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## Conference Paper

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## **Text mining the entrepreneurship policy agenda in the EU: From naïveté into reality**

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## Abstract

This paper analyses the learning curve in the emergence and development of an entrepreneurship policy in the European Union (EU) during the period 1990–2016 by identifying the key topics in the policy agenda-setting and their evolution over time within a corpus of 576 selected policy-making documents. To this end, the paper uses a combination of text mining techniques, cluster analysis and qualitative assessment, illustrating the possibilities of these tools to learn about the evolution of the policy cycle in a particular domain. The results from the analysis display three main stages, each of them with two sub stages. During the initial period, labelled (a) *latent EU entrepreneurship policy*, there were hardly any specific entrepreneurship policy initiatives and only some general enterprise-fostering policies at the EU level which included, tangentially, SMEs and entrepreneurs, and lasted up to late 1990s. In the (b) *emergent EU entrepreneurship policy* stage, the initial steps of an entrepreneurship policy with a main focus on diagnosis of the entrepreneurial ecosystem and some measures of support – mainly to SMEs – can be traced from the late 1990s to the early 2010s. The third and last period to date is a (c) *new normal for EU entrepreneurship policy*, which is a more targeted stage aimed at promoting not only quantity but quality of business ventures; and is ongoing since the early 2010s. Overall, this paper provides a complete overview of the EU entrepreneurship policy evolution and concludes with a granular proposal for its evolution, identifying main themes and foundational concepts, establishing patterns, and finding temporal and contextual relations within the EU policy cycle.

Keywords: Entrepreneurship policy; Policy cycle; Policy analysis; Cluster analysis; Text mining; EU policy.

JEL: L26;

Availability of data: Documents analysed during the current study are available from the Open Science Framework repository, available at:

[https://osf.io/uwph3/?view\\_only=22d372dcf16e4c799d4726e726069990](https://osf.io/uwph3/?view_only=22d372dcf16e4c799d4726e726069990)

## **Introduction**

The emergence of entrepreneurship policy, as a specific field of interest, is the logical consequence of the increased attention on entrepreneurship as a strategic driver of economic progress that started during the last quarter of the 20<sup>th</sup> century (Hart 2003; Wennekers et al. 2002; Lundström and Stevenson 2002). The new economic paradigm – characterised by the globalisation process, technological disruption by information and communications technologies (ICT), and the emergence of knowledge as a key factor for economic growth – implied that conventional policy approaches were considered ineffective to support the economic development and the maintenance of low unemployment rates in Western countries (Gilbert et al., 2004) and new forms of intervention were sought after.

The notion of entrepreneurship policy gradually took special relevance since the 1980s in two of the most important economic areas, US and EU, given the need to face the inability to sustain competitive production and the growing importance of the service sector (Minniti, 2008). In the US, public involvement in entrepreneurship appeared to be a priority within the policy agenda of the Administration during the 1980s as the industrial comparative advantages shifted toward knowledge-based economic activity (Audretsch and Thurik 2010). In the European Union (EU) the debate ignited in the next decade and the start of the 21st century, when entrepreneurship was declared a primary issue in the EU policy agenda (European Commission, 1999; Uhlaner, 2003) placing high hopes on its effects on the European economy and society (Szabo and Herman 2012; Van Der Zwan et al. 2013).

Within this framework, the EU approach to policies in the field has ranged from initial and miscellaneous measures about encouraging individuals to become entrepreneurs and creating new firms (European Commission 2003), to more sophisticated and targeted initiatives about promoting high-growth and innovative businesses where entrepreneurial ecosystems play a pivotal role (European Commission, 2013). Despite these efforts, the effectiveness of these policy interventions

has been widely contentious, in particular on their capacity to support innovative entrepreneurship (Grilo and Thurik 2005; Cincera and Veugelers 2014; Henrekson and Sanandaji 2017).

From a research perspective, scholars have paid extensive attention to discuss how policy instruments in the field have been promoted and implemented and the subsequent effectiveness of those policies (Arhsed et al, 2014), but as Lundström and Stevenson noted (2006, p. 7) in general there is ‘limited knowledge on how entrepreneurship policy is constructed’. Furthermore, little is known about the specific topics considered in the policy agenda-setting process for encouraging more and more people to consider entrepreneurship as an option.

Accordingly, the focus of this paper is on identifying the core topics that have been central for the construction of the EU policy in entrepreneurship along the last decades, specifically on how policy targets have evolved over time, settling priorities to encourage particular stages of the entrepreneurial process. For that purpose, we use the theory of the so-called ‘policy cycle’ or also ‘policy stages heuristic’ (Jones, 1977)<sup>1</sup> as the framework to place the topics that have been part of the agenda-setting and policy formulation stages of this cycle.

This study makes two main contributions to the understanding of entrepreneurship policy in Europe. First, by identifying the core themes of the EU entrepreneurship policy since 1990. For that purpose, we apply text mining techniques to a collection of EU policy Communications related to

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<sup>1</sup> According to this theory, the policy process could be theoretically divided into – and analysed in – several stages or subprocesses, functionally distinct and separated in time. There are different approaches to the number and characteristics of these stages. For instance, Cuadrado-Roura (2005) uses six main stages: issue identification, analysis of alternatives, design of policies, consultations, discussion and decision, and implementation. Other authors widen or reduce the number of stages but maintain the basic structure. For instance, in the rather complete and critical review of Jann and Wegrich (2007) the stages are reduced to five: agenda-setting, policy formulation, decision-making, implementation, and evaluation (eventually leading to termination). With rather similar names and slight extensions, these five stages appear in Howard (2005): agenda-setting, policy design, adoption, implementation, and monitoring and evaluation.

entrepreneurship and published during the period 1990–2016. Specifically, text mining is used to find which ideas have shaped EU policymakers' discourse on entrepreneurship setting coherent stages for shifts in the policy cycle and, above all, to establish which learning paths were taken to the next strand of policies.

Second, the results of the text mining outline a reasonably granular analysis on the evolution of entrepreneurship policy which provides an improved conceptual framework for a deeper understanding of the trial-and-error process followed by entrepreneurship policy at EU level. As a practical realisation, the paper contributes to trace an entrepreneurship policy timeline for the EU, divided into three main stages and six sub-stages.

From the authors' perspective, the results of this analysis will contribute to enhance the common understanding of these types of policies and the influence of the policy cycle, and also to steadily advance, over the next years, more effective policy approaches for entrepreneurship.

Regarding the research methodology, as text mining is still a relatively new approach when reviewing the evolution of a policy field, commonly based on desk research<sup>2</sup>, a secondary aim of the paper is also to illustrate the possibilities of these types of techniques that allow to process a higher number of policy documents and reinforce research granularity to identify key topics<sup>3</sup>, complementing more qualitative research approaches.

With the above goals, this article is structured in five main sections. Section 2 briefly reviews the status and development of the entrepreneurship policy in the EU policy context, establishing a

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<sup>2</sup> For example, the EU policy agenda has been investigated through desk research of a selection of policy documents, 'grey' literature and scientific contributions in combination with a small number of interviews (Edler and James, 2015; Sabato et al., 2017).

<sup>3</sup> A recent example of text mining approaches could represent an alternative of qualitative methods is given by the research on the role of European Union agencies based on the analysis of EU agencies' annual reports (Busuioc and Rimkutė, 2019).

background for the results of this paper. Next, the methodology section describes the formation process of the corpus of documents and the text mining workflow. This is followed by the results and discussion sections which focus on the cluster analysis. Finally, Section 6 compiles the main conclusions and points towards new avenues for research.

### **Entrepreneurship policy: agenda-setting and policy formulation in the EU context**

During his speech *For a New European Entrepreneurship* at the Instituto de Empresa<sup>4</sup> in Madrid, Romano Prodi, President of the European Commission, remarked on the *'lacunae in the field of entrepreneurship'* within the European Union and, at the same time, encouragingly noted that *'the framework conditions that influence entrepreneurship are certainly becoming more supportive inside the Union'* (European Commission, 2002). This occurred in the year 2002; EU policymakers had already diagnosed that Europe lagged behind in entrepreneurship and considered that the EU was laying the foundations for improving the situation. As a consequence, few months later the EC, following the impulse from the Lisbon Strategy, stated the pillars to promote innovation and entrepreneurship as a priority for Europe (European Commission, 2003b).

A decade later, the European Commission itself continued to emphasise that *'Europe needs more entrepreneurs'* (European Commission, 2013) and, three years later, still acknowledged that Europe *'is not yet fully tapping the potential of its entrepreneurial capacity and talent'* and *'more needs to be done'* from the policy point of view at national and European level (European Commission, 2016). These are some evidences of the continuous relevance and reformulation of entrepreneurship policies in different instances of the EU policy cycle, evolving from mere awareness of its role within policy action to become a top priority in every policy agenda.

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<sup>4</sup> The Instituto de Empresa (IE) or IE Business School was founded in 1973 and is one of the one of the world's most prestigious business schools according to international rankings. More information at: <https://www.ie.edu/business-school/the-school/about-ie/>

Prior to Lisbon Strategy and the concrete policy definition<sup>5</sup> launched in the early 2000, entrepreneurship in Europe was far from being a key policy topic. Since the late 80's to the late 90's, policy makers discourse evolved along those years to finally raise awareness on the relevance of introducing entrepreneurship into the policy debate as one of the keys to unlocking greater employment growth and competitiveness in Europe (European Commission, 1998). Connected to this period, relevant academic contributions come from David Audretsch and Roy Thurik that identified up to five stages in the European process – from no policies on entrepreneurship to implementation – (Audretsch et al. 2002; Audretsch and Thurik 2010), which can be interpreted as a first attempt at describing a learning curve for policy makers to start defining an entrepreneurship policy agenda.

At a subsequent stage in which the concept of entrepreneurial economy in Europe was finally emerging (European Commission, 2003a, 2004), the debate among stakeholders was focused on the alternatives to shape and implement a targeted entrepreneurship policy. From an academic perspective, this issue was part of the long debate on the balance between public intervention and market freedom that has been addressed in detail (Jose Luis Gómez-Barroso, 2019). In this context, some authors explore the constituents of what should entrepreneurship policy look like, highlighting the role of policy in enabling the creation and commercialization of knowledge as a core difference from traditional business policy (Acs and Szerb, 2007). Particularly on entrepreneurship policy in the EU several scholars agree that the general rationale for policy interventions has been traditionally based on the idea of correcting market failures (Audretsch, et al., 2007) and also systemic failures (Autio, 2016). To this respect, Erik Stam (2015) reflects on the need for a shift in thinking about the

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<sup>5</sup> As the EC stated, the Communication on innovation policy (2003b), the Communication on industrial policy in an enlarged Europe (2002) and the Green Paper on Entrepreneurship in Europe (2003a), form a 'coherent framework for the development of an enterprise policy that fosters competitiveness of companies and contributes to the growth of Europe's economy'.



rationales for policy, from market and or systemic failures correction to a wider policy scope in which public government, as part of an entrepreneurial ecosystem<sup>6</sup> of stakeholders, can play an important role as a ‘feeder’ of the ecosystem, for example in adjusting laws and regulations. However, the exact nature of those failures appears to be rather diverse across the reviewed literature, therefore lacking from a detailed identification of topics nor issues that were central for policy makers.

Acknowledging the relevance of entrepreneurship and despite the efforts made by the EU, the mentioned debate about policy appropriateness and effectiveness have partly driven research in the field with approaches that are seemingly diverse and heterogeneous, depending on the context of the researcher (Landström, 2015; Welter et al., 2008). Some examples are the analysis of policy capacity to support innovative entrepreneurship (Grilo and Thurik 2005; Cincera and Veugelers 2014; Henrekson and Sanandaji 2017) or the reflections about the role of economic policies at the macro level to encourage high-quality entrepreneurship and stimulate employment and innovation (Román, Congregado, & Millán, 2013). Another relevant study presented by (Ramlogan & Rigby, 2012) examines the effectiveness and impacts of a number of regional and national publicly supported policies for entrepreneurship development.

A step further within the study of the policy effectiveness in entrepreneurship, many scholars have shown their interest to evaluate entrepreneurship policy from a quantitative perspective. For that purpose, academia attention has focused on the conceptualization of entrepreneurship as a complex ecosystem of agents that interact and evolve over time as a necessary step to quantify the

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<sup>6</sup> The concept “entrepreneurial ecosystem” includes cultural aspects and agents (individuals, firms, organizations, and governments), among other relevant elements, and combine and influence the evolution of entrepreneurs and their firms in a single area. Thus, as a main instance, the OCDE definition of the entrepreneurial ecosystem includes a set of interconnected actors (both potential and existing), organizations, institutions, and processes which formally and informally coalesce to connect, mediate, and govern the performance within the local entrepreneurial environment (Mason, Colin, & Brown 2014).

outputs of policy measures (Armuña et al., 2017). As a result, the notion of the entrepreneurial ecosystem has gained relevance in the form of conceptual frameworks of analysis that set specific indicators for qualitative and quantitative assessment. Some examples are the model proposed by Daniel Isenberg and the Babson College in its “Babson Entrepreneurship Ecosystem Project (BEEP)” (Bankinter, 2010) and also the framework developed by the OECD’s Statistics Directorate within the context of the OECD-Eurostat Entrepreneurship Indicators Programme (EIP)(Ahmad & Hoffmann, 2008; OECD, 2008). More recently The European Index of Digital Entrepreneurship Systems (EIDES) addresses the measurement challenge by appraising the framework and systemic conditions for stand-up, start-up, and scale-up activities in the EU28 countries (Autio et al., 2018).

By contrast, the academia has shown limited interest on the study of the initial stages of the policy cycle (Arshed, 2017). Precisely addressing this research gap on the identification of the strategic topics that have led entrepreneurship policy from an EU perspective is one of the main aims of the present article.

In this sense, putting all these pieces in context can illustrate the interest of the academia on entrepreneurship policy in Europe and the gaps worth exploring. For that purpose, the notion of ‘policy cycle’ as previously introduced can be used. Therefore, drawing from this theory and the literature review conducted, we can map that scholars’ attention has been concentrated on the last stage within the policy cycle, but there is a research gap in the rest of the stages, as shown in the Fig. 1:

In summary, research interest on entrepreneurship policy can be seen as unbalanced given the number of researchers focusing on the implementation and evaluation stages (Arshed, 2017) but setting the agenda has attracted little serious attention. We can say, as Lundström and Stevenson noted (2006, p. 7), that in general there is ‘limited knowledge on how entrepreneurship policy is constructed’. In fact, in the particular case of EU, since those early attempts to raise awareness for an entrepreneurship policy agenda and the general consideration of the Lisbon Strategy as the pivotal

moment, previous research work lacks deeper granularity to understand, in detail, the evolution of the entrepreneurship policy domain.

Under these premises, this paper aims to contribute to bridge the existing gap on how the EU entrepreneurship policy agenda has emerged and evolved in terms of the European Commission policy cycle, considering that a new College of Commissioners is appointed approximately every five years<sup>7</sup>. This research gap is addressed in the present paper, focusing on the identification of those key areas, topics and domains of entrepreneurship policy, and on the evolution of the policy discourse over time.

## **Methodology**

The objectives of the paper are addressed using text mining techniques to analyse a collection of policy documents. Text mining and text analytics are a subset of data mining techniques that are focused on turning semi-structured and unstructured textual content into high quality information or knowledge. It is also known as knowledge discovery in the text or knowledge intelligent text analysis (Hotho, et al., 2005; Nahm and Mooney, 2002). The general goal of data mining is to obtain actionable knowledge from a vast amount of textual data by applying different types of specific

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<sup>7</sup> For the period 1990–2016, the EC cabinets has evolved as follows:

- Commissions led by Jacques Delors (January 1985–December 1994, divided into three consecutive periods: 1985–1988, then 1988–1992 and, finally, 1992–1994);
- Commission led by Jacques Santer (23 January 1995–15 March 1999), with a short interim presided over by Manuel Marín, following the resignation of Santer;
- Commission led by Romano Prodi (September 1999–October 2004);
- Commissions led by José Manuel Durao Barroso (November 2004–October 2014, divided into two consecutive periods: 2004–2009 and 2009–2014);
- Commission led by Jean Claude Juncker (November 2014–present day and is due to serve until 2019).

Source: [https://ec.europa.eu/info/about-european-union/organisational-structure/how-commission-organised\\_en](https://ec.europa.eu/info/about-european-union/organisational-structure/how-commission-organised_en)

algorithms suited to the task. As text is basically unstructured data, text mining and text analytics are aimed at finding patterns and relationships between terms and providing means to interpret them appropriately.

Typical objectives of text mining are natural language processing and text representation, concept extraction, search and information retrieval, web mining, information extraction, document classification and document clustering (Miner, et al., 2012). These aims connect with the need of policymakers to extract relevant information from the increasing amount of textual data from different sources that they have to manage<sup>8</sup>.

From a research point of view, text mining techniques are increasingly used within policy studies. For example, some authors have used text mining to study the evolution of the policy agenda in specific fields by analysing the historical evolution of a policy-related academic domain (José Luis Gómez-Barroso, Feijóo, Quiles-Casas, & Bohlin, 2016); and also text mining has been recently used to explore deviations between the co-legislators and their trilogue negotiators within the EU legislative policy-making (Laloux and Delreux, 2018).

Precisely, this paper aims to extract concepts that define the entrepreneurship policy agenda in the EU and increase the granularity in the analysis by putting the most relevant themes in a temporal framework. Besides, this paper conducts a cluster analysis to find which European Commission (EC) documents are linked in their usage of terms, concepts and relationships between them.

This section explains how text mining has been applied to achieve these objectives, in particular: (i) the text data collection to form the corpus of policy documents; (ii) the pre-processing tasks to prepare the textual content for the analysis; (iii) the text mining techniques applied to conduct the analyses; and (iv) the software used to do it.

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<sup>8</sup> There have already been some initiatives to explore the benefits of text mining in the EU policy making processes. For instance, the EU Science Hub—related to the EC—organised a conference about text mining in policy making on December 2016. More information available at: <https://ec.europa.eu/jrc/en/event/conference/text-mining-policy-making>.

### ***Text gathering and corpora definitions***

The analysis considers a comprehensive selection of literature that refers explicitly to entrepreneurship policies in the EU named as EU Policy. This corpus consists of a total of 576 EC Communications during the period 1990–2016 related to entrepreneurship or start-ups. Despite the fact that there are several EU bodies and institutions that produce a wide range of documents, the EC Communications embody a very representative image about the EU views and insights on a particular topic.

The EC is defined as the ‘politically independent institution that represents and defends the interests of the Union as a whole’, and the executive branch of the EU that ‘proposes laws, policies, agreements and promotes the Union’ (European Union, 2014). In this sense, the EC holds the monopoly to set down policy proposals (Arndt Wonka, 2008) so it plays a leading role setting the agenda of the EU by defining and bringing together the policy vision of the EU in any particular field, as it is the case of entrepreneurship. From the range of the EC policy documents, the EC Communications are those that establish ‘*its thinking on a topical issue*’ (European Judicial Network, n.d.) Although they do not have a mandatory authority or a legal effect, they are used by the EC to set out thoughts and its action plans about different topics in each moment and to promote a common basis for the joint decisions of Member States. They are also typically the base for follow-up initiatives such as *Recommendations* or *Directives*.

An initial search of the EC policy documents reported 2,120 results. After discarding those that were different from EC Communications, 708 documents were retained. These documents have been manually filtered to remove duplicates and also documents that do not contain any real reference to entrepreneurship in spite of mentioning the term. Finally, the corpus is composed of 576 EC Communications, representing 16.35% of the total EC Communications of the period considered. The Fig. 2 shows the distribution of EC Communications per year. A similar analysis has been conducted, which considers the yearly percentage of EC Communications related to entrepreneurship with respect to the total number of EC Communications. Results are shown in the Fig. 3.

### *Pre-processing and stemming*

Corpus EU Policy comes from electronic documents; therefore, they are unstructured texts and require two groups of tasks before the analysis, such as pre-processing and stemming. Following standard practices in text mining (Miner et al., 2012), the preparatory tasks include: (i) the tokenisation of the text to split it into indivisible words (e.g., ‘tokens’); (ii) data cleaning to remove numbers, punctuation and non-alphanumeric characters; (iii) normalisation of cases (i.e., convert words to lower case); (iv) filtering out the most common English stop words, such as articles or prepositions, since they are uninformative for text mining<sup>9</sup>; and (v) filtering out those tokens that contain less than three characters. The output of pre-processing is a tokenised corpus ready for stemming.

Stemming consists of reducing and grouping words to a common root or stem with the purpose of saving time and memory resources, as well as conducting a more meaningful analysis. This paper applies the Snowball algorithm, the newest version of the Porter stemmer (Porter, 2001) and one of the most popular stemming algorithms, which is a truncating method based on the idea that the suffixes in the English language are mostly composed by grouping smaller and simpler suffixes; thus, they could be removed under certain conditions and maintain their meaning. Typical results of this stemming are singular and plural nouns being reduced to the same token, and verbs with different conjugations being cut down to the same root.

The results of pre-processing and stemming for the two corpuses are as follows. The corpus EU Policy started with 31,283 root terms, which were reduced initially to 21,111 root terms after the

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<sup>9</sup> This fourth step is carried out by comparing a predefined, built-in list of words, which is provided by RapidMiner, the software used in the analysis. The list contains 452 English common terms such as ‘a’, ‘now’ or ‘yourself’. The whole list is configured as a Java class of the library WV Tool. Available at <https://sourceforge.net/projects/wvtool/>

stemming process and then to 9,013 root terms after pruning out the less frequent root terms<sup>10</sup>, seeking a trade-off between relevance of the terms and requirements in terms of process time and memory resources. The pruning process of the whole data set, before the analysis, is recommended in those cases where there is an excessive number of terms, as this is the case with more than about 10,000 terms per corpus (Ertek, Tapucu, & Arin, 2013).

### *Data Analysis*

The analysis of the data starts with the creation of the word vectors that numerically represent the documents from the tokens, resulting from the above processes. This is done via the Term Frequency-Inverse Document Frequency (TF-IDF) which is a numerical statistic that reflects the relative importance of a word in a given document by comparing it to the importance of the word in the rest of the documents of the corpus. For a given term of a document, TF-IDF value is proportional to the frequency of the word in the document, but it is balanced by the frequency of the word in the rest of the documents of the corpus as a way to evaluate the real importance of the word by considering that some words are naturally more common than others. The result is a term-document matrix composed by word vectors, representing the relationship between terms and documents by means of a TF-IDF score—an already structured data that now is possible to analyse. Taking these structured data as an input, the first step of the analysis has involved the study of evolution along with time of the relevance of the main words and concepts within the corpus.

Then, the next stage is conducting a cluster analysis. In the context of text mining, clustering enables categorisation of a number of documents in a limited number of coherent clusters, each of them around a specific theme, concept or meaning. The aim of clustering is to obtain groups that present a high intra-cluster similarity, so documents within a cluster are similar; and also, a low inter-cluster similarity, so documents from different clusters are dissimilar. For this, clustering requires an adequate definition of the metric for similarities between documents of each corpus as a previous

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<sup>10</sup> Root terms with less than 40 occurrences were pruned out.

step for the cluster analysis itself. Typically, since at this point of the analysis documents are represented as vectors, similarities between two documents are basically some form of correlation between their respective vectors. In this paper, the authors have opted to use Euclidean distance, which is one of the most popular and frequently used techniques (Hotho et al., 2005; Jain, 2010; Lin, Jiang, & Lee, 2014).

Additionally, it is necessary to choose a clustering algorithm. This algorithm defines how clusters are composed, that is, how to search and assign documents into clusters. There are several types of algorithms, depending on the heuristics to start the clustering, such as hierarchical clustering, partitioning clustering or density-based models. In the case of the this paper and considering the large amount of text data, we have opted to use the standard K-Means—a partitioning clustering algorithm—because this type of algorithm has been outlined as the best trade-off option, in terms of clustering performance and computational requirements (Cutting, Karger, Pedersen, & Tukey, 1992). In general, partitioning clustering algorithms represent a cluster by means of the centre of the cluster (i.e., centroid object). The idea is that documents in a cluster are closer to the centroid of that cluster than to any other centroid of the rest of the clusters. Standard K-Means is a popular iterative, partitioning clustering algorithm that considers items as vectors and the similarity between them is based on a measure of their distance, which is represented by the Euclidean distance in this case. First, it starts with a partition of the items or documents in a pre-defined number of  $k$  clusters, and then it makes an initial determination of the centroids of each cluster. After that, documents are assigned to the cluster for which they are more similar, and then centroids of the  $k$  clusters are recalculated and updated based on the current status. The process is repeated several times until the centroids remain constant. During the analysis, this paper has opted to use an improved version of K-Means with a randomised seeding technique and a maximum number of ten runs of the algorithm, looking for a trade-off between quality of the clustering process and computing resources consumption.



It is worth to note that, as it generally occurs in partitioning clustering algorithms, the number of clusters,  $k$ , is an input parameter that should be specified a priori by the user in K-Means. For this reason, as part of the cluster analysis, the clustering results have been checked for a range of values of  $k$ . Where possible, it is also recommended to conduct some diagnostic tests to determine, theoretically in advance, the best number of clusters for each data set. This paper has combined the qualitative examination of the clustering results for  $k$  values, from 4 to 13, with the comparison of the Davies-Bouldin index values of each clustering result. The Davies-Bouldin index (Davies and Bouldin 1979) measures the similarity within a cluster (i.e., compactness) and the dissimilarity with the rest of the clusters (i.e., separation); thus, it evaluates the appropriateness of various divisions of the data, considering that the lower value of Davies-Bouldin index means a better clustering result (Arbelaitz et al., 2013; Rendón, et al., 2011).

The analyses within this paper has been developed considering the whole period, 1990–2016, and also examining five-year terms since 1990, with the exception of the last period (2015–2016), which only comprises of two years. As previously mentioned, this choice is based on the typical EU policy cycle, considering that a new college of Commissioners is appointed approximately every five years.

### *Software*

RapidMiner<sup>11</sup> has been the baseline software to conduct the different analyses of this paper. RapidMiner is an open source platform that supports multiple applications on the field of data science; for example, the text analytics add-on extension that was used in this paper. Some of the advantages of RapidMiner are the existence of a wealth of official documentation, a well-structured online community, a copyleft license and the ability combine and extends its use with Python™ or R scripts. The analyses have been complemented with Microsoft Excel.

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<sup>11</sup> Documentation for RapidMiner Studio and a free version of the software can be downloaded at:

[www.rapid-i.com](http://www.rapid-i.com)

## Results of the analysis

### *Preliminary analysis*

The preliminary analysis consists of the absolute word frequency, measured as the total occurrences of a word within the corpus EU Policy after having pruned out irrelevant elements and consolidating those terms with similar meaning by using the Porter stemmer as explained in previous methodology section.

Fig. 4 shows the most repeated words stems in the whole corpus. *State, country, member* and *nation*, all gathered as a single term, are the most repeated concepts in this corpus, followed by *European* at 2<sup>nd</sup>, all of which are rather obvious results for EC documents. Considering topics related specifically to the economics of entrepreneurship, *employ, work, labour* and *job*, grouped as a single concept, rank at 3<sup>rd</sup> in the analysed EC Communications; followed by *market* at 6<sup>th</sup>, *economy* at 7<sup>th</sup>, *sector* at 17<sup>th</sup>, *industry* at 29<sup>th</sup> and *growth* at 30<sup>th</sup>, thus, highlighting which are the policy priorities at the EU. In addition to *policy*, which appears at 5<sup>th</sup> place as the general theme of this research, a number of related terms surface in the corpus, such as: *programme* at 8<sup>th</sup>, *support* at 10<sup>th</sup>, *measure* at 16<sup>th</sup>, *strategy* at 34<sup>th</sup>, *competition* at 38<sup>th</sup>, *plan* at 47<sup>th</sup>, *regulation* at 63<sup>rd</sup> and *legislation* at 66<sup>th</sup>. *Innovation* appears at 18<sup>th</sup>, accompanied by *research* at 19<sup>th</sup> and *technology* at 32<sup>nd</sup>, which are indicators of the high relevance attached to new technologies as the base for innovation and entrepreneurship from the point of view of policymakers. Financing-related terms are a next group of interest, with *finance* at 12<sup>th</sup>, *fund* at 20<sup>th</sup> and *invest* at 22<sup>nd</sup>.

A significant group of terms are those related to education, with *education* at 28<sup>th</sup>, *train* at 39<sup>th</sup> and *skill* at 70<sup>th</sup>, which points to a gap in the investigation on human capital in the entrepreneurship policy research agenda, due to its absence there. The business perspective is represented by *firm, company* and *enterprise*, all of which are grouped-ranked at 14<sup>th</sup>, while *business* is at 26<sup>th</sup> and *entrepreneur* is at 180<sup>th</sup>. The social point of view is quite frequent, since the term *social* emerges at 11<sup>th</sup>, with *people* at 44<sup>th</sup>, *sustainability* at 55<sup>th</sup> and *participation* at 61<sup>st</sup>. From a geographical point of

view, in addition to the European and national references, the regional level is also significant with *region* at 23<sup>rd</sup>.

Similar studies were carried out in each five-year period, since 1990–2016, except for the last period (2015–2016), which only comprises of two years. Results are shown in the Online Supplemental Data (Figs. 1–6), and they have been considered as an input to extract the conclusions.

### ***Cluster analysis***

The next stage in the analysis consists of the usage of the K-Means clustering algorithm to group similar documents of the corpus together and drill into the categorisation and relationships between terms. The K-Means algorithm needs the a priori selection of the optimal value for the number of clusters. For this reason, this paper starts with a subsequent evaluation of the K-Means clustering results for a range of values of *k*, from four to thirteen, by comparing their performance using the Davies-Bouldin Index. In fact, the standard approach for the selection of the number of clusters in partitioning algorithms, such as K-Means, is determined typically by running independent analysis for different values of *k* and evaluating the significance of resulting partitions (Jain, 2010).

In this case, the Davies-Bouldin index minimum values correspond to nine, eleven, twelve and thirteen clusters. Therefore, this paper examines the results of the analysis from four to thirteen clusters. Starting with four clusters, the groups result in: (i) *Digital Technologies–Innovation–Research*; (ii) *Primary sector–Culture–Environment–Energy*; (iii) *SMEs–Business–Finance*; and (iv) *Education–Inclusion*. The five-cluster partition isolates *Migration* as a particular topic in a specific group. In the case of six clusters, *Migration* merges with *Digital Technologies–Innovation*, and *Research* emerges as a separated theme from *Digital Technologies–Innovation*. Advancing to seven clusters, *Migration* becomes a separated topic again and both *Research* and *Primary sector–Culture* are also separated from *Digital Technologies–Innovation* and *Environment–Energy*, respectively. Eight clusters introduce *Employment* as a new theme, grouping concepts related to labour. The nine-cluster partition adds a broad new cluster that could be summarised as

*Infrastructures–External relations*. Likewise, that broad new cluster is split in two in the ten-cluster analysis, being *Infrastructure* and *External relations*. In the eleven-cluster analysis, *Taxation–Regulation* is separated from *SMEs–Business–Finance*. The twelve-cluster analysis divides *Digital Technologies* and *Innovation–Research* in two separated clusters, and it maintains the rest of the themes. Finally, the thirteen-cluster analysis separates *SMEs–Business* from *Finance*, and it maintains the rest of the aforementioned themes. From the authors’ perspective, this thirteen-partition clustering is a rather meaningful combination of the main themes for entrepreneurship policy in the EU.

Results of the cluster analysis are summarised in Tables with captions

**Table 1** for the thirteen clusters, by means of the top 20 concepts in each case. Similarly, the remaining results of the supervised cluster options are shown Tables 1–9 in the Online Supplemental Data. Likewise, the defining topics of each cluster could be used to classify the EC Communications related to entrepreneurship policy, as shown in Fig. 5.

The next step of the cluster analysis is to study the evolution of the thirteen-cluster partition by lustrums during the period 1990–2016. Fig. 6 shows the results of this analysis. Some of the more remarkable differences, among periods for each theme of the thirteen-cluster partition, are exposed in the following. The cluster on *Research–Innovation* peaked during 2000–2004, just when the Lisbon Strategy was adopted, and it remained stable until 2015. *Digital Technologies* presents a similar behaviour, with a peak in the number of documents up to 2015, correlating with the launch of the Digital Single Market Strategy in 2015 and the legislative initiatives connected to relevant topics—like collaborative economy or digital platforms. The relevance of *SMEs–Business* grew from 1995 to 2014 and then decreased dramatically, which was coherent with the deceleration of the specific SME policy developed by the EC. *Regulation–Taxation* increased the number of documents since 2005, simultaneously with the global financial crisis that burst in 2007–2008 and the subsequent period of recession and public intervention. *Finance* became relevant since 2000 and shows a significant

growth in the percentage of documents belonging to this topic in the last period, 2015–2016, highlighting the recent interest on public support through venture capital of entrepreneurship.

The behaviour of *Inclusion* presented a peak in 2000–2004, when the Lisbon Agenda was adopted, but it decreased in 2005–2009; however, it started to grow again in 2010, as a consequence of the adoption of the Europe 2020 strategy. *Employment* reached a maximum in 2000–2004 when entrepreneurship was considered as a pivotal activity to reduce unemployment; however, it started to decline in 2010 when most of the goals of the Lisbon Agenda were not achieved. On the other hand, *Education* became relevant in 2000 and strengthen its position by 2005, coinciding with the Lifelong Learning Programme launched by the EC in 2007 and the later consideration of entrepreneurial skills as key competences. Similarly, *Environment–Energy* grew by 2005 and reached a maximum number of documents in 2010–2014, coherent with the focus of the Europe 2020 strategy on sustainability and efficiency in the use of resources. *Tourism–Culture–Primary sector* is a broad topic that reached its maximums during 2005–2014 and then declines. Similarly, *Infrastructures* grew during 2000–2010, coinciding with some standardisation and interoperability initiatives at the EU level. Finally, *Migration* emerged in 2005 and picked up momentum again in 2015; whereas, *External relations–Justice* had a peak in the number of documents during the accession of East European countries in 2000–2004, and it increased again in 2015, as a consequence mostly of the new negotiations about trade agreements.

## **Findings and discussion**

This paper uses text mining to analyse 576 EU policy documents related to entrepreneurship (communications from the European Commission) with the aim of mapping the key concepts and themes that have shaped the entrepreneurship policy agenda in the EU during the 1990–2016 period and their evolution considering the EU policy cycle. The results of the analysis display the most frequent words within the corpus, both for the whole period and also in five-year terms. In addition,

results from the cluster analysis show how the documents are distributed among thirteen key topics for the EU policy agenda on entrepreneurship.

The authors' interpretation of the results is summarised in Table 2, which suggests a new and more granular and complete view about the evolution of the entrepreneurship policy agenda in the EU than previous attempts. Based on these results, this paper proposes a division of the learning curve of EU policy ideas into three main stages which, in turn, are separated into six sub-stages. These six sub-stages coincide, largely, with the different EU Commissions in office since 1990.

***a. Latent EU entrepreneurship policy (up to late 1990s)***

This first stage is hardly characterised by any specific entrepreneurship initiative. Only general enterprise-encouraging policy is applied to support SMEs and entrepreneurs. Almost up to the end of the 1990s, entrepreneurship was not even explicitly stated. This period would essentially correspond, in time, to the four consecutive stages of *denial*, *recognition*, *envy* and *consensus* that previous authors (Audretsch and Thurik 2010) have identified, however, with some particular notes. This paper splits those stages into two sub- stages.

***a1. Oblivion (up to mid-1990s)***

At the time, European policymakers aimed to promote the EU industry and large companies within traditional sectors, as a way to face unemployment challenges. From the point of view of economic policy principles, the ideas of Jean-Jacques and Servan-Schreiber (1968)—about the promotion of larger companies as the way to increase European competitiveness—were, at some extent, still present when the Cecchini Report (1988) made the economic case for the Single Market, thus, emphasising gains due to the economies of scale.<sup>12</sup>

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<sup>12</sup> The industrial policy developed by Delors' Commissions was mainly based on the aim of capitalising the opportunities offered by the Single Market. Even the '*White Paper on Growth, Competitiveness, and Employment*' (1993) was a late attempt, developed by Delors' cabinet, to include new approaches for the

Entrepreneurship, although already known at the time<sup>13</sup>, including its potential on employment and economic growth<sup>14</sup>, is not only unconsidered within the core strategy, but it is almost not even mentioned as such. The geographic dimension of the policy measures is strictly European and, as much, at national level. In this context, technology is considered as the key production factor. However, the relevance of ICT, as a whole, is still limited, despite the high consideration about the relevance of telecommunications as infrastructures for the future<sup>15</sup>. It is also, at some extent, relevant in the role of research, although it is still far from the idea of innovation as a core engine in economic growth.

Therefore, the EU policymakers were rather focused on large companies and traditional employment growth policies.

This sub-stage is largely coincident with the *denial* stage presented in previous works (Audretsch and Thurik 2010)). This paper prefers the term *oblivion* since denial seems to imply a conscious decision on the side of EU policymakers, which is an intention difficult to prove from the text mining analysis.

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European economy development, which were not supported by the Member States (Ross and Jenson 2017).

<sup>13</sup> Since the late 1980s there were some references to the need of improving the business environment and promoting the development of enterprises, with particular references to SMEs; for example, the Council Decision of 28 July 1989.

<sup>14</sup> The conclusions of the Edinburgh European Council (1992) already mentioned the principles of ‘an action plan by the Member States and the Community to promote growth and to combat unemployment’. They also emphasised the role of SMEs for ‘creating jobs and stimulating growth’. These principles were even amplified by the conclusions of the Copenhagen European Council of 1993. These ideas were also gathered and, at some extent, developed by the ‘*White Paper on Growth, Competitiveness, and Employment*’ (1993).

<sup>15</sup> As an example, the Commission Directive, in ‘*Competition in the Markets for Telecommunications Services*’ (1990) already stated the essential role of telecommunications for the development of economic activities in the community.

*a2. Discovery (from mid-1990s to late 1990s)*

The mid 1990s were a turning point in the valuation that EU policymakers attached to the contribution of entrepreneurship to the European competitiveness. For the first time, SMEs and entrepreneurs gained their own space, but they were still incipient and, therefore, not always ingrained in the enterprise-support general discourse. The strategic change can be linked to the adoption of the plan, '*Small and Medium Sized Enterprises: A Dynamic Source of Employment, Growth and Competitiveness in the European Union*' (1995). Then, '*The Green Paper on Innovation*' (1995) introduced the principles that were developed later by '*The First Action Plan for Innovation in Europe*' (1996), '*Employment Guidelines*' (1998) and '*Fostering Entrepreneurship in Europe: Priorities for the Future*' (1998). All of them, together, constitute the genesis of an entrepreneurship policy in Europe, and they laid the foundations that later led to the Lisbon Agenda. Regarding other relevant features, technology continued to be viewed as a key production factor, and the relevance of ICT grew compared to the previous sub-stage.

As a consequence, this paper argues EU policymakers were still laying the bases to launch policies aimed at entrepreneurship and policy discourse on the topic is not far sophisticated. This sub-stage is approximately coincident with the *recognition* and *envy* stages presented in previous works (Audretsch and Thurik 2010). However, this paper prefers to insist in the relevance of '*awareness*', as it was in this period where the key concepts of the links between entrepreneurship and economy were rediscovered by EU policymakers.

***b. Emergent EU entrepreneurship policy (from early 2000s to 2010)***

The second stage gathers the initial steps of a practical entrepreneurship policy in the EU. From the previous stage political vision, SMEs and entrepreneurs are considered for the first time as standalone and relevant objectives of policy-making—being that the Lisbon Agenda (2000) is the key milestone. After an initial period featured by the political hype under the assumption of the theoretical outputs of entrepreneurship but hardly any implementation up to mid 2000s, EU



policymakers tried to initially launch specific actions based on previous diagnosis. Despite these efforts, the result was mainly a mixed bag of measures that combined protection to traditional SMEs and the creation of an enabling entrepreneurial environment, aimed at the increase of the number of this type of firms. From the analysis, this paper suggests distinguishing two sub-stages.

*b1. Hype (from early 2000s to mid 2000s)*

This period is characterised by an optimistic political vision on the benefits of entrepreneurship<sup>16</sup> European policymakers seemed convinced, at the time, about the need to develop a proper framework where European entrepreneurs, in a broad sense, could thrive, and this was seen as a means to boost European competitiveness. From the analysis, the focus of the EU Communications was on identifying the options on how to shape a conducive entrepreneurship policy from a top-down approach.

The topics and the approach of the EU Policy seem to relate with the interest on more sophisticated themes—such as, the relationship between entrepreneurship and employment, or the influence of innovation and research on role of digital technologies—and they also begin to broaden the scope of entrepreneurship as a way to achieve economic and social objectives, like gender equality or inclusion. However, through this theoretical advance, the analysis reveals that almost no relevant, specific initiatives were developed in this period. Also, although the role of knowledge continues to be acknowledged, apparently education does not have a crucial function yet.

Other works (Audretsch and Thurik 2010) ) mention a stage of consensus—about the need of shifting the European economy to be more entrepreneurial at about the same period—followed by a stage of attainment to implement it in the early 2000s. The authors consider that consensus is represented at a particular point in time with the Lisbon Agenda (2000), and that attainment only happened later (see below).

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<sup>16</sup> Giving continuity to the ambitions of the Lisbon Agenda (2000), Romano Prodi—President of the EC—delivered a speech in 2002, aiming to achieve a ‘new European entrepreneurship’ as the way to recover economic and social progress.

b2. *Pivot (from mid-2000s to 2010)*

After having recognised the lack of success for a range of policies, up to the start of this period, and the need of a new stimulus to the Lisbon Agenda<sup>17</sup> for a stronger position of the EU on innovation, the analysis of this period is characterised by the launch of specific initiatives to promote small businesses with an emphasis on the regional approach, in addition to the previous national and European dimensions. The aim seems to establish the proper conditions—mainly legislative and regulatory—which favour the launch and survival of SMEs under the principle, ‘Think Small First’.<sup>18</sup> Consequently, the analysis highlights SMEs’ policies as transversal and the distinct nature of the new ventures and entrepreneurs. The analysis also portrays education as a relevant theme for the first time. In fact, Oslo Agenda (2006) represents the first systematic policy approach to provide a framework for the entrepreneurship education in the EU, fostering the entrepreneurial mind-set in society and in all levels of education.

In addition, there are innovative elements in the policies that were not taken into account in previous stages. From the authors’ view, policymakers truly start to learn about the previous failures through a trial-and-error-process. Nevertheless, despite these initial steps towards the implementation of practical initiatives, the analysis indicates a mix of purposes, maintaining the traditional protection of small businesses while promoting the creation of an enabling entrepreneurial environment with the aim to increase the number of small firms.

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<sup>17</sup> The Report from the High-Level Group—coordinated by Wim Kok (2004)—about the progress of the Lisbon Agenda (2000), concluded with a call for action aimed at EU policymakers to change the course of implementation to prevent its failure. It was the base for the ‘*New Start for the Lisbon Agenda*’, launched by the EC in 2005, which attempted to give a new impetus that allows the EU to achieve the pending goals.

<sup>18</sup> The Community Lisbon Programme (2005) was the EC’s contribution to the partnership for growth and employment, which had been established by the new start for the Lisbon Agenda in 2005. To implement it, the EC launched the EC Communication, ‘*Modern SME policy for growth and Employment*’ (2005), which aimed to ‘provide a coherent framework for the various enterprise policy instruments and at making the ‘*Think Small First*’ principle effective across all EU policies’.

From this sub-stage onwards, there are no previous works from other authors that explain the learning curve of entrepreneurship policy in the EU and the present work is a novelty.

*c. The new normal for EU entrepreneurship policy (from early 2010s to 2016)*

After the worst of the financial crisis and having acknowledged the failure in meeting the objectives of the Lisbon Agenda<sup>19</sup>, European policymakers started to set up more targeted initiatives with a focus on both economic growth and the efficiency in the usage of available resources. Accordingly, and as pointed out in the analysis, quality of the start-ups and quantity of the business became relevant. Important elements from the text mining exercise, for this stage, are innovation and technology-based approaches to business creation. It is also remarkable how the focus increased on financial needs of business ventures and, consequently, the implementation of dedicated budgets and a range of instruments—such as, tax incentives, loans or even non-recoverable funds

From the analysis of the evolution of the main themes, this paper depicts two distinct sub-stages.

*c1. Minimum viable policy (from early 2010s to mid 2010s)*

Entrepreneurship policy in the EU starts to shift from generic approaches and SME-oriented policies to a more targeted entrepreneurial policy and, at the same time, there is a definitive reinforcement of European dimension specifically addressing previous failures. Thus, in addition to the aim of increasing the gross number of entrepreneurs in the EU, the quality of the entrepreneurial ventures starts to be evaluated. The analysis of the EU Policy documents points to the main examples of this latter trend: (i) the efficiency on the allocation of resources; (ii) giving priority to specific sectors; and (iii) an approach to entrepreneurship education that is focused on learning outcomes in terms of attitudes, knowledge and skills. Also, sustainability is, for the first time, a key element of

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<sup>19</sup> The official evaluation of the Lisbon Agenda occurred in March 2010 at the European Summit, where the new Europe 2020 strategy was also launched; however, there were already voices highlighting the existing problems. See, for instance, the Swedish Prime Minister Fredrik Reinfeldt, who declared—just prior to assuming over the revolving EU presidency in 2009—that ‘Lisbon Agenda has been a failure and should to be rebooted’ (Euroactiv 2009).

the EU policymakers' discourse. Finally, and also for the first time, social entrepreneurship becomes a core objective, in itself, and entrepreneurship is definitively considered as a tool to promote the inclusion among disadvantaged social groups.

The authors' choice for the name of this sub-stage tries to reflect the achievement of a targeted entrepreneurial policy and, therefore, similar to the minimum viable product of the lean approach to entrepreneurship—a welcome novelty in policy-making of this domain and a true result of the learning process.

#### *c2. Market launch (from mid 2010s to 2016)*

In this next sub-stage, the EU Policy approach to entrepreneurship continues to evolve with even more elaborated instruments and sophisticated evaluation processes based on the rising amount of available data on previous successes and failures. In particular, the analysis displays that fostering high impact and digital-based entrepreneurship has become central in this last sub-stage. Innovation and improving connectivity among the start-ups and the rest of the agents in the ecosystem—such as investors or research centres—are increasingly considered, despite the role of universities as such declines. The relevance of the generic denomination of SMEs becomes diluted and, on the contrary, start-ups and new technology-based ventures are considered as the main entrepreneurial agents. This brings to the forefront new policy challenges, such as regulations on collaborative economy, the role of platforms and privacy related issues.

Furthermore, an examination of the EU Policy documents reveals that, from previous focus on the creation of new ventures, the support now gravitates towards growth performance while siloed regional approaches lose momentum. In this sense, EU policymakers seem to consider that the EU entrepreneurial spirit has reached a sufficient level, but that it is needed to improve the context to help European start-ups to scale, first by easing the access to the internal market by means of promoting the investments and simplifying cross country tax systems and, second, by aiming to become worldwide leaders.

The evolution of entrepreneurship education continues through the consideration of entrepreneurship as a key competence for every EU citizen. Youth challenges continue to consolidate since the mid 2000s, as a strategic aspect and migration, and external affairs are also gathered in EU entrepreneurship related policy documents.

This last sub-stage is still very short to be fully evaluated but in authors' opinion EU Policy reaches certain maturity, developing themes from former stages. For this reason, the name of this sub-stage tries to represent the influence of the existence of a real market for entrepreneurship.

## **Conclusions**

The EU has been defined as the most complex socio-political and economic space in the world (Kleibrink and Magro 2018); it is obvious that there are a range of stakeholders that can influence on the agenda. This article draws from Pollack's definition of formal agenda-setting<sup>20</sup>. Although there are several EU bodies and institutions that produce a wide range of documents which shape the agenda, the executive branch of the EU, the EC, holds a monopoly in setting down policy proposals (Arndt Wonka, 2008) and this designates the EC a relevant position in setting the political agenda of the EU (Schmidt, 2000).

The study of the EU agenda through the lens of EC priorities is not new. Previous studies have analysed how the agenda has been set by different European Commission presidents by examining the thematic distribution of their respective speeches (Müller, 2017) and how the EC has led disparate EU policies: from mobile roaming regulation (Cini and Šuplata 2017) to social policy (Crespy and Menz 2015).

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<sup>20</sup> Pollack distinguished between formal and informal agenda-setting; formal agenda-setting involves institutions such as the European Parliament or the European Commission and informal corresponds to 'issue entrepreneurs' (Pollack, 1997)

With this background and drawing from theory on the policy cycle, the initial steps of agenda-setting and formulation stages where problems/issues are identified and then proposals for action are raised has been traditionally under researched in the case of entrepreneurship policy; at the same time, it has been noted as a cause of the lack of effectiveness of the entrepreneurship policy (Arshed, et al., 2014). Moreover, we know few details about the topics that have been central for the EU entrepreneurship policy agenda, when these topics have been leading policy efforts (public investment mechanisms and support, grants, research) and how they have evolved acknowledging the need to move from one priority to another.

The main contribution of this paper precisely lies on the identification of key concepts and the categorisation of main themes of this agenda, identifying the key constructs of each of the different policies and establishing appropriate stages for coherent sets of policies. A secondary contribution of the paper is to showcase the potential of text mining techniques to complement other qualitative approaches in the field of policy studies.

In conclusion, the analyses and results gathered in the paper show that the EU entrepreneurship policy agenda can be considered to have started in the early 2000s, coinciding with the launch of the Lisbon Agenda and has followed a learning curve during the last two decades, moving from vague and naïve support to increasingly targeted measures, and to early maturity. In particular, the results of the paper offer hints about the temporal dimension of the emergence, development and decline of the key topics and concepts that formed the entrepreneurship policy conceptual framework in the EU.

Policy rationales for public intervention within the field have evolved from general issues to confronting specific market failures (e.g., lack of access to sufficient investment, lack of skilled labour, or lack of support infrastructure) or systemic failures (e.g., the absence of entrepreneurial values in European society). The initial lack of information, due to the novelty of the field, has forced a trial-and-error process to expand knowledge on the context and specific needs of entrepreneurship, which has resulted in innovative policy ideas.

In addition, EU policy-making documents were compared for the main categories and through their evolution over time, considering the evolution of the EU policy cycle. In general, the focus of policymakers' discourse shifts every five years, coinciding with the EU policy cycle, suggesting that every new College of Commissioners intends to bring their ideas to the agenda. This evolution has not been completely homogenous: initially, themes appeared disconnected in time and scope, but later displayed potential influences and continuity from previous stages.

All in all, from the authors' point of view, the evolution of the EU entrepreneurship policy has undergone changes that mimic the standard entrepreneurial cycle of any venture: (i) conception or discovery of an idea to solve a customer's problem and initial enthusiasm; (ii) consecutive phases of developing the product/service, including troubles and adjustments of the initial idea until market launch; and (iii) the constant learning process associated with this life cycle. In the authors' view, a new normal of experimentation with policies in those domains with little prior knowledge is not only unavoidable but a rather logical consequence and a – sometimes neglected – rather efficient path to successful implementation.

This research is also significant in showing how text mining could complement and add value to other qualitative approaches when reviewing a policy field both from academic and policymaker perspectives. As demonstrated, text mining permits identifying key patterns, trends and shifts within the most relevant concepts and topics that have configured the policy discourse; thus, it can contribute to complex research tasks. In the particular case of the EU entrepreneurship policy agenda, the results of this paper accumulate relevant knowledge that could help the current policymakers look back and compare former theoretical priorities in the field with the later policy realisations.

Ultimately, analyses and results gathered in this paper are obviously a simplification of the evolution of the EU entrepreneurship policy agenda in this period because of the nature of the sample. First of all, this paper only considers EC communications; however, other policy and/or

legislation documents, such as legislative acts (directives, decisions, regulations), other non-binding documents (recommendations, opinions or nonpapers) or discussion documents (green papers or white papers) could be considered to obtain new insights. In addition, future works could add country-based policy documents in national languages to study cross-national similarities and differences between EU policy approach and the different national approaches. Finally, further analysis could also include the synchronous analysis of other stakeholders, such as academic research knowledge in this field, to try to establish potential links of influence between policy-making and academia, contributing to the debate about knowledge utilisation in policy-making – an area where there are considerable controversies (Daviter, 2015)

Nevertheless, this paper expects to contribute to the identification of the main themes that have configured the policy priorities of the EU in the domain of entrepreneurship, putting them in a temporal framework within the policy cycle, and showing how this policy cycle has shaped the agenda in this field. All in all, the authors strongly advocate for a better understanding of the learning curve in policymaking and, from here, for an entrepreneurial (lean) approach to policy-making in new domains. The main objective should be to gather enough – and promptly – iterations with the available resources, so as to effectively approach the real needs of customers: the EU entrepreneurial ecosystem stakeholders.

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## Tables with captions

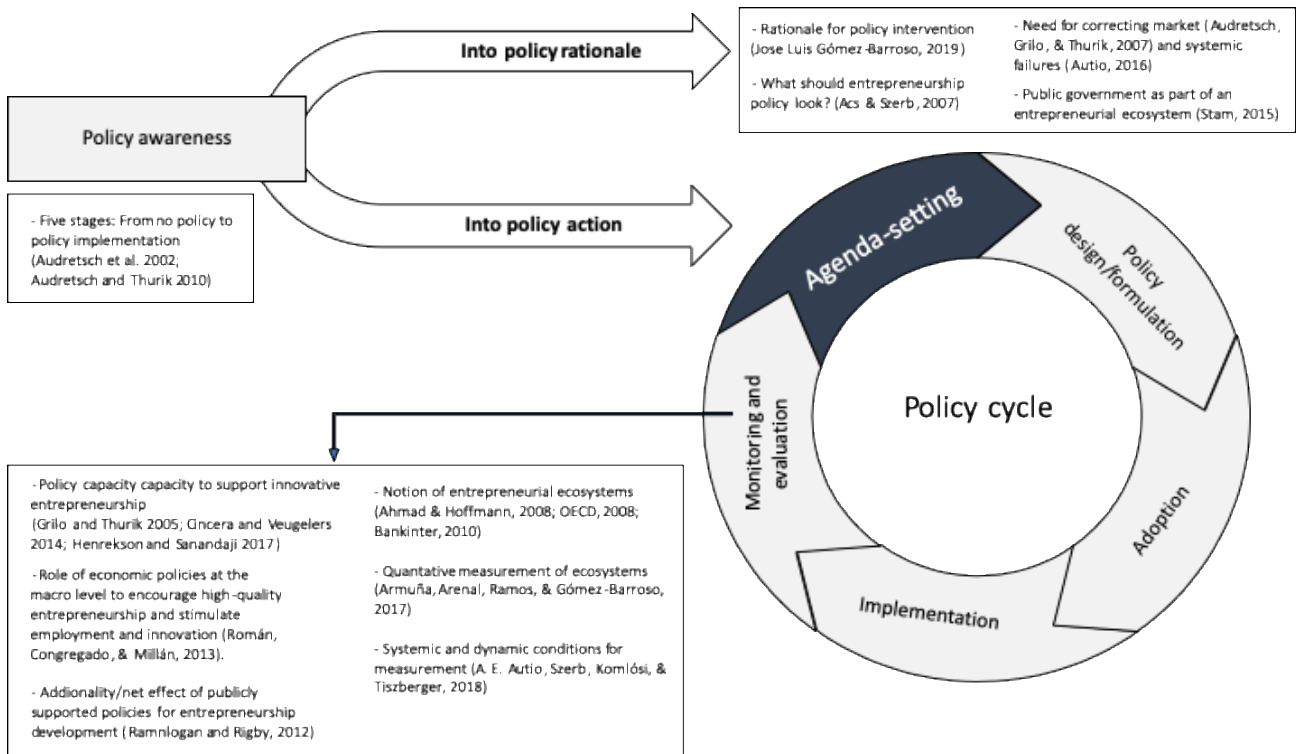
**Table 1** Top 20 relevant word stems for the thirteen-cluster analysis of the corpus EU Policy (1990–2016)

Order	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	<i>Research - Innovation</i>	<i>Inclusion</i>	<i>Taxation - Regulation</i>	<i>Education</i>	<i>Migration issues</i>	<i>Tourism - Culture - Primary sector</i>	<i>Employment</i>	<i>Environment and Energy</i>	<i>External relations - Justice</i>	<i>Infrastructure</i>	<i>SMEs - Business</i>	<i>Digital Technologies</i>	<i>Finance</i>
1	research	gender	tax	youth	migrat	tourism	unemploy	energi	textil	standardis	smes	ICT	euro
2	biotechnolog	women	crisi	educ	immigr	maritim	labour	carbon	Turkey	transport	craft	digit	ventur
3	patent	poverti	singl	learn	asylum	cultur	pension	eco	trade	safeti	entrepren	internet	EIB
4	innov	men	energi	teacher	refuge	heritag	Lisbon	emiss	WTO	Africa	enterpris	onlin	investor
5	scienc	equal	consum	student	visa	urban	wage	green	judici	railway	up	space	loan
6	panel	children	vat	school	irregular	marin	employ	raw	corrupt	port	bankruptcy	interoper	capit
7	cluster	mainstream	reform	languag	traffick	sea	worker	wast	court	rail	insolv	satellit	cash
8	excel	inclus	fiscal	lifelong	return	coastal	tax	electr	export	logist	burden	broadband	equiti
9	industri	discrimin	citizen	teach	resid	fish	ESF	environment	enlarg	aviat	multiannu	electron	bank
10	manufactur	famili	digit	univers	illeg	creativ	reform	renew	justic	accid	internationalis	commerc	EIF
11	knowledg	exclus	bank	train	admiss	rural	older	recycl	acqui	road	commerc	comput	currenc
12	ICT	disabl	transposit	skill	recept	ERDF	age	materi	solidar	health	busi	telecom	asset
13	technolog	health	stabil	peopl	seeker	fisheri	rate	climat	Balkan	navig	cluster	spectrum	payment
14	Lisbon	inequ	burden	adult	origin	citi	GDP	gas	food	African	micro	user	amount
15	horizon	decent	border	graduatu	arriv	farm	women	industri	negoti	energi	charter	deploy	pension
16	SMEs	pension	euro	mobil	eastern	biodivers	guidelin	water	parti	surveil	procur	data	liabil
17	societ	incom	enforc	qualif	host	travel	expenditur	fuel	reform	Galileo	vat	platform	debt
18	team	labour	procur	Erasmus	labour	local	gender	clean	energi	enlarg	failur	copyright	credit
19	ethic	care	unemploy	apprenticeship	border	agricultur	job	bio	Ukrain	infrastructur	observatory	telecommun	revenu
20	dissemin	age	recoveri	vocat	crime	anim	cohes	consumpt	Western	mode	ventur	signatur	statement

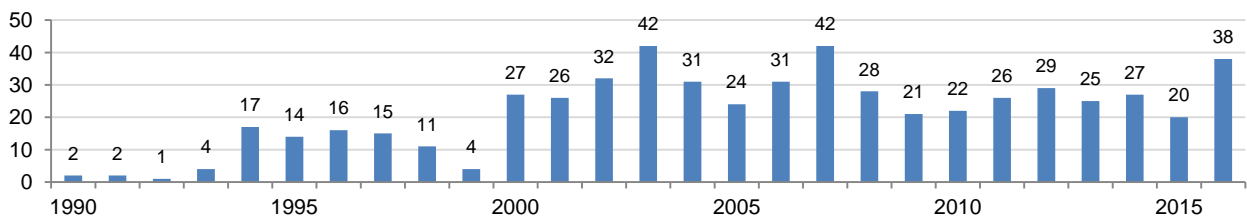
**Table 2** Stages of evolution of entrepreneurship policy in the EU (1990–2016)

STAGE	Main features	SUBSTAGE	Main features
<b>a. Latent EU entrepreneurship policy</b>	<ul style="list-style-type: none"> <li>• General enterprise policy is applied to both SMEs and entrepreneurs.</li> <li>• European and, to a lesser extent, national dimensions.</li> </ul>	<b>a1. Oblivion</b> (early 1990s–mid-1990s)	<ul style="list-style-type: none"> <li>• No specific measures for entrepreneurship.</li> </ul>
		<b>a2. Discovery</b> (mid-1990s–late 1990)	<ul style="list-style-type: none"> <li>• Preliminary mentions up to the end of the period.</li> </ul>
<b>b. Emergent EU entrepreneurship policy</b>	<ul style="list-style-type: none"> <li>• Greater focus on the diagnosis of a proper framework for SMEs and entrepreneurs rather than implementation.</li> </ul>	<b>b1. Hype</b> (early 2000–mid-2000s)	<ul style="list-style-type: none"> <li>• SMEs and entrepreneurship as specific agents of public intervention.</li> <li>• Entrepreneurship begins to be considered not only as an economic but also a social engine.</li> <li>• Diagnosis of the needs, but still a lack of specific initiatives.</li> </ul>
		<b>b2. Pivot</b> (mid-2000s–late 2000s)	<ul style="list-style-type: none"> <li>• From hype to implementation. SME Policy.</li> <li>• First policy approach to provide a framework for entrepreneurship education (entrepreneurial mindsets).</li> </ul>
<b>c. The new normal for EU entrepreneurship policy</b>	<ul style="list-style-type: none"> <li>• Growing interest in environmental issues and efficiency of resource consumption, not only economic growth.</li> <li>• Quality of ventures begins to be relevant.</li> </ul>	<b>c1. Minimum Viable Policy</b> (early 2010s–mid-2010s)	<ul style="list-style-type: none"> <li>• Revising the essentials.</li> <li>• Environmental issues and sustainability gain momentum. Consolidation of the social goals of entrepreneurship.</li> <li>• Entrepreneurship education approach widens the scope (attitudes, knowledge and skills).</li> </ul>
		<b>c2. Market Launch</b> (mid-2010s–in progress)	<ul style="list-style-type: none"> <li>• Targeted support of high growth entrepreneurship, mainly digital-based.</li> <li>• Broad focus on agglomeration and also internationalisation of business ventures (both EU internal market and worldwide).</li> </ul>

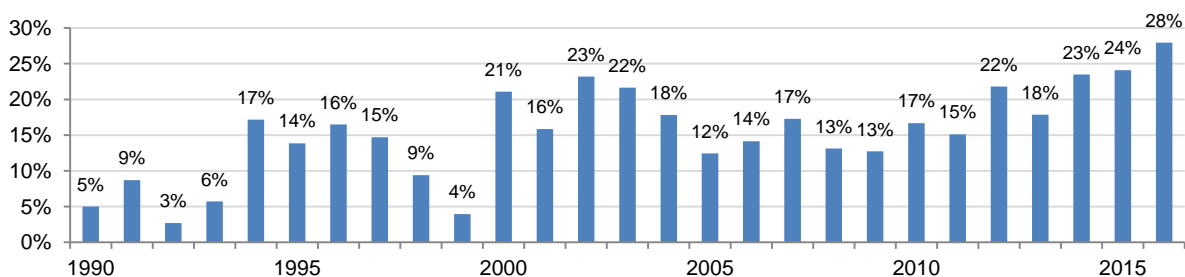
## Figures



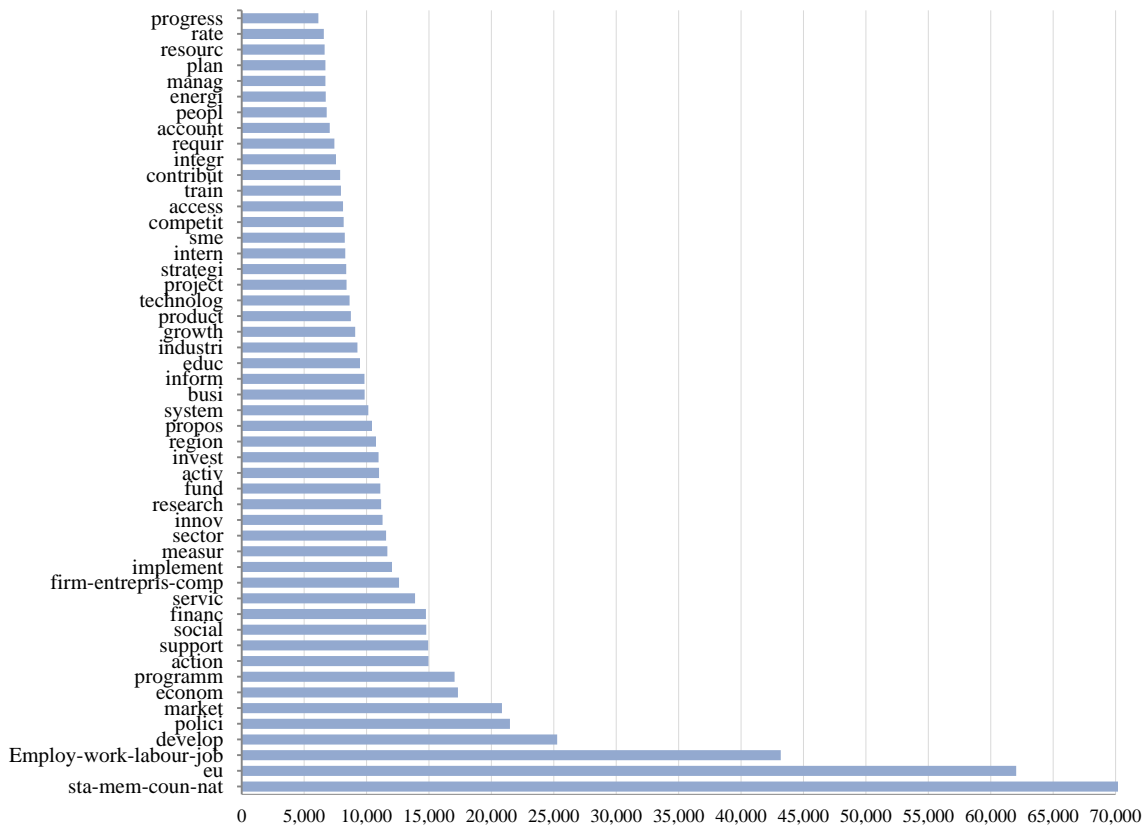
**Fig. 1** Conceptualization of the policy cycle process and its link to research focus on entrepreneurship policy. The paper focuses on the dark shaded area. Source: Own elaboration.



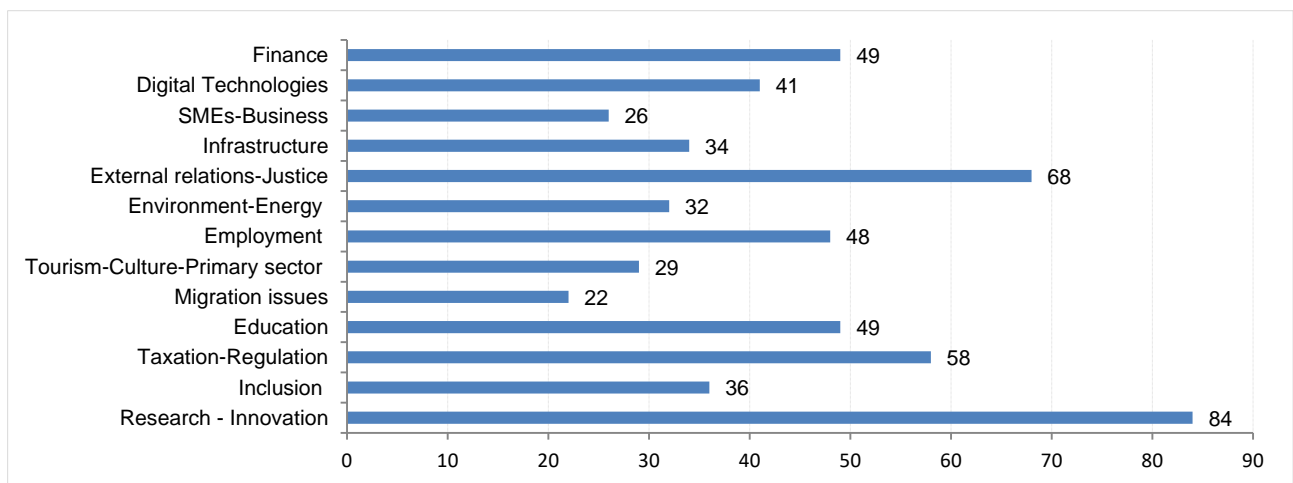
**Fig. 2** Evolution of the total number of EC communications related to entrepreneurship and start-ups per year within the period 1990–2016



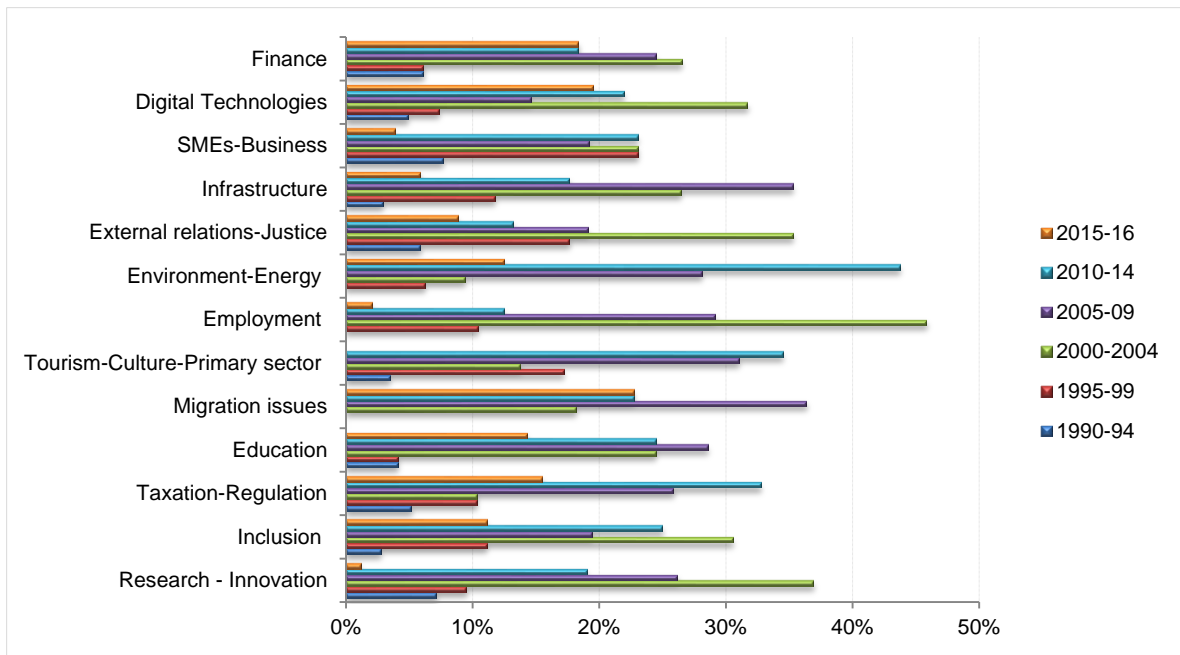
**Fig. 3** Percentage of EC communications related to entrepreneurship per year with respect to the total number of EC communications.



**Fig. 4** Top 50 most frequent word stems within the corpus EU Policy by absolute number of occurrences (1990–2016)



**Fig. 5** Distribution of EC Communications (Corpus EU Policy) related to entrepreneurship for the thirteen-cluster taxonomy (1990–2016)



**Fig. 6** Evolution of the relative weight of EC communications related to entrepreneurship in the thirteen-cluster taxonomy for each five-year period (corpus EU Policy, 1990–2016)

## List of figures

**Fig. 7** Conceptualization of the policy cycle process and its link to research focus on entrepreneurship policy. The paper focuses on the dark shaded area. Source: Own elaboration.

**Fig. 8** Evolution of the total number of EC communications related to entrepreneurship and start-ups per year within the period 1990–2016

**Fig. 9** Percentage of EC communications related to entrepreneurship per year with respect to the total number of EC communications.

**Fig. 10** Top 50 most frequent word stems within the corpus EU Policy by absolute number of occurrences (1990–2016)

**Fig. 11** Distribution of EC Communications (Corpus EU Policy) related to entrepreneurship for the thirteen-cluster taxonomy (1990–2016)

**Fig. 12** Evolution of the relative weight of EC communications related to entrepreneurship in the thirteen-cluster taxonomy for each five-year period (corpus EU Policy, 1990–2016)