachers are specifically targeted. The second main target group innovation policies are the "Research and education institutions" (23.5%), with HEIs and Public research institutes having almost the same importance in terms of their occurrences as targets named in the policy initiatives. Firms by age and firms by size account for about a similar importance as target group (respectively, 11.3% and 10.9% of all occurrences coding the target groups), with firms of any age and firms of any size, SMES and micro firms as main targets. Target groups of similar importance (about 6-7% of occurrences of the target group categories) are: Intermediaries, Governmental entities, Individual beneficiaries and Social groups especially emphasizes (civil society is the most specifically targeted).

The classification of theme areas that has been implemented by the OECD staff can be analysed by category and by theme (Figure 3). "Innovation in firms and innovative entrepreneurship" (about 22.7%) is the main theme category; "Public research system" is the second most occurring category (19.4%), followed by "Public private knowledge transfers and linkages" (14.5%); "Governance", "Research and innovation for society" and "Human resources for research and innovation" occur about 10-12% each; "ERA related initiatives" (occurring less than 4%) and "Digitalisation" (less than 4%).

Policy initiatives by yearly budget range

The overall composition of policy initiatives has been presented in the previous three paragraphs by weighting each code category and type by the relative number of records, but a different structure would emerge when information is weighted on the budget of the innovation policy instruments or the target groups (Table A1). From Figure A1, which summarises the number of policy instruments by yearly budget range and by country, the missing data is large and it would affect any elaboration on this dimension of the analysis. Further investigation will be implemented in the new version of STIP Compass.

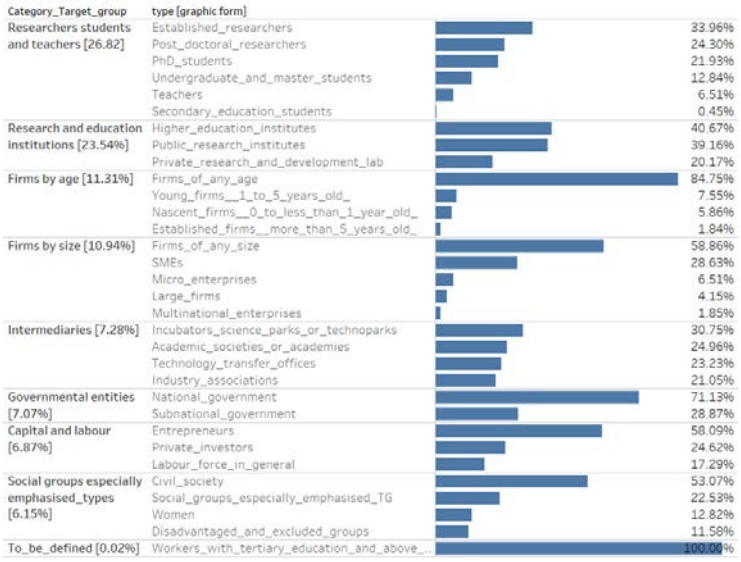
Policy mix emerging from co-occurring multiple coding of policy initiatives

Although it helps in assessing the relative importance of the individual categories and type (of policy instruments, target groups and themes), the results on the occurrences of individual categories and types do not shed light on the multiple categorization. In this perspective, we analyse the network of co-occurrences between categories in each of the three domains under analysis – i.e. policy instruments, target groups, themes - and the network of co-occurrences among the three domains.

With regard to the policy interventions domain, as expected, the five categories and the various types never co-occur in the same policy intervention (results are plotted in Graph A1), while target groups categories (Graph 1 left panel) largely overlap, and the same holds true for the types of targets within and among categories (Graph 2). With regard to theme areas (Graph 1, right panel, and Graph 3) the results highlight that the theme areas' categories "Governance", "Public research system" and "ERA related initiatives" largely co-occur together (they belong to the same modularity class), the same holds true also for the categories "Public private knowledge transfers and linkages" and "Innovation in firms and innovative entrepreneurship" and "Digitalisation", while the categories "Human resources for research and innovation" and "Research and innovation for society" occur independently.

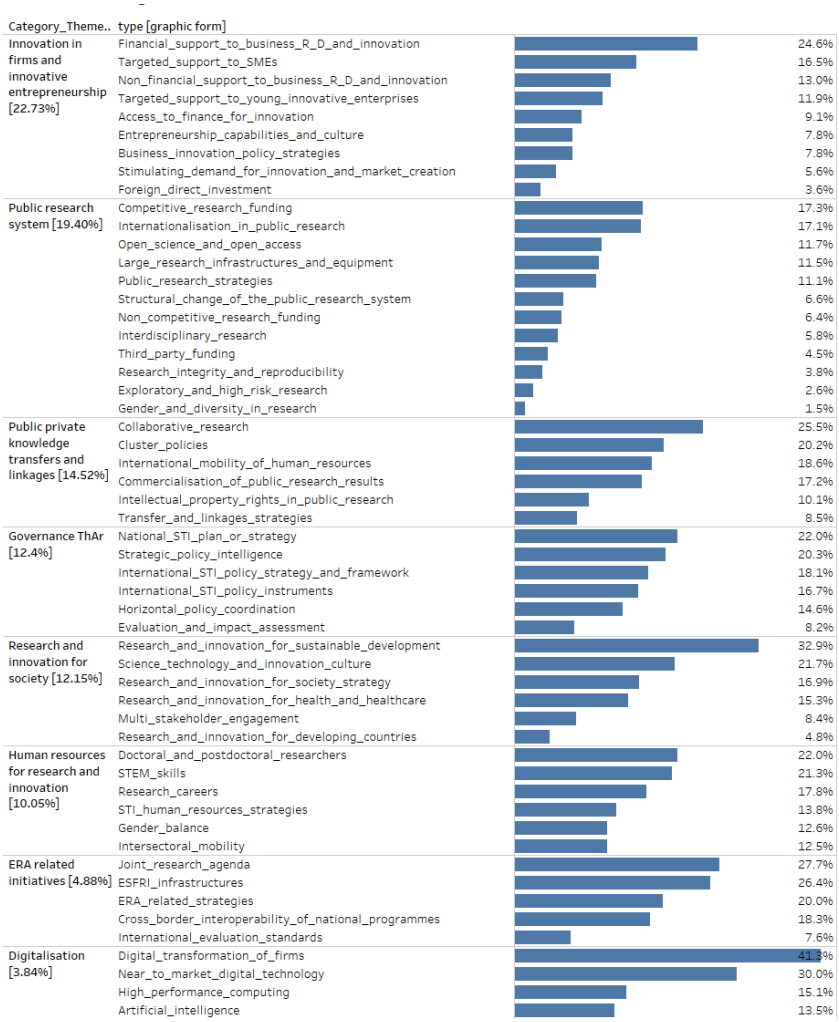
When the analysis will be implemented with STIP Compass updated dataset, the clusters of co-occurrences will be examined in detail. Here it deserves attention the result showing the overall mix emerging over the three dimensions under analysis (with regard to the categories and types in which they are categorised): policy intervention, target group, theme area (Graph 4). In such analysis we use Iramuteq and not the entire co-occurrence matrix generated by Taltac2. The features characterizing the various semantic communities are listed in Table A2.

Figure 3 – Target groups: categories and types



Source: authors' elaboration on STIP Compass [download 24.08.2019]

Figure 4 - Theme areas: categories and types

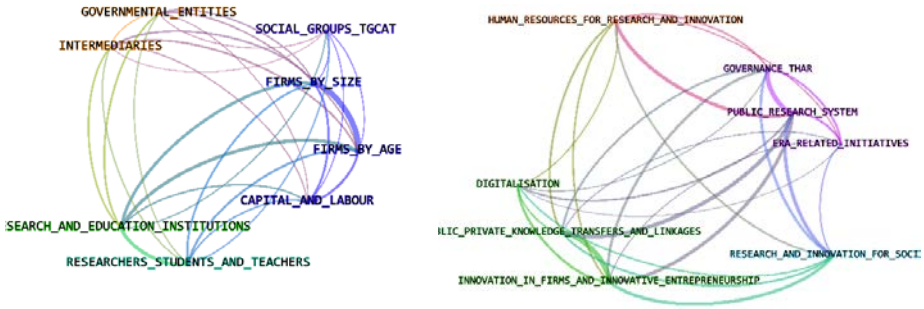


Source: authors' elaboration on STIP Compass [download 24.08.2019]

Graph 1 - Co-occurrences of categories of target groups (left panel) and categories of theme areas (right panel)

Elaboration of the co-occurrence matrix with Taltac2, modularity classes and graph elaborated with Gephi
Nodes' are colored according the modularity class; edge's width is proportional to the co-occurrences between nodes and edge's colour is a mixed colour between the two nodes.

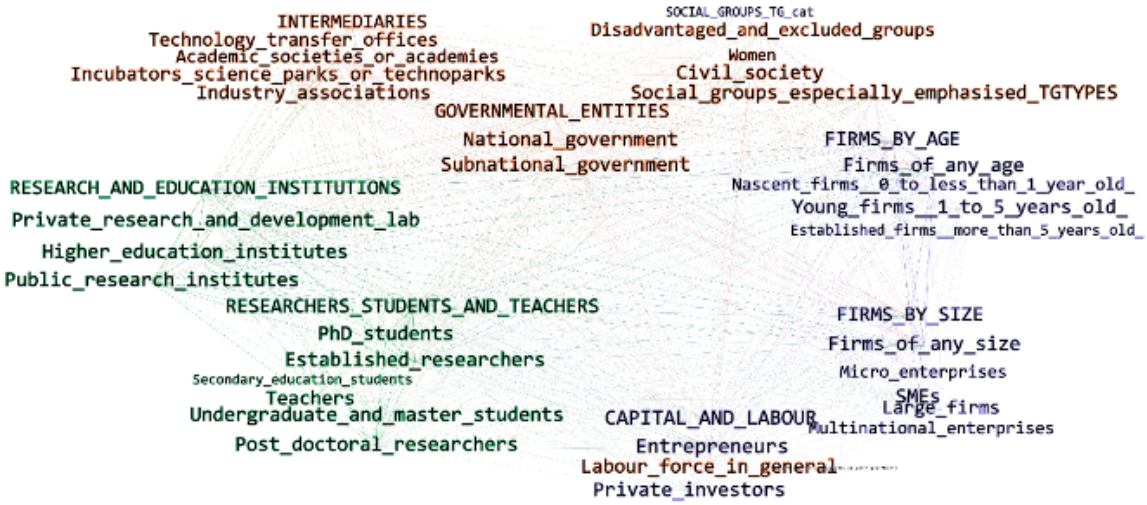
Target groups (3 modularity classes) **Theme areas** (4 modularity classes)



Source: authors' elaboration on STIP Compass [download 24.08.2019]

Graph 2 - Modularity classes of categories and types of target groups

Elaboration of the co-occurrence matrix with Taltac2, modularity classes (3) and graph elaborated with Gephi
Nodes' are colored according the modularity class; edge's width is proportional to the co-occurrences between nodes and edge's colour is a mixed colour between the two nodes.



Source: authors' elaboration on STIP Compass [download 24.08.2019]

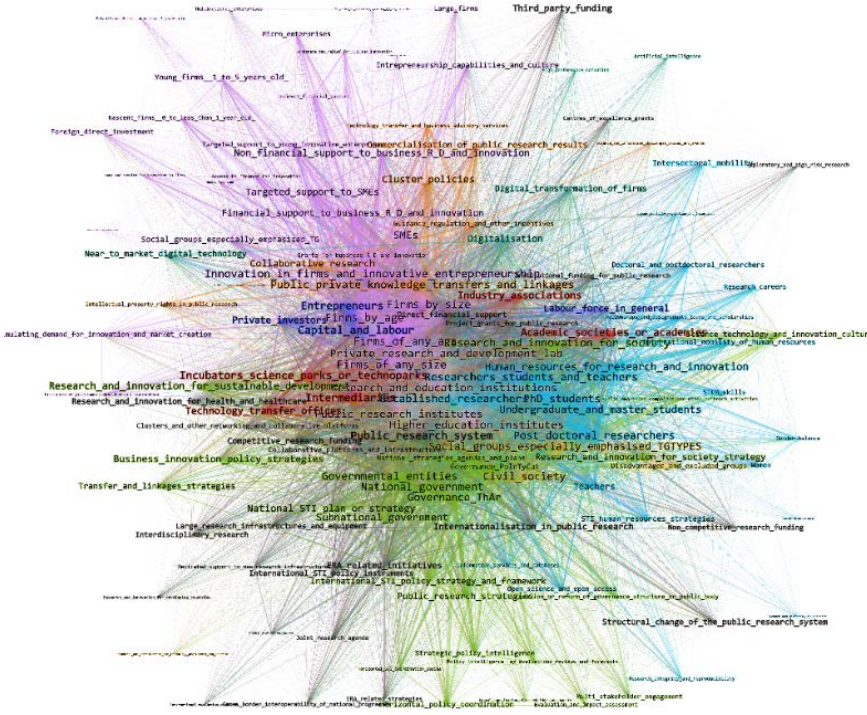
Graph 3 - Modularity classes of categories and types of theme areas

Elaboration of the co-occurrence matrix with Taltac2, modularity classes (4) and graph elaborated with Gephi
Nodes' are colored according the modularity class; edge's width is proportional to the co-occurrences between nodes and edge's colour is a mixed colour between the two nodes.

Source: authors' elaboration on STIP Compass [download 24.08.2019]

Graph 4 - Modularity classes over all the co-occurrences of codes

The co-occurrence matrix elaborated with Taltac2 has been processed with the modularity algorithm implemented by Gephy identifying 11 classes



Source: authors' elaboration on STIP Compass [download 24.08.2019]

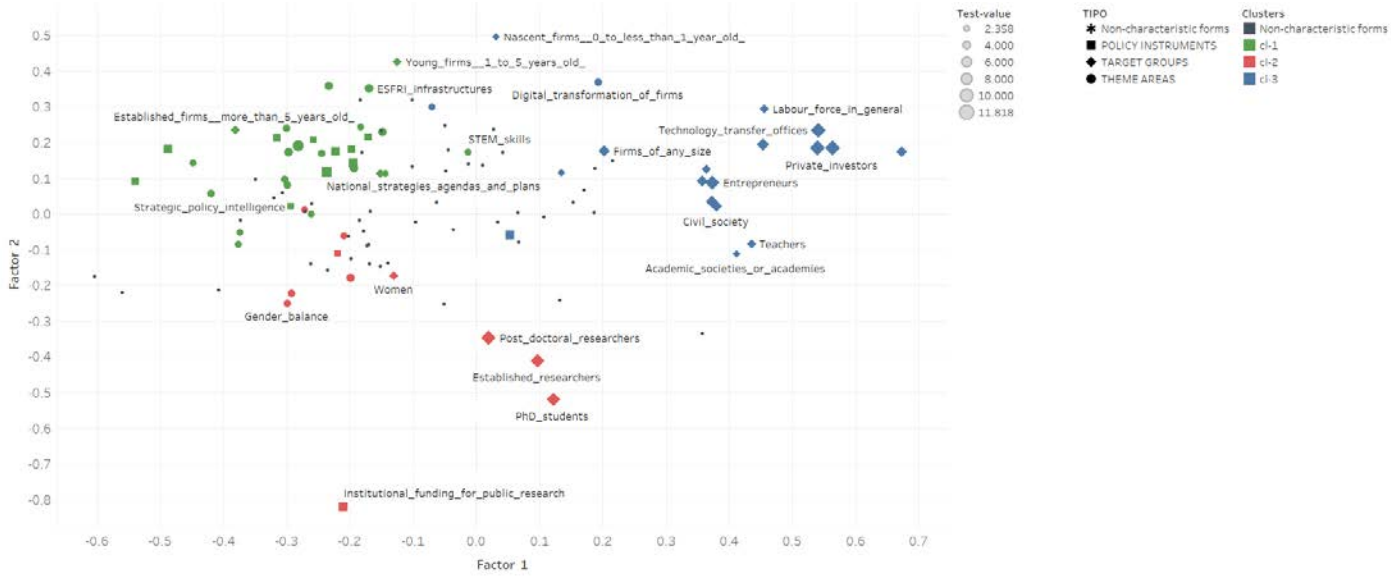
Policy mix emerging from cluster analysis on codes of policy initiatives

A way to address the analysis of multiple coding is through the correspondence analysis on the matrix Countries × Codes (56×112)[9]. Focusing on the visualisation of codes, Figure 5 presents the results of the first two factors, describing the larger variability among the classifications of the three domains. In such analysis, only the codes types are considered, and not also the categories which they belong to. The factorial plan *f1f2* represents all the 112 codes, with different symbols according to the domain of classification (square for policy interventions, diamond for target groups, circle for theme areas), and size proportional to their test-value[10]. Colours mark the different clusters that are identified with a hierarchical method[11] applied on the results of the first two factors resulting from the correspondence analysis. The codes that are not characteristic forms of the various clusters are included in the graph as black dots. The distribution of codes in the factorial plan shows a polarization on factor 1: from theme areas focusing on SMEs (young and innovative)[12] – on the left – to target groups of innovation Intermediaries (Incubators science parks or techno parks, Technology transfer offices, Industry associations), on the right. Factor 2 shows a polarisation, from bottom to top, between interventions targeting researchers (post-doctoral, PhD, established researchers, …) and those interventions targeting business companies (nascent, young firms).

Three main patterns emerge from the cluster analysis, characterising three perspectives on innovation policies that focus on interventions to support, respectively, SMES (cl-1), research institutions and researchers (cl-2), intermediaries, individual private investors and entrepreneurs (cl-3).

Figure 5 - Factorial plan *f1f2* - Distribution Codes - Matrix Countries × Codes (56 × 112)

dots are proportional to the test-value



Source: authors' elaboration on STIP Compass [download 24.08.2019]

[9] Three countries out of the 59 territorial entities entering information in the STIP Compass web platform (i.e. Indonesia, Kazakhstan and Malaysia) have been excluded by the analysis because if incompleteness of codes.

[10] Test-value is a statistical criterion associated with the comparison of two portions within the framework of a hypergeometric law approximated by a standardized normal law. The test-value = 2.1 corresponds to a bilateral test probability $\alpha/2$ of less than 2.5%.

[11] Ward method, Euclidean distance.

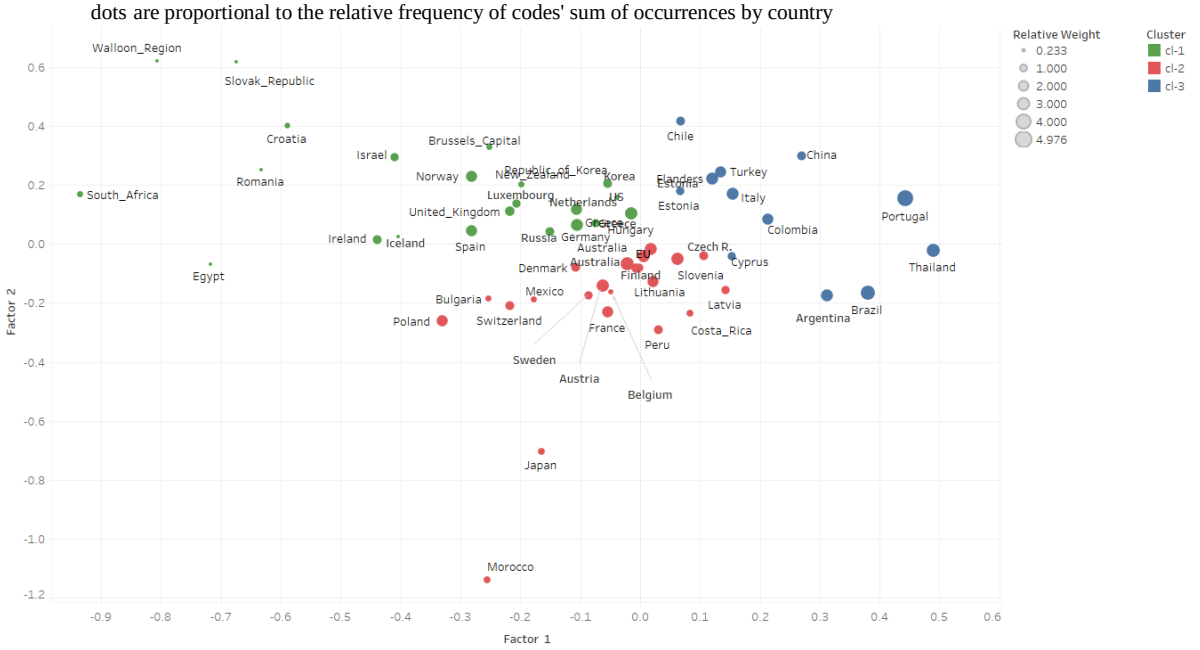
[12] Theme areas are "Targeted support to SMEs", "Young firms 1 to 5 years old", "Targeted support to young innovative enterprises"; target group category is "firms by age", and policy interventions refer to Governance with regard to "National strategies agendas and plans" and to "Collaborative platforms and infrastructure")

The matrix Countries × Codes, analysed in Figure 5, is presented in Figure 6 with the visualisation of the distribution of countries and other territorial entities (dots are proportional to the relative frequency of codes' sum of occurrences by country). The two complementary results allow to characterize the mix of policies instruments adopted by three groups of countries (Table 2), thus supporting a comparative analysis of countries that have a mix of policies relatively homogeneous. The three main clusters may be labelled according to their main characteristics, listed in Table 2 by decreasing ranking of Test-value.

Being aware that these results could change, due to new data being collected, the general picture emerging from the correspondence and cluster analysis is quite useful in orienting the future analysis on patterns of policy mix. In particular, a result emerging from the cluster analysis is that the only country presenting both national and subnational policies, Belgium, displays a variety of policy instruments, target groups and theme areas that characterize the territorial entities in three different clusters. This result strongly supports the need of integrating the database with information on the policies implemented at subnational level.

Figure 6 - Factorial plan *f1f2* - Distribution Countries - Matrix Countries × Codes (56 × 112)

dots are proportional to the relative frequency of codes' sum of occurrences by country



Source: authors' elaboration on STIP Compass [download 24.08.2019]

cl.codes_1 - Focus on: SMEs (young and innovative); support to R&D; research infrastructures.

Characteristic categories of codes of this cluster are **theme areas** (INNOVATION IN FIRMS AND INNOVATIVE ENTREPRENEURSHIP; ERA RELATED INITIATIVES; PUBLIC PRIVATE KNOWLEDGE TRANSFERS AND LINKAGES) and **policy categories** (GOVERNANCE POINTYCAT; COLLABORATIVE PLATFORMS AND INFRASTRUCTURE; DIRECT FINANCIAL SUPPORT) and **target groups**, specifically firms by age (both the ones with 1-5 years and those with more than 5 years old) and social groups especially emphasized.

This cluster encompasses 22 territorial entities: Belgium_Walloon, Belgium_Brussels, Croatia, Egypt, Germany, Greece, Hungary, Iceland, Ireland, Israel, Luxembourg, Netherlands, New Zealand, Norway, Republic of Korea, Romania, Russian Federation, Slovak Republic, South Africa, Spain, United Kingdom, United States

cl.codes_2 - Focus on: Researchers (individual and organisations).

The characteristic domains of this cluster are the **target groups** of RESEARCHERS STUDENTS AND TEACHERS, the policy domain of COLLABORATIVE PLATFORMS AND INFRASTRUCTURE and the **theme**

areas related to PUBLIC, PRIVATE, KNOWLEDGE, TRANSFERS, AND, LINKAGES and to ERA RELATED INITIATIVES, HUMAN RESOURCES FOR RESEARCH AND INNOVATION; PUBLIC RESEARCH SYSTEM; RESEARCH AND INNOVATION FOR SOCIETY.

The 22 territorial entities in this cluster are: Australia, Austria, Belgium, Bulgaria, Canada, Costa Rica, Czech Republic, Denmark, European Union, Finland, France, Japan, Latvia, Lithuania, Malta, Mexico, Morocco, Peru, Poland, Slovenia, Sweden, Switzerland

cl.codes_3- Focus on: Innovation intermediaries and investors.

This cluster is characterised by all the **target group** categories with a focus on INTERMEDIARIES, CAPITAL AND LABOUR, RESEARCH AND EDUCATION INSTITUTIONS, SOCIAL GROUPS ESPECIALLY EMPHASISED TGTYPES, GOVERNMENTAL ENTITIES, FIRMS BY SIZE. The 12 countries in this cluster are: Argentina, Brazil, Chile, China, Colombia, Cyprus, Estonia, Flanders, Italy, Portugal, Thailand, Turkey.

Table 2 – Clusters of countries and characterizing policy focus, with details on the type codes characteristic frequencies and their domain categories

Domain	Category	Characteristic frequencies	% of weight in the cluster	Test-value	Weight	territorial entities (in alphabetic order)
cl-1 main characteristic focus: SMEs (young and innovative); support to R&D; research infrastructures						
THEME	INNOVATION_IN_FIRMS_AND_INNOVATIVE_ENTREPRENEURSHIP	**Targeted_support_to_SMEs**	44.03	6.79	427	
POLICY	GOVERNANCE_POINTYCAT	National_strategies_agendas_and_plans	36.96	5.85	1020	
POLICY	COLLABORATIVE_PLATFORMS_AND_INFRASTRUCTURE	Clusters_and_other_networking_and_collaborative_platforms	41.14	5.13	367	
THEME	ERA_RELATED_INITIATIVES	**ESFRI_infrastructures**	46.31	4.52	149	
TARGET	FIRMS_BY_AGE	Young_firms__1_to_5_years_old_	44.87	4.26	156	
THEME	INNOVATION_IN_FIRMS_AND_INNOVATIVE_ENTREPRENEURSHIP	**Targeted_support_to_young_innovative_enterprises**	39.87	4.24	311	**Belgium_Walloon Region, Belgium_Brussels Capital, Croatia, Egypt, Germany, Greece, Hungary, Iceland, Ireland, Israel, Luxembourg, Netherlands, New Zealand, Norway, Republic of Korea, Romania, Russian Federation, Slovak Republic, South Africa, Spain, United Kingdom, United States**
THEME	INNOVATION_IN_FIRMS_AND_INNOVATIVE_ENTREPRENEURSHIP	**Financial_support_to_business_R_D_and_innovation**	36.29	4.24	642	
TARGET	SOCIAL_GROUPS_ESPECIALLY_EMPHASISED_TGTYPES	Social_groups_especially_emphasised_TG	41.11	4.23	253	
POLICY	COLLABORATIVE_PLATFORMS_AND_INFRASTRUCTURE	Dedicated_support_to_new_research_infrastructures	42.25	4.21	213	
THEME	PUBLIC_PRIVATE_KNOWLEDGE_TRANSFERS_AND_LINKAGES	Intellectual_property_rights_in_public_research	43.20	3.99	169	
TARGET	FIRMS_BY_AGE	Established_firms__more_than_5_years_old_	60.53	3.95	38	
THEME	PUBLIC_PRIVATE_KNOWLEDGE_TRANSFERS_AND_LINKAGES	Cluster_policies	38.53	3.85	327	
POLICY	DIRECT_FINANCIAL_SUPPORT	Centres_of_excellence_grants	44.53	3.76	128	
POLICY	GOVERNANCE_POINTYCAT	Creation_or_reform_of_governance_structure_or_public_body	39.18	3.69	268	
THEME	RESEARCH_AND_INNOVATION_FOR_SOCIETY	Science_technology_and_innovation_culture	38.18	3.52	296	
POLICY	GUIDANCE_REGULATION_AND_OTHER_INCENTIVES	Technology_transfer_and_business_advisory_services	38.80	3.44	250	
THEME	ERA_RELATED_INITIATIVES	Strategic_policy_intelligence	37.86	3.31	280	
POLICY	DIRECT_FINANCIAL_SUPPORT	Loans_and_credits_for_innovation_in_firms	45.05	3.25	91	
THEME	ERA_RELATED_INITIATIVES	Horizontal_policy_coordination	39.30	3.22	201	
THEME	RESEARCH_AND_INNOVATION_FOR_SOCIETY	Multi_stakeholder_engagement	42.74	3.19	117	
THEME	INNOVATION_IN_FIRMS_AND_INNOVATIVE_ENTREPRENEURSHIP	Stimulating_demand_for_innovation_and_market_creation	41.26	3.18	143	
POLICY	DIRECT_FINANCIAL_SUPPORT	Project_grants_for_public_research	34.29	3.11	624	
POLICY	DIRECT_FINANCIAL_SUPPORT	Grants_for_business_R_D_and_innovation	34.62	3.06	546	
THEME	PUBLIC_RESEARCH_SYSTEM	Competitive_research_funding	35.51	2.92	383	
THEME	HUMAN_RESOURCES_FOR_RESEARCH_AND_INNOVATION	Doctoral_and_postdoctoral_researchers	37.01	2.86	254	
THEME	PUBLIC_PRIVATE_KNOWLEDGE_TRANSFERS_AND_LINKAGES	Commercialisation_of_public_research_results	36.49	2.85	285	
THEME	PUBLIC_RESEARCH_SYSTEM	Large_research_infrastructures_and_equipment	36.76	2.77	253	
THEME	HUMAN_RESOURCES_FOR_RESEARCH_AND_INNOVATION	STEM_skills	36.89	2.76	244	
POLICY	GOVERNANCE_POINTYCAT	Public_awareness_campaigns_and_other_outreach_activities	35.99	2.69	289	
POLICY	GUIDANCE_REGULATION_AND_OTHER_INCENTIVES	Intellectual_property_regulation_and_incentives	40.71	2.68	113	
THEME	ERA_RELATED_INITIATIVES	Joint_research_agenda	38.46	2.59	156	
THEME	INNOVATION_IN_FIRMS_AND_INNOVATIVE_ENTREPRENEURSHIP	Foreign_direct_investment	41.11	2.45	90	
THEME	HUMAN_RESOURCES_FOR_RESEARCH_AND_INNOVATION	Intersectoral_mobility	38.03	2.36	142	
cl-2 main characteristic focus: Researchers (individual and organisations)						
TARGET	RESEARCHERS_STUDENTS_AND_TEACHERS	Post_doctoral_researchers	54.92	10.41	1189	**Australia, Austria, Belgium, Bulgaria, Canada, Costa Rica, Czech_Republic, Denmark, European Union, Finland, France, Japan, Latvia, Lithuania, Malta, Mexico, Morocco, Peru, Poland, Slovenia, Sweden, Switzerland**
TARGET	RESEARCHERS_STUDENTS_AND_TEACHERS	PhD_students	54.06	9.29	1071	
TARGET	RESEARCHERS_STUDENTS_AND_TEACHERS	Established_researchers	50.90	9.04	1660	
TARGET	RESEARCHERS_STUDENTS_AND_TEACHERS	Undergraduate_and_master_students	50.80	5.39	626	
POLICY	COLLABORATIVE_PLATFORMS_AND_INFRASTRUCTURE	Institutional_funding_for_public_research	53.85	4.84	312	
POLICY	DIRECT_FINANCIAL_SUPPORT	Project_grants_for_public_research	49.20	4.57	624	
TARGET	SOCIAL_GROUPS_ESPECIALLY_EMPHASISED_TGTYPES	Women	56.64	3.90	143	
THEME	PUBLIC_PRIVATE_KNOWLEDGE_TRANSFERS_AND_LINKAGES	International_mobility_of_human_resources	51.14	3.85	307	
THEME	ERA_RELATED_INITIATIVES	Joint_research_agenda	55.13	3.70	156	
THEME	ERA_RELATED_INITIATIVES	International_STI_policy_instruments	52.08	3.68	240	
THEME	HUMAN_RESOURCES_FOR_RESEARCH_AND_INNOVATION	Gender_balance	54.48	3.40	145	
THEME	PUBLIC_RESEARCH_SYSTEM	Public_research_strategies	49.19	2.83	248	
THEME	RESEARCH_AND_INNOVATION_FOR_SOCIETY	Research_and_innovation_for_health_and_healthcare	48.60	2.44	214	
POLICY	GOVERNANCE_POINTYCAT	Formal_consultation_of_stakeholders_or_experts	53.41	2.41	88	
cl-3 main characteristic focus: Innovation intermediaries and investors						
TARGET	INTERMEDIARIES	Incubators_science_parks_or_technoparks	59.71	11.82	407	
TARGET	INTERMEDIARIES	Technology_transfer_offices	62.87	11.36	307	
TARGET	CAPITAL_AND_LABOUR	Private_investors	61.56	10.90	307	
TARGET	CAPITAL_AND_LABOUR	Entrepreneurs	49.38	10.21	727	
TARGET	RESEARCH_AND_EDUCATION_INSTITUTIONS	Private_research_and_development_lab	43.30	7.48	866	
TARGET	INTERMEDIARIES	Industry_associations	52.86	7.44	280	
TARGET	SOCIAL_GROUPS_ESPECIALLY_EMPHASISED_TGTYPES	Civil_society	44.95	6.99	594	
TARGET	GOVERNMENTAL_ENTITIES	Subnational_government	47.31	6.43	372	**Argentina, Brazil, Chile, China, Colombia, Cyprus, Estonia, Flanders, Italy, Portugal, Thailand, Turkey**
TARGET	FIRMS_BY_SIZE	Firms_of_any_size	39.95	6.35	1174	
TARGET	SOCIAL_GROUPS_ESPECIALLY_EMPHASISED_TGTYPES	Disadvantaged_and_excluded_groups	56.59	5.85	129	
TARGET	CAPITAL_AND_LABOUR	Labour_force_in_general	46.30	4.56	216	
POLICY	DIRECT_FINANCIAL_SUPPORT	Procurement_programmes_for_R_D_and_innovation	51.28	4.41	117	
TARGET	FIRMS_BY_SIZE	Micro_enterprises	50.00	4.36	130	
TARGET	RESEARCHERS_STUDENTS_AND_TEACHERS	Teachers	41.77	3.89	316	
TARGET	RESEARCHERS_STUDENTS_AND_TEACHERS	Undergraduate_and_master_students	38.50	3.82	626	
TARGET	INTERMEDIARIES	Academic_societies_or_academies	41.09	3.72	331	
TARGET	FIRMS_BY_AGE	Firms_of_any_age	35.14	3.51	1750	
THEME	DIGITALISATION	Digital_transformation_of_firms	43.72	3.47	183	
TARGET	FIRMS_BY_AGE	Nascent_firms__0_to_less_than_1_year_old_	45.45	3.18	121	
THEME	INNOVATION_IN_FIRMS_AND_INNOVATIVE_ENTREPRENEURSHIP	Entrepreneurship_capabilities_and_culture	40.39	2.68	203	

Source: authors' elaboration on STIP Compass [download 24.08.2019]

4.2 Current policy debated issues

With regard to the second research question on the dimensions in the narratives adopted to describe the current policy issues, the results of the correspondence analysis and the cluster analysis of the corpus of free texts refer only to 33 out of 59 territorial entities, for which the overview is available. The results of the correspondence analysis, on the textual matrix Records × Active lexical units (33×743), are displayed in Figures 7 and 8, showing the first two factors of the distribution of the lexicon and of the countries, respectively. The hierarchical algorithm applied on the first 10 factors returns four clusters characterized by the following main topics and groups of countries.

The list of characteristic forms in each theme area of policy debate issue (see Table 3) summarizes the topics in each area. Topics are listed in increasing order of p-value. The results return the overall lexicon adopted in the 33 overviews and the lexicon associated to the eight theme areas of the current policy debate is coherent with what we expect for each of the theme areas: Governance, Public research system, Innovation in firms and innovative entrepreneurship, Public-private knowledge transfers and linkages, Human resources for research and innovation, Research and innovation for society, Digitalisation, ERA-related initiatives.

Table 3 – Specificities of topics by theme area in the current policy debate

Terms are listed in increasing order of p-value

Governance		Public research system		Innovation in firms and innovative entrepreneurship		Public-private knowledge transfers and linkages		Human resources for research and innovation		Research and innovation for society		Digitalisation		ERA-related initiatives	
graphic form	p-value	graphic form	p-value	graphic form	p-value	graphic form	p-value	graphic form	p-value	graphic form	p-value	graphic form	p-value	graphic form	p-value
governance	6.70E-12	research system	1.54E-04	business innovatio	2.35E-12	knowledge transfe	0	researchers	1.46E-11	societal	9.30E-21	digital	0	framework progran	7.54E-10
science	1.67E-05	report	2.86E-04	firms	4.76E-08	linkages	3.10E-11	talent	4.44E-10	cohesion	1.61E-19	online	2.13E-09	priorities	2.88E-08
policy	7.59E-05	research	4.26E-04	capital	1.66E-07	universities	7.67E-11	doctoral	4.60E-10	social	2.92E-10	information	1.73E-08	national	3.83E-06
technology	2.86E-04	funding	5.21E-04	innovation	1.93E-07	industry	1.11E-08	students	1.10E-08	life	1.58E-06	digital transformati	4.03E-08	policies	1.19E-05
involved	3.62E-04	evaluation	5.82E-04	business	2.72E-07	clusters	8.32E-07	staff	1.36E-07	societal challenges	5.43E-06	data	1.94E-06	joint	4.05E-05
ministries	4.32E-04	financing	6.89E-04	small	4.05E-07	academia	1.11E-05	engineering	2.47E-07	solutions	4.15E-05	services	1.94E-06	future	4.10E-04
reform	6.20E-04	international	2.30E-03	tax	5.33E-07	knowledge	1.63E-05	career	2.47E-07	challenges	4.67E-05	digital skills	9.89E-06	objectives	6.77E-04
recommendations	6.20E-04	R&D	6.49E-03	support	1.25E-05	commercialisation	1.71E-05	skills	4.72E-07	health	3.33E-04	citizens	7.38E-04	partnerships	1.90E-03
strategic	2.95E-03	share	9.15E-03	companies	2.02E-05	research organisat	2.57E-05	graduates	8.70E-07	innovation policy	5.63E-04	economy	9.38E-04	landscape	2.40E-03
results	7.08E-03	budget	9.25E-03	innovative	2.58E-05	commercial	4.46E-05	human resources	1.91E-06	citizens	7.42E-04	infrastructure	9.70E-04	partnership	5.65E-03
government	7.21E-03	priority areas	9.25E-03	enterprises	8.99E-05	private	7.80E-05	number	4.88E-06	culture	1.08E-03	society	1.22E-03	actions	8.91E-03
public research	1.10E-02	public funding	1.08E-02	instruments	1.82E-04	collaboration	1.22E-04	employment	5.73E-06	population	1.73E-03	applications	3.80E-03	reforms	1.16E-02
system	1.96E-02	higher education	1.08E-02	growth	2.55E-04	research institutior	1.89E-04	careers	6.23E-06	innovation	1.77E-03	government	4.78E-03	research centres	1.68E-02
federal	2.22E-02	calls	1.26E-02	economic	3.33E-04	centres	4.64E-04	education	1.81E-05	society	1.84E-03	security	5.53E-03	play	1.68E-02
		impact	1.39E-02	market	7.71E-04	research results	1.43E-03	scientists	2.82E-05	working	1.89E-03	creating	7.39E-03	active	1.68E-02
		competitive	1.54E-02	environment	8.23E-04	organisations	2.34E-03	scientific	1.08E-04	focusing	1.89E-03	systems	9.04E-03	implementing	1.96E-02
		applied research	1.73E-02	businesses	8.77E-04	creation	2.34E-03	women	3.35E-04	stakeholders	2.70E-03	efforts	1.07E-02	international	2.44E-02
		excellence	1.73E-02	markets	9.44E-04	transfer	2.61E-03	technology	2.61E-03	change	5.42E-03	technology	1.34E-02		
		aim	1.75E-02	R&D	1.99E-03	technology transfe	4.34E-03	young	3.91E-03	focus	1.11E-02	platform	2.01E-02		
		public	2.01E-02	technologies	2.53E-03	research institutes	4.34E-03	skilled	3.91E-03	global	1.11E-02				
		context	2.19E-02	incentives	3.69E-03	new	1.04E-02	meet	3.91E-03	initiative	1.44E-02				
				financial	3.74E-03	public	1.70E-02	mobility	5.07E-03	sustainable	0.0144767				
				economy	5.34E-03	support	1.86E-02	success	6.44E-03	issues	2.14E-02				
				guidelines	7.32E-03	firms	2.44E-02	increasing	8.55E-03						
				sector	7.96E-03			continue	1.19E-02						
				entrepreneurship	8.13E-03			debate	1.25E-02						
				supporting	9.99E-03			actions	1.27E-02						
				foreign	0.0118615			qualified	1.46E-02						
				hand	1.80E-02			demand	1.46E-02						
				sectors	2.17E-02			labour	0.0204108						

Source: authors' elaboration on STIP Compass [download 24.08.2019]

In identifying the characteristic lemmas of each of the four clusters we do not refer to any specific theme-area category, as we were able to do in Section 4.1 with regard to the categories of the types of codes of policy initiatives, target groups and theme areas that characterize those clusters. In fact, with regard to the corpus of free texts describing the issues in the current policy debate, only in few cases the theme area results to be a characterizing element in a cluster. This can be explained by the fact that lemmas might be used over several categories, becoming significant for a cluster but without any specific category to be associated. The four clusters are summarized below (detailed information in Figures 7 and 8 and in table 4), highlighting the specific topics that characterize the four groups of countries.

cl.freetext_1 Focus on: research organisations, digital agenda, ecosystems, market

This cluster encompasses eight territorial entities: Switzerland, Austria, Czech Republic, Luxembourg, Denmark, Finland, New Zealand, Belgium-Federal government. The main topics refer to *actors, federal, research organisations, private sector, federal research institutes, digital agenda, priorities, public research institutes, corporate, ecosystems, market, funding*

cl.freetext_2: Focus on research centres, policy mix, skilled personnel

In this cluster there are only three territorial entities (Greece, Walloon Region, Republic of Korea) and the issue of policy debate is around *research centres, policy mix, brain drain, skilled, consultation, support, research results, personnel*.

cl.freetext_3: Focus on R&D, societal challenges, entrepreneurship and financial support

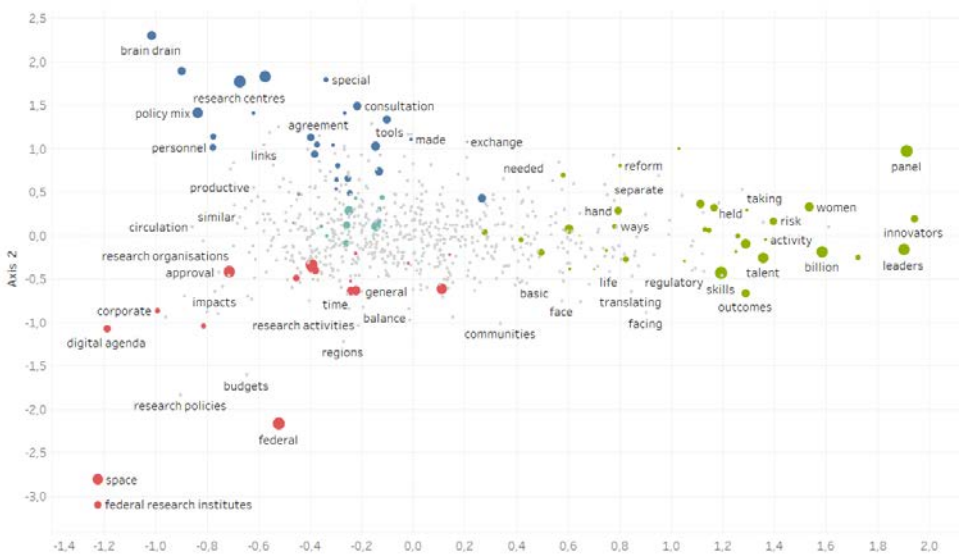
This cluster encompasses the largest group of 18 territorial entities: Italy, Estonia, France, Slovenia, Germany, Lithuania, Latvia, Chile, Flanders, Ireland, Iceland, Spain, Israel, Portugal, Sweden, Netherlands, Hungary, Brussels Capital. The focus here is around *R&D, priority, societal challenges, entrepreneurship, financial, supporting, framework, cohesion*

cl.freetext_4 focus on: skills, women, university, growth and cooperation

Another small cluster, with four territorial entities (United Kingdom, Canada, Australia, Poland) focusing on *skills, leaders, talent, capital, women, businesses, outcomes, university, risk, innovators, recommendations, jobs, innovation, workforce, world, targeted, digital skills, diversity, reform, benefits, economic growth, cooperation, committed, activity*

Figure 7 - Factorial plan *f1f2* - Distribution of the Lexicon - Matrix Countries × Lexical units (33×743)

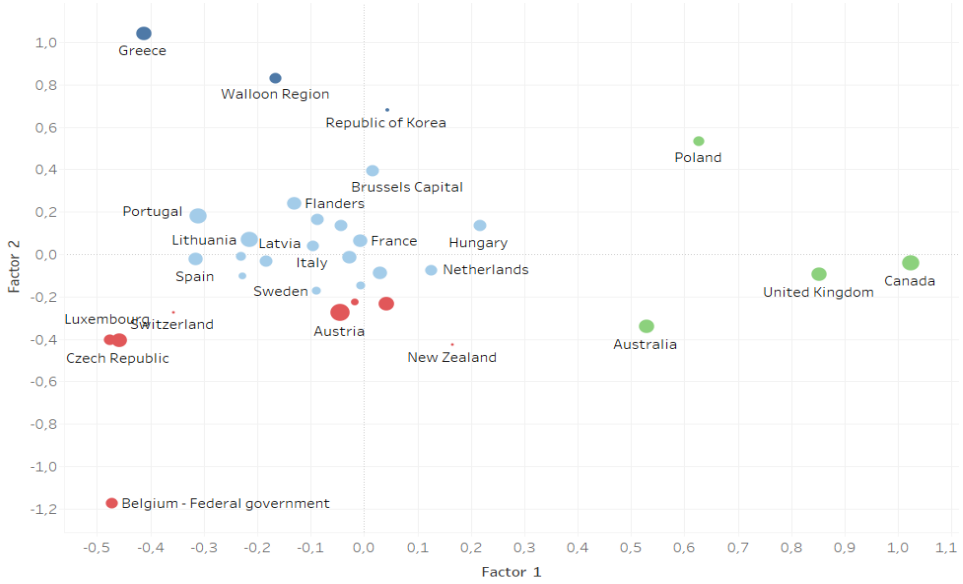
dots are proportional test-value



Source: authors' elaboration on STIP Compass [download 24.08.2019]

Figure 8 - Factorial plan *f1f2* - Distribution Countries - Matrix Countries × Lexical Units (33×743)

dots are proportional to the relative frequency of codes' sum of occurrences by country



Source: authors' elaboration on STIP Compass [download 24.08.2019]

Table 4 – Cluster of specificities topics in the current policy debate and territorial entities (case identifiers), by cluster

Terms are listed in increasing order of p-value. Characteristic frequencies in bold are the terms mentioned in Section 4.3
Countries are listed according their distance to the cluster' s center

Characteristic frequencies				Clusters representatives		
	% of weight in the cluster	Test-value	Weight	Rank	Distance to cluster's center	Territorial entities (case identifier)
cl.texts_1						
actors	65.52	4.75	29			
federal	81.25	4.73	16	1	0.04167	**Switzerland**
research organisations	76.47	4.47	17	2	0.04781	**Austria**
cuts	100.00	4.01	7	3	0.06198	**Czech Republic**
space	100.00	4.01	7	4	0.07041	**Luxembourg**
activities	50.00	3.63	40	5	0.07241	**Denmark**
current	48.78	3.52	41	6	0.09676	**Finland**
private sector	61.11	3.28	18	7	0.14176	**New Zealand**
federal research institutes	100.00	3.24	5	8	0.64456	**Belgium - Federal gov.t**
digital agenda	100.00	3.24	5			
priorities	44.19	2.98	43			
public research institutes	75.00	2.81	8			
corporate	83.33	2.76	6			
question	63.64	2.63	11			
political	66.67	2.51	9			
ecosystems	66.67	2.51	9			
market	50.00	2.47	20			
funding	33.04	2.43	112			
terms	71.43	2.40	7			
cl.texts_2						
research centres	63.64	4.65	11	1	0.02281	**Greece**
entire	66.67	4.36	9	2	0.03033	**Belgium_Walloon Region**
policy mix	71.43	4.05	7	3	0.18537	**Republic of Korea**
brain drain	80.00	3.72	5			
tools	46.15	3.70	13			
efforts	35.00	3.51	20			
skilled	50.00	3.47	10			
consultation	50.00	3.47	10			
institution	66.67	3.45	6			
support	16.22	3.33	111			
research results	35.29	3.24	17			
contact points	57.14	3.23	7			
industrial	33.33	3.14	18			
personnel	50.00	3.05	8			
cl.texts_3						
R&D	74.47	3.77	94	1	0.00092	**Italy**
priority	94.74	3.54	19	2	0.00731	**Estonia**
societal	84.38	3.30	32	3	0.00829	**France**
societal challenges	85.19	3.09	27	4	0.00875	**Slovenia**
entrepreneurship	92.86	2.75	14	5	0.01198	**Germany**
calls	92.86	2.75	14	6	0.01351	**Lithuania**
projects	76.92	2.65	39	7	0.01741	**Latvia**
gov	100.00	2.60	9	8	0.02416	**Chile**
plan	100.00	2.60	9	9	0.02959	**Belgium_Flanders**
financial	85.00	2.57	20	10	0.04148	**Ireland**
supporting	73.08	2.51	52	11	0.04628	**Iceland**
framework	79.31	2.51	29	12	0.05572	**Spain**
cohesion	84.21	2.41	19	13	0.05589	**Israel**
dedicated	91.67	2.39	12	14	0.05719	**Portugal**
				15	0.05865	**Sweden**
				16	0.07198	**Netherlands**
				17	0.10381	**Hungary**
				18	0.11898	**Belgium_Brussels Capital**
cl.texts_4						
skills	65.00	4.82	20			
panel	100.00	4.61	7	1	0.00560	**United Kingdom**
billion	66.67	4.25	15	2	0.05317	**Canada**

leaders	80.00	4.25	10	3	0.15490	**Australia**
talent	57.14	4.21	21	4	0.36623	**Poland**
capital	58.82	3.89	17			
women	61.54	3.55	13			
businesses	39.02	3.53	41			
outcomes	75.00	3.45	8			
university	75.00	3.45	8			
risk	83.33	3.32	6			
innovators	83.33	3.32	6			
recommendations	58.33	3.16	12			
hand	58.33	3.16	12			
key	34.00	3.13	50			
jobs	53.85	2.97	13			
innovation	22.73	2.96	242			
workforce	80.00	2.81	5			
world	50.00	2.80	14			
targeted	50.00	2.80	14			
ways	54.55	2.74	11			
digital skills	54.55	2.74	11			
diversity	62.50	2.73	8			
reform	50.00	2.56	12			
benefits	55.56	2.49	9			
taking	55.56	2.49	9			
economic growth	66.67	2.48	6			
cooperation	66.67	2.48	6			
committed	66.67	2.48	6			
activity	66.67	2.48	6			

Source: authors' elaboration on STIP Compass [download 24.08.2019]

4.3 Clustering of countries' policy mix

The cross tabulation of the results obtained by the two cluster analyses, described in Section 4.1 and 4.2, is presented in Table 5. It highlights differences in the overall perspective on policy initiatives as they emerge from the description of the current debate issues vs. the overall information available on the entire set of policies implemented by the countries over the years.

The narratives proposed by the countries in their focus on policy debate issues provide an additional layer of information on their policy mix. Being aware that the present information available in the data set is incomplete and that the cross tabulation refers only to the subset of territorial entities for which the overview is available, this way of displaying the results provides a tool to disentangle the features characterizing the different mix of policies among countries. In the new round of elaboration of the updated dataset, comments on this representation of the results will orient the explorations of the specific sets of policy instruments that have actually enacted (and are summarized in each cell of the cross tabulation).

Table 5 – Cross tabulation of 33 territorial entities by cluster of free texts and clusters of codes

clusters of free texts	clusters of codes cl.codes_ 1 SMEs (young and innovative); support to R&D; research infrastructures	cl.codes_2 Researchers (individual and organisations)	cl.codes_3 Innovation intermediaries and investors
cl.freetext_1 research organisations, digital agenda, ecosystems, market	Luxembourg New Zealand	Austria Belgium - Federal government Czech Republic Denmark Finland Switzerland	
cl.freetext_2 research centres, policy mix, skilled personnel	Belgium_Walloon_Region Greece Republic of Korea		
cl.freetext_3 R&D, societal challenges, entrepreneurship and financial support	Belgium_Brussels_Capit.. Germany Hungary Iceland Ireland Israel Netherlands Spain	France Latvia Lithuania Slovenia Sweden	Belgium_Flanders Chile Estonia Italy Portugal
cl.freetext_4 skills, women, university, growth and cooperation	United Kingdom	Australia Canada Poland	

Source: authors' elaboration on STIP Compass [download 24.08.2019]

5. Discussion and further developments

An increasing consensus is shared among scholars on the relevance of policy mix in supporting innovation processes (Cunningham, Edler, Flanagan, & Larédo, 2013; Edler & Fagerberg, 2017; Guimón & Paunov, 2019): a variety of tailored policy instruments are needed to target the diverse goals and beneficiaries of the public intervention, which are supported by different governance. Their implementation might be straightforward (as in the case of tax incentives) or very complex (when holistic changes are addressed to enhance ecosystems creation). The impact of individual instruments and of their combined mix is difficult to assess because of many interactions occurring in their enactment. Case studies have highlighted that those interactions not always produce a reinforced effect and policy management may become a critical issue *per se* (Mazzucato & Semieniuk, 2017). When addressed through counterfactual analysis, significant hints highlight the potential of a more informed design of the policy (Caloffi et al., 2018), so far largely determined by path dependence of interventions in the various countries. In general, the comparative analysis is challenged by the need of information. To fill this gap, an essential support for innovation policies is the reference to a comparative framework, across countries and different policy tools, provided by STIP Compass.

As a joint initiative of the European Commission and OECD, STIP Compass is the portal that hosts and provides access to the EC/OECD international database on Science, Technology and Innovation Policy (STIP). Publicly available online, STIP Compass collects quantitative and qualitative data on countries' STI policies freely accessible following the FAIR principles (Findable, Accessible, Interoperable, and Re-usable). At present, STIP Compass contains taxonomies of policies, databases, monitoring tools, and links between various sources data, and it is expected that both the OECD and the European Commission will refer to the Compass for information on policies in support of innovation.

The paper is the first systematic analysis aiming at identifying patterns of mix of innovation policies implemented by the 59 territorial entities (the OECD member countries, three subnational entities and some other non-OECD member countries) that have so far entered information in the online database. By using a multidimensional analysis, three main patterns emerge, characterised by a mix of policy instruments, target groups and theme areas. The results pave the way to a more in depth comparative analysis of the specific policy initiatives undertaken by countries showing a similar pattern of interventions.

With the implementation of STIP Compass, OECD and the European Union have started a new generation of tools to analyse innovation policies: it makes available a wide set of information allowing individual countries to learn from the innovation policies implemented in the OECD countries (and beyond): data aggregated by domain of intervention and target groups can be easily compared by using the online tools, by setting the query in the dashboard: average data and information on the policies can be easily browsed. Referring to a common framework in comparing innovation policy instruments will be of utmost importance for policy analysis.

Even though some polishing of the platform is needed to enhance consistency of information with regard to the visualisation of information, by country and topic, and with regard to the criteria adopted in labelling the themes of policy initiative in the database, the web platform is a very powerful tool, but also very fragile, for three main reasons.

The first reason concerns the unit of analysis of policy instruments: choosing the national level, as a reference for all EU and OECD countries, ends up simplifying the complexity of the policy instruments that in the different countries are developed on a regional scale, as in the case of Italy, or of the states, the Lander, as in the case of a federal state such as Germany.

Beyond the methodological features suggested in the analysis of policy initiatives, one urgent message is drawn from the analysis undertaken in this paper: the need of a radical shift in the European Commission, which is now supporting STIP Compass only for the information on the national policies. Innovation policy in Europe, as the Research and Innovation Smart Specialisation Strategy clearly shows(Isaksen & Trippl, 2017; Magro & Wilson, 2018; Russo, et al. 2019a, 2019b) is built not only on national policies, but also on regional policies. Hence, aiming at providing an effective analytical framework and tools for innovation policies in Europe, the European Commission cannot overlook that subnational policies need to be entered in STIP Compass. This should be done not relying in volunteer entry of information by almost 200 regions in Europe, but in a straightforward way by populating STIP Compass automatically, with information on regional innovation policies already available in the DG Regio, which collects the administrative data on regional policies supported by the FESR and FSE funds. As a matter of fact, our results show that different patterns of policy mix characterize the national level and the subnational levels, as in the case of Belgium that has entered information on policy initiatives on both the national level and the three regions on Belgium. The simplification adopted in conceptualizing STIP Compass web platform only for national policy is unacceptable and disconcerting: differences can be large and significant in outlining the variety of policy measures adopted by countries, exactly because of the interplay of different policy mix at national and subnational levels.

A second reason of fragility is related to a classification issue, of policy instruments and of target groups. For example, in STIP Compass classification, "innovation intermediaries" are a type of target group, but in several cases they are not specified, while the ultimate target group of the innovation policy instruments is specified (such as SMEs). If STIP Compass has to be used for the TIP "co-creation project", in which a specific analysis on innovation intermediaries is expected, it is urgent to address the classification of the broad areas of interventions that are now encompassed under the label "innovation intermediaries", but that are not classified as such in the conceptual framework of those who are entering information in the database. A big effort in creating a common language (codes) has been put forward through many tutorials produced by STIP Compass staff, but some critical areas still deserve attention (and might be possible food for thought in the discussion on policy initiatives among the TIP delegates).

A more pervasive reason of fragility concerns the quality of the data provided by the countries. It is an essential condition to allow an effective use of the tool that assumes that the comparison refers to the policies that the countries have implemented. The various pieces of information can be easily compared by using STIP Compass database, but at the present the database is incomplete and the external user who simply compare data by using the dashboard has no information that clearly indicates to what extent it is complete and who and when the information has been updated, or who is responsible for updating it, unless a country contact point. Such details are now available for each country only to the persons authorized to entry the information (and to the OECD staff in charge for developing and maintaining STIP Compass): they should be made transparent in the navigation. The next version of STIP Compass is ready to support this change. Full information on each policy instrument will shed light on their actual mix, thus allowing an interpretation of their composition in terms of resources that are invested for each component of the mix. The clustering of countries will then be weighted on that dimension and not simply on counting the different categories of policy instruments. Moreover, the temporal dimension deserves more accurate data: start-end date could significantly improve our understanding of the development of policy instruments both in a cross country perspective and in a longitudinal one.

In general, the discussion in the TIP group at OECD has highlighted that innovation policy databases are necessary, but there is great concern about data quality and data processing. In particular, as far as European Union member states are concerned, regional data could be taken directly from what DG Regio already collects on innovation measures at regional and national level. If this proposal would be implemented, it would become possible to create procedures for automatic population of information in STIP Compass as soon as a policy is implemented or it is accounted.

Being aware of the incompleteness of information available, the analysis focused on a set of information that are available for all the policy instruments entered so far in the database, i.e. the classification, by category and type, of policy instruments, target groups and theme areas. The results of multidimensional analysis on those classification allows to single out three main patterns of policy mix characterising three groups of countries. A different clustering of countries emerged when tacking free texts describing the current debate issues on innovation policy. This result might be a signal of the incompleteness of information entered in STIP Compass and also of the classification issues mentioned above. Nevertheless, even though its bias, the cross tabulation provides an additional layer of information on the countries' policy mix.

As soon as the updated version of the database will be available, all the elaborations will be run again and results will be interpreted to investigate the different patterns of policy mix with regard to budget of the various policy interventions and their combination in the policy mix and the temporal structure of policy mix across countries. Such perspective on innovation policy will be integrated by a complementary set of information on structural features characterising the countries, thus allowing a more effective interpretation of the patterns emerging from the analysis.

Moreover, a further development will be implemented by the research team with regard to the contents emerging from the free texts available in STIP Compass. The goal is to single out patterns characterizing the policy initiatives in the countries and to compare such patterns with what emerges from the cluster analysis on codes classifying the three domains of policy instruments, target groups and theme areas. The corpus of free texts refers to the "Description", "Background" and the "Objective(s)" of each policy instrument entered in the database. If the results will result to be consistent with those emerging from codes, any further analysis on updated information could be implemented by focusing only on one or the other corpus.

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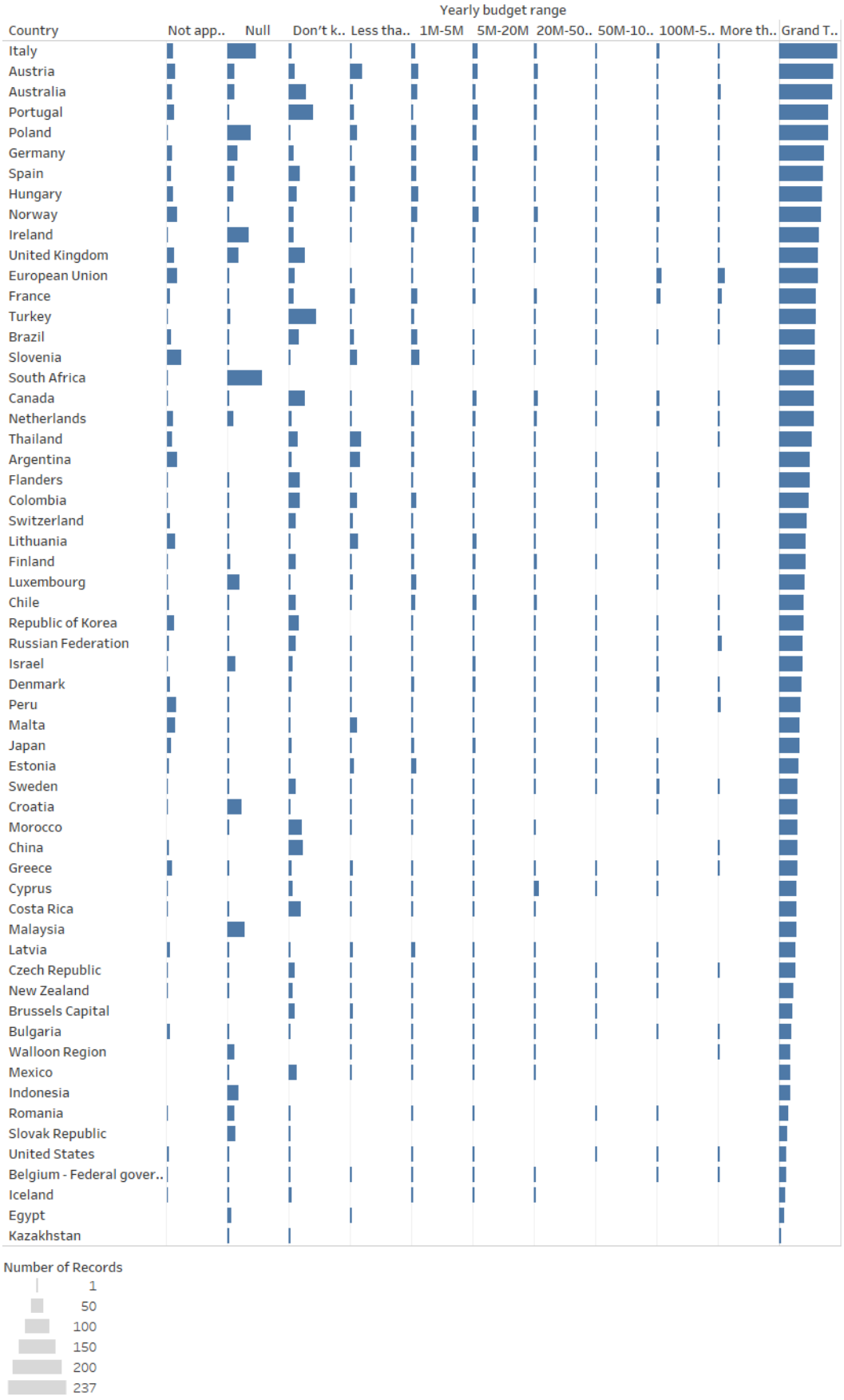
Annex - Table, Figures and Graphs

Source: Tables, figures and graphs are authors' elaboration on STIP Compass [download 24.08.2019]; elaboration with Taltac2, Iramuteq, Gephi and Tableau. A selection of tables and figures (marked with the symbol ❄) can be browsed by using the navigation on Tableau Public, available at https://www.poliinnovazione.unimore.it/supplementary159/

❄ Table A1 – Categories of policy instruments by yearly budget range

	Yearly budget range										
Category_Policy instrument type category	Less than 1M	1M-5M	5M-20..	20M-5..	50M-1..	100M-..	More than 500M	Not applicable	Don't know	Null	Grand Total
Direct financial support [37.6%]	228	348	289	227	153	161	101	86	441	242	2.276
Governance [35.3%]	193	101	62	32	20	54	60	615	511	492	2.140
Collaborative platforms and infrastructure [13.7..	98	96	54	42	19	26	11	79	242	166	833
Guidance, regulation and other incentives [10.3%]	79	56	38	14	8	14	12	101	163	139	624
Indirect financial support [3.1%]	10	6	8	7	5	14	16	44	54	21	185
Null	2	5	8	6	2	2	1	4	5	123	158
Grand Total	610	612	459	328	207	271	201	929	1.416	1.183	6.216

Figure A1 - Number of policy instruments by yearly budget range, by country



Source: authors' elaboration on STIP Compass DB 24/08/2019

Table A2 – Taxonomy of categories and types of policy instruments, target groups and theme areas, by modularity class (11 classes)

domain	category	Id types & **categories**	Degree	modularity
Policy_instrument		**Direct_financial_support**	220	0
Policy_instrument	Direct_financial_support	Centres_of_excellence_grants	184	0
Policy_instrument	Direct_financial_support	Institutional_funding_for_public_research	198	0
Policy_instrument	Direct_financial_support	Project_grants_for_public_research	202	0
Theme_Area		**ERA_related_initiatives**	230	0
Theme_Area	ERA_related_initiatives	Cross_border_interoperability_of_national_programmes	184	0
Theme_Area	ERA_related_initiatives	ERA_related_strategies	190	0
Theme_Area	ERA_related_initiatives	International_evaluation_standards	146	0
Theme_Area	ERA_related_initiatives	Joint_research_agenda	192	0
Theme_Area	Governance_ThAr	International_STI_policy_instruments	220	0
Theme_Area		**Public_research_system**	260	0
Theme_Area	Public_research_system	Competitive_research_funding	224	0
Theme_Area	Public_research_system	Exploratory_and_high_risk_research	178	0
Theme_Area	Public_research_system	Interdisciplinary_research	214	0
Theme_Area	Public_research_system	Internationalisation_in_public_research	232	0
Theme_Area	Public_research_system	Large_research_infrastructures_and_equipment	214	0
Theme_Area	Public_research_system	Non_competitive_research_funding	212	0
Theme_Area	Public_research_system	Structural_change_of_the_public_research_system	224	0
Theme_Area	Public_research_system	Third_party_funding	236	0
Theme_Area	Research_and_innovation_for_society	Research_and_innovation_for_developing_countries	156	0
Theme_Area	Research_and_innovation_for_society	Research_and_innovation_for_health_and_healthcare	226	0
Policy_instrument	Direct_financial_support	Equity_financing	132	1
Policy_instrument	Direct_financial_support	Grants_for_business_R_D_and_innovation	192	1
Policy_instrument	Direct_financial_support	Innovation_vouchers	104	1
Policy_instrument	Direct_financial_support	Loans_and_credits_for_innovation_in_firms	146	1
Policy_instrument	Direct_financial_support	Procurement_programmes_for_R_D_and_innovation	164	1
Policy_instrument		**Indirect_financial_support**	172	1
Policy_instrument	Indirect_financial_support	Corporate_tax_relief_for_R_D_and_innovation	154	1
Policy_instrument	Indirect_financial_support	Debt_guarantees_and_risk_sharing_schemes	92	1
Policy_instrument	Indirect_financial_support	Tax_relief_for_individuals_supporting_R_D_and_innovation	120	1
Target_group		**Firms_by_age**	264	1
Target_group	Firms_by_age	Established_firms__more_than_5_years_old_	154	1
Target_group	Firms_by_age	Firms_of_any_age	262	1
Target_group	Firms_by_age	Nascent_firms__0_to_less_than_1_year_old_	194	1
Target_group	Firms_by_age	Young_firms__1_to_5_years_old_	218	1
Target_group		**Firms_by_size**	262	1
Target_group	Firms_by_size	Firms_of_any_size	262	1
Target_group	Firms_by_size	Large_firms	206	1
Target_group	Firms_by_size	Micro_enterprises	206	1
Target_group	Firms_by_size	Multinational_enterprises	168	1
Target_group	Firms_by_size	SMEs	256	1
Theme_Area		**Innovation_in_firms_and_innovative_entrepreneurship**	264	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Access_to_finance_for_innovation	172	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Entrepreneurship_capabilities_and_culture	216	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Financial_support_to_business_R_D_and_innovation	240	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Foreign_direct_investment	208	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Non_financial_support_to_business_R_D_and_innovation	244	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Stimulating_demand_for_innovation_and_market_creation	210	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Targeted_support_to_SMEs	242	1
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Targeted_support_to_young_innovative_enterprises	200	1
Target_group		**Social_groups_especially_emphasised_TG**	222	1
To_be_defined	To_be_defined	Workers_with_tertiary_education_and_above_specifically	38	1
Target_group		**Research_and_education_institutions**	262	2
Target_group	Research_and_education_institutions	Higher_education_institutes	262	2
Target_group	Research_and_education_institutions	Private_research_and_development_lab	262	2
Target_group	Research_and_education_institutions	Public_research_institutes	262	2
Policy_instrument	Collaborative_platforms_and_infrastructure	Information_services_and_databases	180	3
Policy_instrument	Direct_financial_support	Fellowships_and_postgraduate_loans_and_scholarships	176	3
Policy_instrument	Guidance_regulation_and_other_incentives	Labour_mobility_regulation_and_incentives	142	3
Target_group		**Researchers_students_and_teachers**	262	3
Target_group	Researchers_students_and_teachers	Established_researchers	262	3
Target_group	Researchers_students_and_teachers	PhD_students	260	3
Target_group	Researchers_students_and_teachers	Post_doctoral_researchers	260	3
Target_group	Researchers_students_and_teachers	Secondary_education_students	110	3
Target_group	Researchers_students_and_teachers	Teachers	234	3
Target_group	Researchers_students_and_teachers	Undergraduate_and_master_students	254	3
Target_group	Social_groups_especially_emphasised_TGTYPES	Women	202	3
Theme_Area		**Human_resources_for_research_and_innovation**	254	3
Theme_Area	Human_resources_for_research_and_innovation	Doctoral_and_postdoctoral_researchers	210	3
Theme_Area	Human_resources_for_research_and_innovation	Gender_balance	182	3
Theme_Area	Human_resources_for_research_and_innovation	Intersectoral_mobility	220	3
Theme_Area	Human_resources_for_research_and_innovation	Research_careers	204	3
Theme_Area	Human_resources_for_research_and_innovation	STEM_skills	202	3
Theme_Area	Human_resources_for_research_and_innovation	STI_human_resources_strategies	216	3
Theme_Area	Public_private_knowledge_transfers_and_linkages	International_mobility_of_human_resources	212	3
Theme_Area	Public_research_system	Gender_and_diversity_in_research	138	3
Theme_Area	Public_research_system	Open_science_and_open_access	202	3
Theme_Area	Public_research_system	Research_integrity_and_reproducibility	170	3

domain	category	Id types & **categories**	Degree	modularity
Target_group		**Capital_and_labour**	260	4
Target_group	Capital_and_labour	Entrepreneurs	258	4
Target_group	Capital_and_labour	Labour_force_in_general	240	4
Target_group	Capital_and_labour	Private_investors	242	4
Policy_instrument	Governance_PoInTyCat	Standards_and_certification_for_technology_development_and_adoption	134	5
Target_group	Social_groups_especially_emphasised_TGTYPES	Civil_society	258	5
Target_group	Social_groups_especially_emphasised_TGTYPES	Disadvantaged_and_excluded_groups	208	5
Target_group	Social_groups_especially_emphasised_TGTYPES	Social_groups_especially_emphasised_TGTYPES	258	5
Policy_instrument		**Guidance_regulation_and_other_incentives**	206	6
Policy_instrument	Guidance_regulation_and_other_incentives	Intellectual_property_regulation_and_incentives	112	6
Policy_instrument	Guidance_regulation_and_other_incentives	Science_and_innovation_challenges_prizes_and_awards	148	6
Policy_instrument	Guidance_regulation_and_other_incentives	Technology_transfer_and_business_advisory_services	186	6
Theme_Area		**Public_private_knowledge_transfers_and_linkages**	260	6
Theme_Area	Public_private_knowledge_transfers_and_linkages	Cluster_policies	248	6
Theme_Area	Public_private_knowledge_transfers_and_linkages	Collaborative_research	244	6
Theme_Area	Public_private_knowledge_transfers_and_linkages	Commercialisation_of_public_research_results	230	6
Theme_Area	Public_private_knowledge_transfers_and_linkages	Intellectual_property_rights_in_public_research	186	6
Target_group		**Intermediaries**	260	7
Target_group	Intermediaries	Academic_societies_or_academies	252	7
Target_group	Intermediaries	Incubators_science_parks_or_technoparks	258	7
Target_group	Intermediaries	Industry_associations	250	7
Target_group	Intermediaries	Technology_transfer_offices	246	7
Theme_Area		**Digitalisation**	238	8
Theme_Area	Digitalisation	Artificial_intelligence	176	8
Theme_Area	Digitalisation	Digital_transformation_of_firms	228	8
Theme_Area	Digitalisation	High_performance_computing	164	8
Theme_Area	Digitalisation	Near_to_market_digital_technology	228	8
Policy_instrument		**Governance_PoInTyCat**	218	9
Policy_instrument	Governance_PoInTyCat	Creation_or_reform_of_governance_structure_or_public_body	196	9
Policy_instrument	Governance_PoInTyCat	Formal_consultation_of_stakeholders_or_experts	144	9
Policy_instrument	Governance_PoInTyCat	Horizontal_STI_coordination_bodies	162	9
Policy_instrument	Governance_PoInTyCat	National_strategies_agendas_and_plans	206	9
Policy_instrument	Governance_PoInTyCat	Policy_intelligence__eg_evaluations_reviews_and_forecasts_	178	9
Policy_instrument	Governance_PoInTyCat	Public_awareness_campaigns_and_other_outreach_activities	170	9
Target_group		**Governmental_entities**	262	9
Target_group	Governmental_entities	National_government	260	9
Target_group	Governmental_entities	Subnational_government	252	9
Theme_Area		**Governance_ThAr**	256	9
Theme_Area	Governance_ThAr	Evaluation_and_impact_assessment	184	9
Theme_Area	Governance_ThAr	Horizontal_policy_coordination	218	9
Theme_Area	Governance_ThAr	International_STI_policy_strategy_and_framework	230	9
Theme_Area	Governance_ThAr	National_STI_plan_or_strategy	246	9
Theme_Area	Governance_ThAr	Strategic_policy_intelligence	208	9
Theme_Area	Innovation_in_firms_and_innovative_entrepreneurship	Business_innovation_policy_strategies	244	9
Theme_Area	Public_private_knowledge_transfers_and_linkages	Transfer_and_linkages_strategies	228	9
Theme_Area	Public_research_system	Public_research_strategies	234	9
Theme_Area		**Research_and_innovation_for_society**	260	9
Theme_Area	Research_and_innovation_for_society	Multi_stakeholder_engagement	198	9
Theme_Area	Research_and_innovation_for_society	Research_and_innovation_for_society_strategy	236	9
Theme_Area	Research_and_innovation_for_society	Research_and_innovation_for_sustainable_development	250	9
Theme_Area	Research_and_innovation_for_society	Science_technology_and_innovation_culture	220	9
Policy_instrument		**Collaborative_platforms_and_infrastructure**	208	10
Policy_instrument	Collaborative_platforms_and_infrastructure	Clusters_and_other_networking_and_collaborative_platforms	202	10
Policy_instrument	Collaborative_platforms_and_infrastructure	Dedicated_support_to_new_research_infrastructures	182	10
Theme_Area	ERA_related_initiatives	ESFRI_infrastructures	148	10

Source: authors' elaboration on STIP Compass DB 24/08/2019

Figure A2 – Number of policy initiatives (records), total number and average number of codes (categories and types) of themes, target groups, policy instruments, by territorial entity

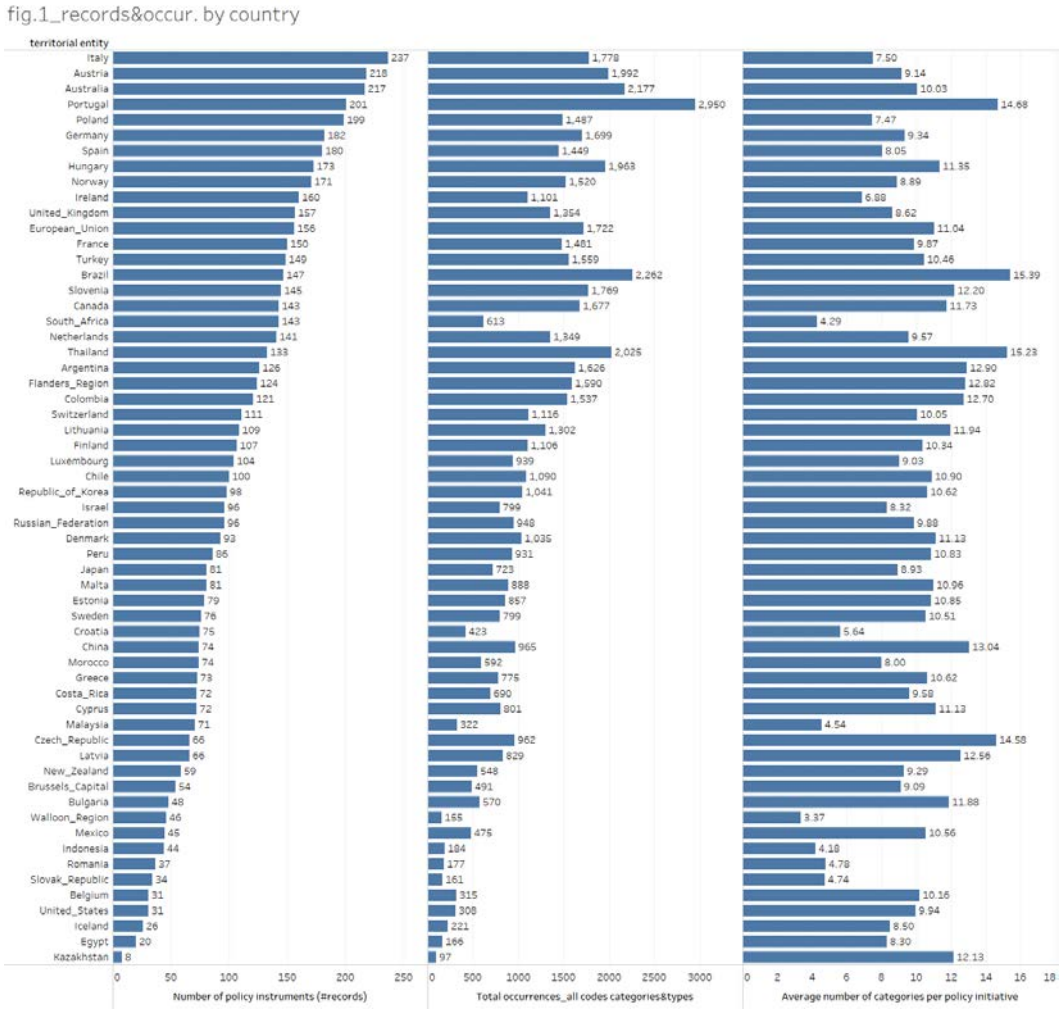


Figure A3 – Categories of policy instruments by yearly budget range

Only policy initiative with full information on yearly budget range are considered (about 35% of records). *Percentage are computed on the total rows*

Yearly budget range

Category_ Policy instrument type category	Less than 1M	1M-5M	5M-20M	20M-50M	50M-100M	100M-500M	More than 500M
Direct financial support	15,13%	23,09%	19,18%	15,06%	10,15%	10,68%	6,70%
Governance	36,97%	19,35%	11,88%	6,13%	3,83%	10,34%	11,49%
Collaborative platforms and infrastructure	28,32%	27,75%	15,61%	12,14%	5,49%	7,51%	3,18%
Guidance, regulation and other incentives	35,75%	25,34%	17,19%	6,33%	3,62%	6,33%	5,43%
Indirect financial support	15,15%	9,09%	12,12%	10,61%	7,58%	21,21%	24,24%

Graph A1 - Modularity classes of categories and types of policy instruments