



Paper to be presented at the DRUID Academy Conference 2016 in Bordeaux, France on January 13-15, 2016

## **Innovation Policy for Challenge-Led Socio-technical Transitions**

**Gijs Diercks**  
**Imperial College London**  
**Centre for Environmental Policy**  
**[g.diercks14@imperial.ac.uk](mailto:g.diercks14@imperial.ac.uk)**

### **Abstract**

Innovation Policy for Challenge-Led Socio-technical Transitions Gijs Diercks – Imperial College London 2nd year PhD. Expected final date: July 1st, 2017 [g.diercks14@imperial.ac.uk](mailto:g.diercks14@imperial.ac.uk) State of the Art In the 20th century, innovation became directly linked to competitiveness and seen as a major source behind economic growth. Consequently, academics and politicians were increasingly interested in the promotion of innovation (Fagerberg, and Verspagen, 2009; Perren and Sapsed, 2012) up till the point that innovation equalled science-driven and technology-mediated progress (Godin, 2008; Stirling 2009). However, the last decade has seen a shift in innovation policy of which the sources are twofold. In the first place it embraces a much broader model of innovation than before, emphasising among others its interactive nature (Jensen et al, 2007), the role of users (von Hippel, 2005) and the notion of openness (Chesbrough, 2003). Secondly, a normative turn is advocated, where innovation is explicitly addressing a set of wider societal targets sometimes called 'grand challenges' (Kuhlmann and Smits, 2014; Steward, 2012). Research Gap Little research has been done on identifying these discursive shifts and how associated new ideas are adopted and structured by policy documents and institutionalised in policy practices. This paper looks at current developments of 21st century innovation policy of the EU. It observes changes in innovation discourses, their structuration in policy documents and their institutionalisation in daily practices that move beyond a narrow science-based and competitiveness-driven. The main research question is: how is EU innovation policy and practice responding to 'grand challenges'. Theoretical Arguments This research challenges the rational model of policy change in which new information leads to policy adaptation, since it does not provide a satisfactory explanation for observed policy change and divergence. Instead, this research takes an approach in which ideas matter and together with institutions and interests shape policy outcomes (Kern, 2011). It argues that ideas influence policy making through the consecutive phases of discourse creation, structuration and institutionalisation. It argues that the creation of discursive structures is not random, but it's the outcome of a struggle between various parties that have not necessarily met, but share similar storylines; particular ways of talking and thinking about a topic. By doing so, they form discourse coalitions responsible for producing, reproducing and at times transforming discourses (Hajer, 1995). Discourse are therefore the result of a constant underlying power struggle between different discourse coalitions competing for influence. Identifying different discourses will tell you something about this underlying power struggle. The importance of unravelling these power struggles lies in the Foucauldian model of social change in which structural changes in society can be conceptualized as shifts in the relevant influence of different systems of meaning, i.e. different discourses (Sharp and Richardson, 2001).

Method The methodology used is argumentative discourse analysis applied through structural coding of strategic policy documents produced over the last decade. The argumentative analysis looks at the particular position that is being defended by a certain statement, or against which criticisms are being expressed. This builds on the so-called argumentative turn in discourse analysis (Billig, 1986), in which any expression of language is seen as part of a dialogue, embedded in but also actively shaping discursive structures. Results The result is the display of a struggle between four different meta-discourses identified in the theoretical framework of this paper. Traces of all discourses are being manifested in the policy documents, but over the last decade a clear shift towards a more broad-based and challenge-led approach is observed. Future research will focus on the embeddedness of this new discourse in the daily policy practices of a number of EU organisations.

# Assessing the uptake of a ‘third generation’ challenge-led and broad-based innovation by the European Union

Gijs Diercks<sup>1\*</sup>

<sup>1\*</sup> Imperial College London, Centre for Environmental Policy, PL 1000, London, United Kingdom

\* g.diercks14@imperial.ac.uk

**Keywords: Innovation Policy; Challenge-led; Broad-based; European Union; Discourse Analysis**

## FINAL PAPER

### 1. Introduction: the emergence of a third generation of innovation policy

Policy for the advancement of innovation has been under a growing attention of both social scientists and policy makers. Fagerberg and Verspagen (2009) quantified the enormous increase in academic attention, observing a relative increase of factor twenty between 1960 and 2006. Perren and Sapsed (2012) identify a similar trend in politics, showing that in the UK there has been a tenfold increase in the use of the term in parliamentary debates between the 1960s and the 2000s.

This attention can roughly be divided into two phases. Until the 1980’s, Innovation policy making was dominated by mission-led support for military technologies and civil engineering technologies and was usually labelled as Science & Technology policy (Borras, 2009). However, in the past decades the national and regional innovation systems have established themselves as the main analytical framework for the promotion of innovation and can be seen as the second generation of innovation policy. It has been of major influence to policy makers, forming the basis of many policy strategies (Borras, 2009; Lundval, 2007). This second generation of innovation policy did not fully replace the first, but can be seen as layered upon each other, extending the overall agenda.

A number of prominent scholars suggest we are currently witnessing a new shift to what can be understood as a third generation innovation policy making. This new policy agenda has an interest in innovation to not only boost competitiveness and economic growth, but also direct our innovative efforts by explicitly addressing societal challenges such as demographic change (aging population), growing health costs, environmental sustainability, or energy/resource security. As these challenges are deeply embedded in our systems of production and consumption – in our daily lifestyles – it acknowledges that the ability to address them will need the direct engagement of a diversity of ‘social partners’ such as public authorities, economic actors and citizens alike (Steward, 2012). In short, this shift can be understood as having two main dimension, moving the agenda in the direction of both a more broad-based and challenge-led approach. By doing so, it contests both the mission-oriented innovation model and the innovation systems framework

This paper is structured as follows. The second section of this paper will introduce a framework for understanding the current shift in innovation policy resulting in four distinctive meta-discourses. In section three, a methodology is presented with which I use the presented framework to assess the uptake of a more challenge-led and broad-based agenda. The fourth part of this paper uses this approach to see how these discourses are being structured and institutionalised in innovation policy of the EU. Section five will draw some conclusions and suggests further research questions.

## **2. A framework for understanding innovation discourses**

This section will introduce a framework to understand different innovation policy discourses and argues that the third generation of innovation policy making can be understood as both a further broadening of the concept of innovation and the introduction of an explicitly challenge-led agenda.

### **A broader concept of innovation**

The first generation of innovation policy had a very narrow understanding that focussed on science as the source of all innovation and technology as the means to transfer its benefits to society. A linear model of diffusion dominated the discourse and market failures were identified to legitimise policy interventions. The second generation of policies embraced a broader framing, meaning that innovation is not done by lone actors or organizations (scientists, firms), but that it happens in systems. A systemic view of diffusion means that innovation takes place in a broader network of interactions with other actors, institutions and even infrastructures (wieczorek et al, 2012). Innovation is not only understood in terms of technology, but also in business models, legislation, design, operations, etc. Consequently, not only narrow market barriers but also additional cognitive, social, institutional and political barriers are seen as critical for innovation (Smith, 2010).

I argue that the recent ‘third generation’ practice-based approaches such as user-driven (Von Hippel, 2005), open (Chesbrough, 2003) and social innovation (Sharra and Nyssens, 2010) are a further opening of the innovation system by the inclusion of novel actors and institutions and hence a further broadening of the concept, in which innovation can simply be understood as new ways of doing things. Advocates of a broad-based approach argue that the current framework has too much emphasis on actors within the field of science and technology as a source of innovation (Caraca et al, 2009), presenting a number of novel insights. The most important ones are (1) an acknowledgement of the existence of different modes of innovation and types of knowledge (Jensen et al, 2007), and (2) broadening of what can be considered an innovation actor (Rip et al, 2010; Bogers et al, 2010; Sharra and Nyssens, 2010). Consequently, a broader understanding of the concept is adopted and is not limited to new technologies alone. Innovations can take many forms such as novel advances in organisations, services, business models or new social practices. While science remains important as a fundamental source of innovation, seeing science as a direct source, or even the only major source, is counter-effective. More attention is given to interactive learning by firms, and managing feedback from the broad social and institutional environment. It acknowledges that the ability to achieve this will need the direct

engagement of a diversity of ‘social partners’ such as public authorities, economic actors and citizens alike. (Steward, 2012).

It is important to emphasise that these shifting paradigms did not fully replace each other but layered upon each other. This means that in addition to a healthy science-base, the focus of innovation policy expanded to also cover a well-functioning innovation system. The later inclusion of user-driven, open and social innovation can be understood as a whole-of-society approach where the aim is to create an environment in which the entire society participates in innovation processes.

### **Shifting policy objectives**

The first two generations of innovation policy have a different understanding about the determinants of innovation and appropriate policy instruments, but their objective was similar: providing competitiveness, jobs and growth. The third generation of innovation policy, however, is characterised by a drastic shift in objectives from competitiveness to addressing societal challenges. Advocates of a challenge-led approach to innovation move away from the unilateral performance-driven mantra that any is innovation good as it boosts economic competitiveness. The challenge-led approach is built around a number of insights. These are (1) an acknowledgement that innovations can have negative outcomes (Sveiby et al, 2012), and (2) a need for innovation policy to deal with current societal challenges (Kallerud 2013; Steward, 2008). This means a break with the over-reliance on market-based encouragement of the diffusion-oriented innovation policy led by business and a focus on additional systemic and directionality failures that justify different types of policy intervention (Weber and Rohracher, 2012).

Similar to the understanding of innovation, the policy objective experienced a gradual broadening of perspective. The first challenge-led approaches to innovation had a very narrow approach geared towards cleaner product, process or service innovation. This perspective was first broadened by looking at how entire sectors or industrial parks could be ‘greened’, including organizations across sectors and the development of greener goods and services across the lifecycle, and not just cleaner technology at the firm level (ibid). Smith et al argue that recent attention to the level of (socio-technical) systems of consumption and end-use can be seen as a further broadening of the problem-definition. In short, it defines the challenges around certain societal needs at the level of consumption (housing, food, waste, mobility) not just the products, services or even sectors providing these needs.

### **Identifying four meta-discourses**

By plotting the two dimensions – concept of innovation and policy objective – against each other one can create a matrix, as done in figure 1. Based on this it is theoretically possible to find an endless number of perspectives on innovation. However, I argue that the four quadrants depict four meta-discourse on innovation policy. The first discourse has both a narrow analytical framework and problem understanding and is the dominant science-based and performance-driven innovation discourse that developed throughout the 21st century and was the main informant of the first generation of innovation policy. I name this techno-scientific progress. The second discourse embraces a systemic view of innovation but has no explicit challenge-led

agenda. It has been the dominant informant of the second generation of innovation policy and is named Innovation systems. This discourse has been around since the late eighties but can be seen as evolving overtime, opening up further by including users and citizens as innovators, thereby embracing a whole-of-society approach. The third discourse on the bottom-right is still very much science-based but has a strong challenge-led agenda, I therefore name this discourse mission-oriented innovation. The third. The fourth discourse embraces a combination of both challenge-led and practice-based innovation and is called system innovation.

The remainder of this section will discuss each quadrant of this matrix in more detail, giving explicit attention to what extend these innovation discourses are likely to produce policies that might bring transformative change.

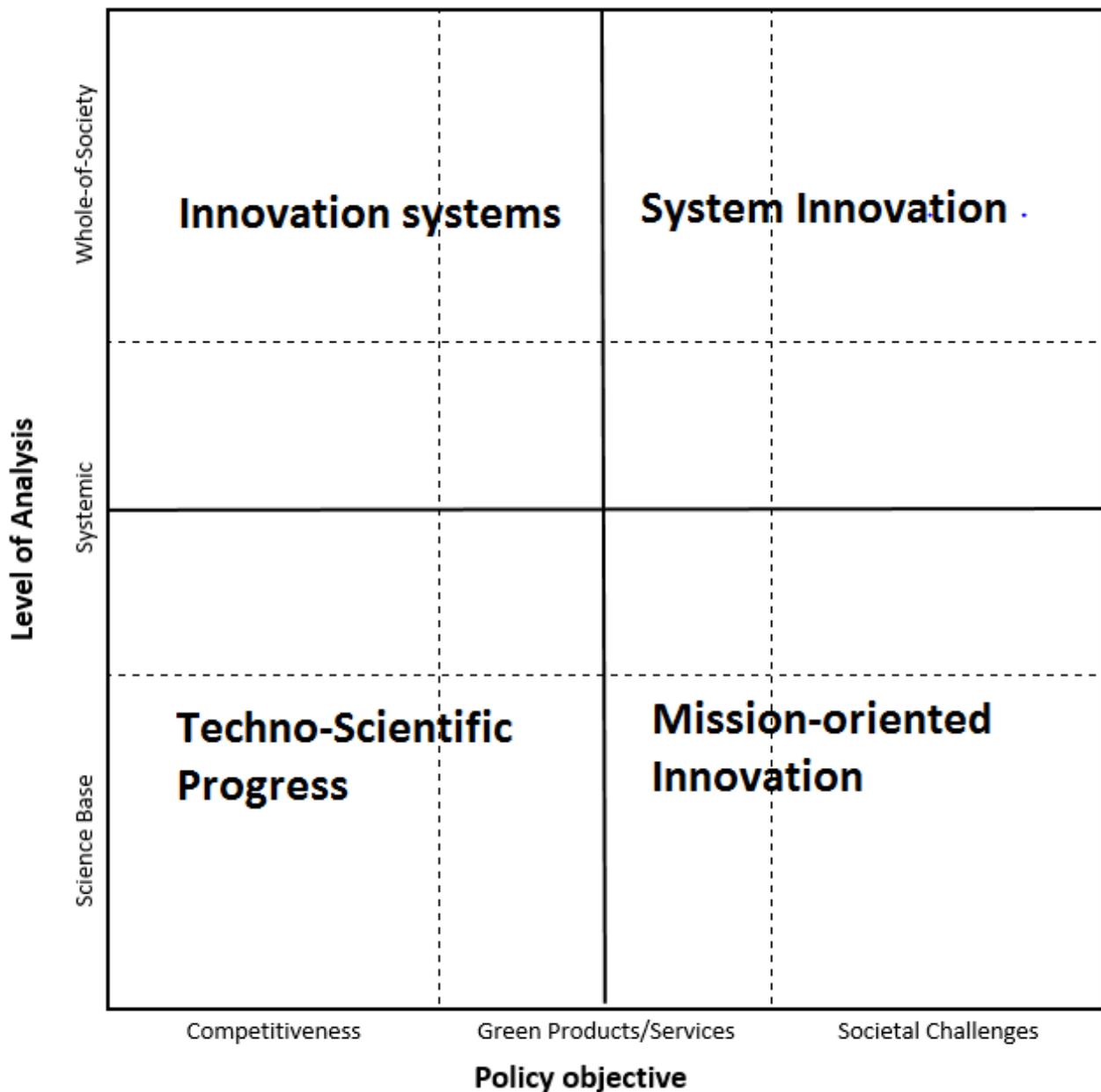


Figure 2: identifying four meta-discourses on innovation policy

## **A. Techno-scientific progress**

According to Rip et al (2010) techno-scientific promises lie at the heart of this discourse. It refers to a strong believe in science as a source of innovation, and new technology as its most important form of mediation. Techno-scientific promises are at the core of conventional Innovation System approaches and the main goal is to increase competitiveness of the economy of a region. The problem definition is narrowly defined around performance, meaning that the problem with innovation is that there is not enough of it. The promises refer to the underlying suggestion that if we create the perfect framework conditions for the innovating actors, then they will steer society towards further progress.

Policy intervention is justified due to market failures (e.g. knowledge spill-overs) leading to underinvestment in R&D or system failures (e.g. infrastructure and institutional) leading to path-dependencies, lock-ins and increasing returns to adaptation. Innovation policy has a focus on formal processes of R&D, and most common tools used are tax subsidies to R&D, training of scientists in high-tech fields, strengthening of linkages between firms and universities in these specific fields. Specific support to SME's and cluster forming is encouraged to escape lock-in.

Over the years, the analytical framework has broadened and goes beyond the Schumpeterian firm-based view as a networked approach towards diffusion of knowledge and commercialisation of inventions is embraced. However, basic science and R&D are still seen as the major, if not only, driver of innovation which means that the linear relation between science, technology and progress is very much alive. The important innovation actors are universities and business with a facilitating role for government. Other societal actors such as users, consumers or citizens are there to comply and conform, leading to the implicit or explicit assertions that 'Science is *the solution, society the problem*' (Rip et al., 2010). Knowledge is predominantly seen as something that is global and can be codified. Innovation is measured using surveys with formal benchmarking variables: R&D expenditures, patenting, and importance of tertiary education; the unit of analysis being the firm.

## **B. Innovation Systems**

The discourse on innovation systems take a systemic view, meaning that innovation takes place in a broader network of interactions with other actors, institutions and even infrastructures. Innovation goes beyond science and technology and refers to new ways of doing things. Recently, the innovation systems heuristic has opened up even further with civil society being a part of the actual innovation process rather than its passive recipient. Focus is widening, also including user-induced innovation and community-based innovation with examples from the communication sector, design, information technology or professional sports where the distinction between developers and users is not sharp and one can speak of 'co-invention'. But Rip et al (2010) name a number of other examples ranging from the involvement of patient associations in health research, participatory plant breeding research, exchange of experiences in peasants networks, and bottom-up innovation in low-input agriculture.

This broad understanding of innovation systems does not mean it only deals with non-technical forms of innovations. Electric vehicles are other examples that have been subject to many social experiments but even more striking examples are the successes of collective experimentation in high-tech industries like defence and marine in which it is argued that their success is among others due to the short feedback loops between researchers, developers and users (Sen, 2013). Thus the innovation is also at a technological level and the aim is to try out things as soon as possible to learn from them, as '*Society becomes a laboratory*'. (Rip et al, 2010, p8)

### **C. Mission-oriented innovation**

Mission-oriented innovation is the term I use to refer to the discourse that is still science-based but has a strong challenge-led agenda. Similar to the discourse of techno-scientific promises policy intervention are justified due to market and system failures, but echoing the post-war mission-oriented innovation paradigm, it sees a central role for the state to steer science and technology into a certain direction. In its most extreme form, mission-oriented innovation embraces a very broad problem-definition meaning that the societal challenges are very well articulated around functional/societal needs. They go beyond individual technologies (solar, wind) or individual sectors (automobile industry, chemistry) but have overarching agendas such as climate change and resource scarcity: 'Green' is the direction (Mazzucato and Perez, 2014). When the problem-definition is less broad, grand challenges is toned down to a more basic 'greening of innovation systems' (focussed on the production and diffusion of green products/services) or 'green growth' narratives.

The analytical framework remains rather narrow, meaning that all views on the innovation process and available policy tools can basically be copied from the section on techno-scientific promises. The difference is that government efforts should create these perfect framework condition around a number of missions ('renewable energy for all') which would then unleash the innovative potential of innovating actors, mainly firms and universities.

### **D. System Innovation**

System innovation embraces both a broad problem framing and a broad analytical framework. The analytical framework is broad in that it goes beyond science and technology but embraces wider institutions (laws, rules, norms), infrastructures (technical artefacts, physical objects), user relations and social expectations. In relation to the grand challenges discourse, system innovation goes beyond technological fixes and an overreliance on the linear assumption that science is the fundamental source of all innovation. Furthermore, its broad approach provides more deliberate, legitimate and accountable choices between different development pathways (Stirling, 2007).

The framing of the challenge is broad in that it is not interested in the ability of the system to produce green goods and services, but in its ability to provide societal needs in a sustainable manner. In relation to the innovation systems discourse, system innovation is much more strategic in its efforts to initiate, nurture and co-ordinate innovation. It's more aware of vested interests within society, or niches with the potential to create

breakthroughs. In addition, its broad framing of the challenges acknowledges difficulty in evaluating the sustainability of isolated technologies, if not analysed as embedded in a system context (Smith et al, 2010).

System innovation is therefore not about massive subsidies or picking winners for technical fixes, but has a more open, experimental approach towards finding new ways of fulfilling societal needs. It engages a diversity of voices and creates safe spaces for niches to develop, experiment and learn by doing, using and interacting. System innovation is about strategically protecting niches and about balancing vested interests, co-ordinating different experiments, facilitating learning and leveraging investments. This is all done through an agenda build on informing expectations through shaping common vision (Scrase et al., 2009).

### **3. Methodology**

The methodology used to assess the uptake a challenge-led and broad-based innovation agenda by the EU is argumentative discourse analysis. An argumentative analysis looks at the particular position that is being defended by a certain statement, or against which criticisms are being expressed. This builds on the so-called argumentative turn in discourse analysis (Billig, 1986), in which any expression of language is seen as part of a dialogue, embedded in but also actively shaping discursive structures.

The creation of discursive structures is not random, but it's the outcome of a struggle between various parties that have not necessarily met, but share similar storylines; particular ways of talking and thinking about a topic. By doing so, they form discourse coalitions responsible for producing, reproducing and at times transforming discourses (Hajer, 1995). Discourse are therefore the result of a constant underlying power struggle between different discourse coalitions competing for influence. Identifying different discourses will tell you something about this underlying power struggle. The importance of unravelling these power struggles lies in the Foucauldian model of social change in which structural changes in society can be conceptualized as shifts in the relevant influence of different systems of meaning, i.e. different discourses (Sharp and Richardson, 2001).

After having identified a particular discourse, Hajer (2005) suggests a simple two-step procedure to assess the influence of this particular discourse: if many people use it to conceptualize the world (discourse structuration) and if it solidifies into institutions and organizational practices (discourse institutionalization). In other words, a discourse is structured if actors can draw on the ideas, concepts, and categories of a given discourse. A discourse is institutionalised, if it is translated into concrete policy. If both criteria are fulfilled we argue that a particular discourse is dominant.

#### **Discourse structuration**

The first step is to assess the level of structuration. Since the analysis covers a big institution like the EU, a sensible approach to discourse analysis is to start broad, focussing on a number of strategic policy documents produced over the years, and to identify the arguments and counterarguments that form discourses. Therefore, a number of strategic policy documents has been identified based on secondary literature and informal talks with experts in the field. The documents are separated into two categories, namely those documents produced

by DG Research and Innovation (intra-discursive documents) and those produced by other DG's or EU organisations (inter-discursive). The list of documents can be found in appendix I. The next step is to assess the level of discourse structuration. This has been done through a process of structural coding.

Structural coding is a content-based methodology by which a conceptual phrase representing a topic of inquiry is linked to a segment of data. The conceptual phrase is linked to a specific research question used to frame the analysis. For this analysis, I created the conceptual phrases 'whole-of-society' and 'societal challenges' to answer the specific research question to what extent a challenge-led and broad-based approach to innovation is adopted. For this coding process, I used the qualitative data analysis software programme Atlas.ti. The similarly coded segments were then collected together for a more detailed analysis. Structural coding is appropriate in qualitative studies, especially for standardises or semi-structured data-gathering protocols or exploratory investigations to gather topics lists or indexes of major categories or themes. Structural coding is a question-based code that "acts as a labelling and indexing device, allowing researchers to quickly access data likely to be relevant to a particular analysis from a larger data set" (Namey et al., 2008, p. 141). Structural coding generally result in the identification of large segments of texts on broad topics. These segments can then form the basis of an in-depth analysis within or across topics. (MacQueen et al., 2008, p. 125). This enables examining comparable segments' commonalities, differences, and relationships. The method was primarily used at a basic level by applying it as a categorisation technique for further qualitative data analysis. However, some simple quantitative applications have been performed i.e. by determining frequencies a theme appears in text, helping to identify which themes, ideas, or domains were common and which rarely occurred.

### **Discourse institutionalisation**

The second step is to assess the level of discourse institutionalisation. A simple start to this assessment would be to look at which policies are actually in place and to see to which of the four discourses they belong. When the analysis goes beyond words and looks at actual policy instruments, it is not enough to simply ask whether it is broad-based or challenge-led. Based on an assessment of the policy objective and the level of analysis/concept of innovation (the x- and y-axes) it is possible to place the instrument on a particular spot of the matrix. The level of detail to which this can be done is up to the interests of the assessor, but it is my opinion that a too specific analysis loses value as no instrument will be a 'perfect' reflection of a particular position. I've chosen to divide the matrix in nine different quadrants, as displayed below in figure 2.

<b>Level of Analysis</b>	<b>3</b> Whole-of-Society	A3	B3	C3
	<b>2</b> Systemic	A2	B2	C2
	<b>1</b> Science Base	A1	B1	C1
		Competitiveness <b>A</b>	Green Products/Services <b>B</b>	Societal Challenges <b>C</b>
		<b>Policy objective</b>		

A policy instruments can now be positioned by attributing it a policy objective (competitiveness, green products/services, or societal challenge) and a level of analysis (science-base, systemic, or whole-of-society). An example of such assessment is given in figure 3 for the European Patent.

<b>Policy instrument</b>	<b>Policy Objective</b>	<b>Level of Analysis</b>	<b>Category</b>
European Patent	Competitiveness	Systemic	A2 (comp/systemic)

When doing this for all policy instruments, one can assess on which discourse the emphasis lies.

An additional way of assessing the level of institutionalisation of a particular discourse is not only look at the different policy instruments, but also look at the funding. A similar analysis as above can be done, but instead of looking at policy instruments, a closer look is taken at where the money is being spent.

This assessment of the institutionalisation of a particular discourse might be shallow first impression, but it is my believe that this will be a good start of the analysis that can be taken further in later stages of this doctoral project.

#### **4. Assessing the uptake of a challenge-led and broad-based innovation agenda by the EU**

The second part of this paper is to use the proposed framework to assess the emergence of a new discourse in EU innovation policy. The EU has a long history of supporting research and innovation in many different fields, ranging from excellence in basic research through to more applied research in agriculture and rural development, climate action, communications networks content and technology, education and culture, energy, enterprise and industry department and space research, environment, mobility and transport and regional policy (EC, 2015). The EU makes an interesting case study due to the size of its investments, but arguably even more so, it has an important role as agenda setter for national and/or regional policies.

The history of EU innovation policy is very similar to the more general trends described in the introduction of this paper. Until halfway the 1990's, the main goal of EU innovation policy can be understood as science & technology policy targeting Europe's ability to produce new technologies, mainly in the fields of defence or civil engineering. During the nineties, the focus shifted to enhance Europe's ability to use new technologies in society at large. Sharp en Peterson (1998) suggest a number of driving forces behind this shift. First of all, the end of the cold war meant a shift from military to civilian technologies. This implies that diffusion now needs to be approached in broad, sociological terms, understanding that technology and society move step by step. Secondly, globalisation and the emergence of multinationals lead to the erosion of national control over economic policy generally, and technology policy specifically.

This second generation of EU innovation policy embraced a more systemic view on innovation, acknowledging it does not always come from research or technological novelty, but arises from complex interactions between individuals, organisations and their operating environment. The 1995 Green Paper on innovation is seen as a ground breaking publication, firmly setting this new agenda. Innovation is understood as a broader and more flexible term that embraces other issues such as intellectual property rights, education and training, organisational change, institutional framework and standards. In short, the objective of policy becomes how to shape an institutional context that enhance the innovation process as a whole. In the words of Borras (2003), in the late nineties EU policy experienced a 'transition from a S&T policy towards an innovation policy.'

This new generation of innovation policy was still driven by competitiveness as a leitmotif, fed by the fear of being left behind in the technology race (Borras, 2003). Furthermore, innovation is a process that takes place within the 'triple helix' of government, universities and business. Other societal actors such as users, consumers or citizens do have a role in this process, but most if it comes to that they simply have to comply and conform. This leads to the implicit or explicit assertions that '*Science is the solution, society the problem*' (Rip et al., 2010). The next section will look at how the EU's more recent publications deal with both these elements.

#### **Structuration of a broad-based discourse**

A broad-based discourse on innovation consists of a number of elements. To guide the analysis, the discourse is broken up into four separate elements, namely open innovation, social innovation, consumer/user-driven

innovation and finally the acknowledgement of different modes (non-technical) of innovation. Appendix 2 gives an overview of the emergence of broad-based innovation discourses.

The analysis shows that going back as far as 1995, some elements of a broad discourse can already be identified. However, these are not prevailing and are limited to ascribing to different modes of innovation and acknowledging the needs of users. This conception did not drastically change over the next decade and a half, as successive communications (EC, 2003; 2006; 2009) do stress the non-technological nature of innovation but see users, consumers and citizens predominantly as compliers or receivers of the innovative efforts of others. COM(2006) 512 mentions the '*user driven refinement of their use*', but most references don't go any further than '*strong demand from consumers or citizens*' (EC, 2006) or '*wide user acceptance*' (EC, 2009).

This perception of users and consumers changes drastically in the 2010 white paper 'Innovation Union' (EC, 2010), where it is argued that innovation in business models or services in fact can be '*driven by users and suppliers*'. They are seen as active participants resulting in firms that '*sometimes co-innovate with users and consumers*'. The successive publications of 2011 and 2014 continue this path, by making arguments for '*user involvement*' and '*individuals ... as co-creators and lead users*' respectively.

The Innovation Union is the first high-level strategic document to explicitly address social innovation, understood as the inclusion of '*the public sector, the social economy and citizens themselves*'. A discourse that has been prominent in all the communications ever since. Open innovation is the third element of a broad-based discourse of innovation that has been introduced in the Innovation Union communication for the first time at a high strategic level, talking about '*the free movement of innovative ideas*' and firms being '*increasingly driven to collaborate*'. However, these notions of openness are less strong successive communications.

In sum, a broader concept of innovation has had a modest emergence to the scene since 1995, but the inclusion of users and citizens, the introduction of social innovation and the concept of openness were all introduced in the communication of the Innovation Union, making it a landmark document. This is confirmed by the applying simple quantitative instruments to the analysis. In total, 21 segments of text were coded as 'whole-of-society', where other communications only contain a few segments with this code. In these segments, social innovation is mentioned eleven times, open innovation four times and notions of 'openness' three times. Both users and citizens are addressed throughout the document.

### **Structuration of a challenge-led discourse**

Similar to the structuration of the broad-based discourse, I have divided the challenge-led discourse into three elements to guide the analysis. Environmental technologies refers to a very narrow understanding, whereas explicitly addressing societal challenges is very broad. The concept of eco-innovation is in-between, as it also covers non-technical innovations in services, business models, etc. Appendix 3 gives an overview of the analysis.

'Offer a response to crucial problems of the present' is already given as a policy objective in 1995, although it can at best seen as a side note in a hefty document that is mostly concerned with boosting

competitiveness. Environmental technologies never became structured as a discourse, but eco-innovation emerged in the early 2000's, where the sustainability challenge gets framed into creating 'new markets for *products and processes*', and is viewed as 'an area of promising prospects for the emergence of an innovation-friendly lead-market'.

However, eco-innovation is also seen as '*One of the main answers to citizens' material concerns about their future*' and societal challenges slowly starts to enter the discourse more explicitly. In 2006 this is still in of cooperating internationally through '*a strong commitment to addressing global challenges with Europe's partners*', but in 2009 innovation is named as needed 'in order to equip itself with all the means needed to address major societal challenges ahead'. Again, the Innovation Union can be seen as a landmark communication of the EU, with the second sentence of this communication being that '*Innovation is also our best means of successfully tackling major societal challenges*'.

Also in terms of quantity the IU is a break with the past. 28 segments of text were coded as 'societal challenges' with only a few occurrences in previous communications. This emphasis is an absolute novelty in European innovation policy and the IU can be considered a turning point in bringing forward a challenge-led approach towards innovation strategy of the EU. The new focus on challenges does not mean that focus shifts away from a performance-led strategy. A similar query on 'competitive' in the same Innovation Union communication has 27 results. Section two concluded that there were two major reasons for the rise of a challenge-led approach to innovation policy. First, a break with the persistent dogma that all innovation is good, and second the view that innovation is needed to solve grand challenges. The innovation union only addresses the latter as it does not state that innovation can potentially be counterproductive in tackling societal challenges, nor does it say that those innovations dealing with societal challenges should have a priority over other forms of innovation. The relation between performance-led and challenge-led innovation is best captured by the opening statement of the document:

*'At a time of public budget constraints, major demographic changes and increasing global competition, Europe's competitiveness, our capacity to create millions of new jobs to replace those lost in the crisis and, overall, our future standard of living depends on our ability to drive innovation in products, services, business and social processes and models. This is why innovation has been placed at the heart of the Europe 2020 strategy. Innovation is also our best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing, which are becoming more urgent by the day.'* (EC, 2010, p2)

As this passage clearly shows, innovation should be performance-led and deal with grand challenges. Looking purely at the structure of this paragraph, it almost seems as if a sentence is added to the core argument, rather than being an integrative part of it. One could even argue that it seems secondary to the performance-led agenda although that would be too rash of a conclusion. In sum, the challenge-led agenda is an addition to the objectives, rather than a more fundamental change of purpose.

## Institutionalisation of a third generation innovation policy

After assessing the level of structuration of both the broad-based and challenge-led discourses on innovation, the next step is to assess its level of institutionalisation. In other words: did these new discourses lead to novel policy, and to what extent? As described in the methodology, this means that current EU policy tools will be assessed on their policy objective and level of analysis/understanding of innovation. As every category has three separate elements, figure 2 shows a matrix with nine different outcomes, of which one is completely challenge-led and broad-based, one has a very narrow policy objective and level of analysis, and the others are one of seven mixed outcomes.

For the analysis, I looked at the EU's current key initiatives. They are presented in the 2010 White Paper on innovation in the form of 34 commitments. An online database gives more information about the nature of these policy initiatives, their objectives, implementation, milestones and background documents ([EC, 2015](#)). Appendix IV lists all the initiatives and shows level of analysis and policy objective can be appointed to them. In a few instances, a policy initiative cannot be appointed either a particular policy objective or a clear level of analysis. In these cases, the initiative covers more than one field and is also treated as such. For instance, the initiative to focus more on societal challenges in European research and innovation programmes covers – in its ambitions – all three levels of analysis. Therefore, the initiative is attributed to the fields C1, C2 and C3

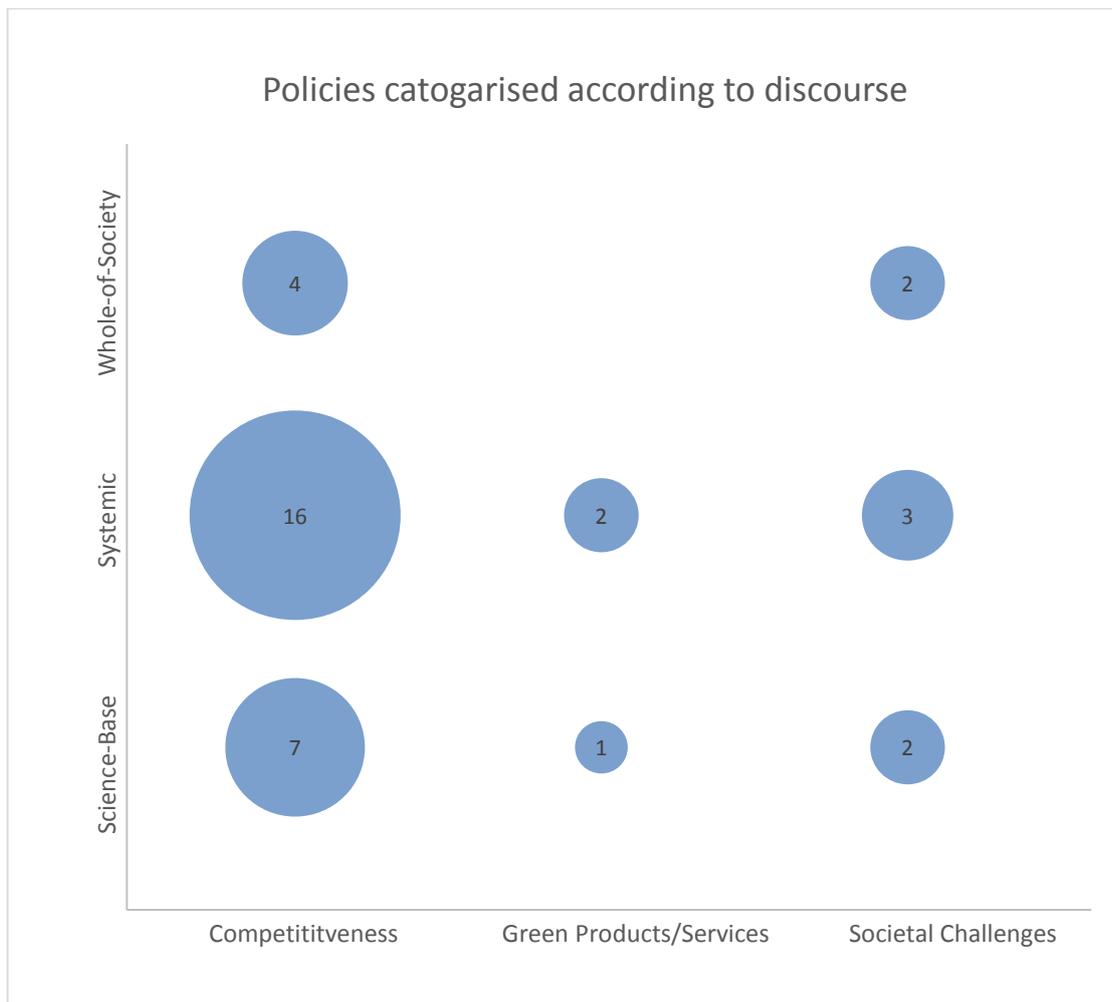


Figure 5 shows the results, and it becomes clear that most policies still focus on improving the competitiveness of the EU. Since 16 policy initiatives target the systemic level, it can be concluded that there is a strong focus on increasing the performance of the European innovation system.

A similar analysis has been done with EU innovation funding. Horizon2020 can be seen as the funding mechanism of the Innovation Union, and was turned into regulation in December 2013. This legal document gives a more detailed breakdown of the overall (77 billion euros) budget, and gives a detailed guidance on the specific policy objectives, rationale and EU added value, and the broad lines of the activities (EP, 2013). Appendix v shows how the budget is attributed to a particular field in the matrix. Figure 6 (below) gives the graphical results.

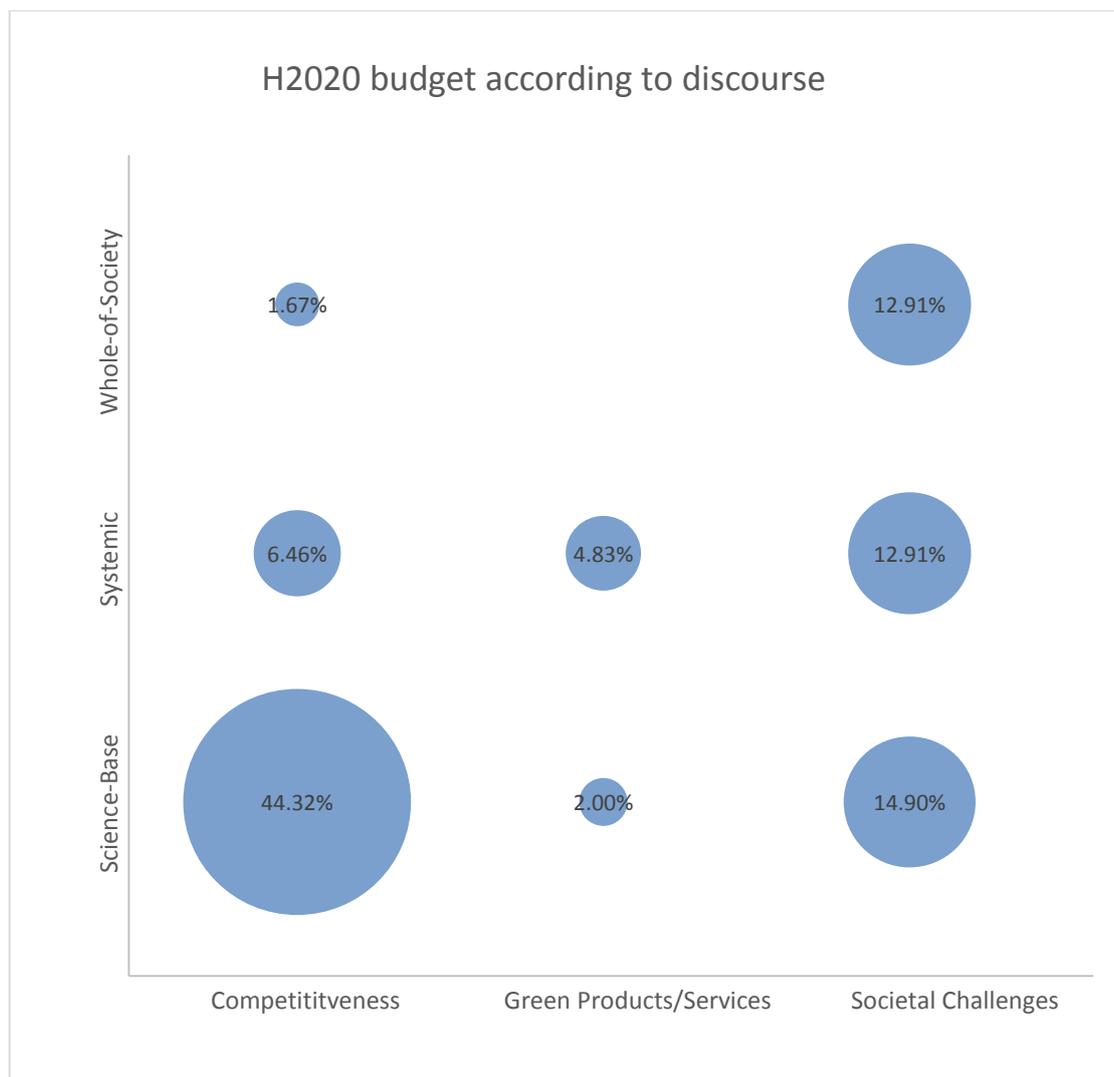


Figure 6 shows that most of the funding still goes to conventional Science&Technology policy the make Europe more competitive. However, a significant part of the budget (more than 40%) is allocated to challenge-led initiatives. In its objectives and the description of the broad lines of activities, most of this money should go to all levels of analysis and the funds are therefore equally spread out over C1, C2 and C3. Whether successful applications will show a similar distribution is uncertain.

#### **4. Conclusion**

In this paper, it is argued that the last 50 years have seen two major generations of innovation policy, namely science and technology policy and innovation systems policy, which can be seen as layered upon each other rather than fully replacing each other. However, both frameworks are currently contested as they do not sufficiently support the uptake for transformative innovation needed at the level of systems of societal needs, such as mobility, housing or food. In response, a ‘third generation’ innovation is suggested with a broader level of analysis and a challenge-led policy objective.

Based on these two contestations of conventional innovation policy, a matrix is proposed to identify four meta-discourses on innovation. By attributing three parameters to both the x-axes (policy objective) and y-axes (level of analysis) of this matrix, a further specification is created leading to nine distinctive types of innovation policy. This matrix consisting of four meta-discourses and nine sub-categories provides a framework for interpreting innovation policy.

Using this framework, a discourse analysis of EU innovation policy is conducted, assessing the uptake of this third generation innovation policy. The analysis of the discursive structuration shows a struggle, adopting – but not fully embracing – a more challenge-led and broad-based innovation agenda. In terms of institutionalisation of the discourse, only the EIP adopts a integrating a broad-based and challenge-led approach. In terms of funding, a big part is allocated to societal challenges in in the general research and innovation programmes, but at this stage of the research, little can be said about where and how this money actually is spent and where to position these programmes in the proposed framework.

## REFERENCES

- Billig, M. (1987), *Arguing and Thinking – A Rhetorical Approach to Social Psychology*, Cambridge University Press, Cambridge.
- Bogers, M., Afuah, a. & Bastian, B. (2010) Users as Innovators: A Review, Critique, and Future Research Directions. *Journal of Management*. [Online] 36 (4), 857–875.
- Borrás, S. (2003): *The Innovation policy of the EU. From Government to Governance* Cheltenham: Edward Elgar publishers. ISBN: 1 84064 993 3. 256 pages.
- Borrás, S. and Conzelmann, T. (2007): “Democracy, Legitimacy and Soft Modes of Governance in the EU: The Empirical Turn” in *Journal of European Integration*, vol. 29, no. 5, pp. 531-548.
- Caraça, J., Lundvall, B.-Å. & Mendonça, S. (2009) The changing role of science in the innovation process: From Queen to Cinderella? *Technological Forecasting and Social Change*. [Online] 76 (6), 861–867.
- Chesbrough, Henry (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.
- Coenen, Lars; Lopez, F. (2009) Comparing systems approaches to innovation and technological change for sustainable and competitive economies: an explorative study into conceptual commonalities, differences and complementarities. *Journal of Cleaner Production*. 18 (12), 1149–1160.
- Elzen, B., Geels, F.W., and Green, K., eds., 2004. *System innovation and the transition to sustainability: Theory, evidence and policy*. Edward Elgar: Cheltenham (UK).
- European Commission (2000) *Towards a European Research Area*, COM (2000) 6 final. EC, Brussels
- European Commission (2006) *Creating an Innovative Europe. Report of the Independent Expert Group on R&D and Innovation appointed following the Hampton Court Summit and chaired by Mr Esko Aho*. Brussels
- European Commission (2007) *The European Research Area: new perspectives*, COM (2007) 161. EC, Brussels
- European Commission (2009) *Preparing for our future: developing a common strategy for key enabling technologies in the EU*, COM (2009) 512 final. EC, Brussels
- European Commission (2010) *Europe 2020 Flagship Initiative Innovation Union* SEC (2010) 1161. EC, Brussels
- Geels, F.W. (2011) The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*. [Online] 1 (1), 24–40. Greenacre, P., Gross, R. & Speirs, J. (2012) *Innovation Theory: A review of the literature*. ICEPT working paper, available online
- Godin, B. (2012) ‘Innovation Studies’: The Invention of a Specialty. *Minerva*. [Online] 50 (4), 397–421.
- Hajer M. 1995. *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*. Clarendon Press: Oxford.
- Von Hippel, L. (2005) Democratizing innovation. [Online]. Available from: doi:10.1111/j.1540-5885.2006.00192\_2.x.
- Jensen, M.B., Johnson, B., Lorenz, E. & Lundvall, B.-Å. (2007) Forms of knowledge and modes of innovation. *Research Policy*. [Online] 36 (5), 680–693.
- Kallerud, E. (2010) Goal conflicts and goal alignment in science, technology and innovation policy discourse. *EASST 2010 Conference: Practicing Science and Technology, Performing the Social*. (1), 1–22.
- Kallerud, E., Amanatidou, E. & Upham, P. (2013) *Dimensions of Research and Innovation Policies to Address Grand and Global Challenges*.
- Kemp, R. (2011) Ten themes for eco-innovation policies in Europe. *S.a.P.I.En.S.* (October), 1–19.
- Lundvall, B.-Å. (2007) *Innovation System Research and Policy Where it came from and where it might go*. 1–50.
- Mazzucato, M. & Perez, C. (2014) *Innovation as Growth Policy: the challenge for Europe*.
- MacQueen, K.M. and Guest, G. (2008) *An introduction to team-based qualitative research*. Lanham, MD: AltaMira Press.
- Namey, E., Guest, G., Thairu, L. and Johnson, L. (2008) *Data reduction techniques for large qualitative datasets*.
- Peterson, J. & Sharp, M (1998) *Technology Policy in the EU*. New York: St. Martins Press, 1998, 260 pp.
- Rip, A., Joly, P. & Callon, M. (2010) *Reinventing Innovation*. in Maarten Arentsen *Governance and Innovation*. (2006), 1–13.
- Saldana, 2013, *the coding manual for qualitative researchers*, SAGE publications, London.

- Scrase I, Stirling A, G.F., Smith A & P., and V.Z. (2009) Transformative Innovation: A report to the Department for Environment, Food and Rural Affairs.
- Sen, a. (2013) Totally radical: From transformative research to transformative innovation. *Science and Public Policy*. [Online] 41 (3), 344–358.
- Sharp, L. & Richardson, T. (2001) Reflections on Foucauldian discourse analysis in planning and environmental policy research. *Journal of Environmental Policy & Planning*. 3 (3), 193–209.
- Leydesdorff, L. & Etzkowitz, H., 1998. The triple helix as a model for innovation studies. *Science and Public Policy*, 25(3), pp. 195-203.
- Sharra, R. & Nyssens, M. (2010) Social Innovation: an Interdisciplinary and Critical Review of the Concept. Université Catholique de Louvain Belgium. 1–15.
- Smith, A., Voß, J.-P. & Grin, J. (2010) Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy*. [Online] 39 (4), 435–448.
- Steward, F. (2008) Breaking the boundaries. (April). London, NESTA.
- Smits, R., Kuhlmann, S. & Shapira, P. (2010) *The Theory and Practice of Innovation Policy: an international research handbook*. Edward Elgar
- Steward, F. (2012) Transformative innovation policy to meet the challenge of climate change: sociotechnical networks aligned with consumption and end-use as new transition arenas for a low-carbon society or green economy. *Technology Analysis & Strategic Management*. [Online] 24 (4), 331–343.
- Stirling, A. (2009) *Direction, Distribution and Diversity! Pluralising Progress in Innovation, Sustainability and Development*.
- Sveiby, K-E., Gripenberg, P. & Segercrantz, B. (2012) *Challenging the Innovation paradigm* Routledge, London.
- Weber, K.M. & Rohracher, H. (2012) Legitimizing research, technology and innovation policies for transformative change. *Research Policy*. [Online] 41 (6), 1037–1047.
- Wieczorek, a. J. & Hekkert, M.P. (2012) Systemic instruments for systemic innovation problems: A framework for policy makers and innovation scholars. *Science and Public Policy*. [Online] 39 (1), 74–87.

## Appendix I

Discursive level	Author/doc	Name
Intra-discursive	COM(2014) 339	Research and innovation as sources of renewed growth
	COM(2011) 48	From Challenges to Opportunities: Towards a Common Strategic Framework for EU Research and Innovation funding
	COM(2010) 546	Innovation Union
	COM(2009) 512	Preparing for our future: developing a common strategy for key enabling technologies in the EU
	COM(2007) 161	The European Research Area: new perspectives
	COM(2006) 502	Putting Knowledge Into Practice – A broad-based innovation strategy for the EU
	COM(2003) 112	Innovation policy: updating the Union's approach in the context of the Lisbon strategy
inter-discursive	DG Environment	General Union Environment Action Programme to 2020
	DG Environment	Innovation for a sustainable Future - The Eco-innovation Action Plan (Eco-AP)
	DG Environment	Roadmap to a Resource Efficient Europe
	DG Regio	Regional Policy contributing to smart growth in Europe 2020
	DG Regio	Regional Policy contributing to sustainable growth in Europe 2020
	DG enterprise & Industry	Competitiveness and Innovation Programme
	DG Growth	For a European Industrial Renaissance
	DG Energy	Energy Technologies and Innovation
	DG Energy	A Roadmap for moving to a competitive low carbon economy in 2050
	DG Mobility	Research and Innovation for Europe's Future Mobility – Developing a European transport-technology strategy
	EEA	The European Environment State and Outlook – Synthesis Report
Extra-discursive	Technopolis	
	OECD	
	Worldbank	

## Appendix II

<b>Broad-based approach to innovation in EU policy making (intra-discursive)</b>		
<b>Concept of innovation</b>	<b>Year and source</b>	<b>quote</b>
Different modes	1995	'the successful production, assimilation and exploitation of novelty in the economic and social spheres'
	2003	'Thus, in addition to the term technological innovation, covering innovation derived from research, further classifications may be identified. Organisational innovation reflects the recognition that new ways of organising work in areas such as workforce management, distribution, finance, manufacturing, etc can have a positive influence on competitiveness. This term may also include business model innovation. Presentational innovation is beginning to be used as a comprehensive term to cover innovation in areas such as design and marketing.'
	COM(2006) 502	'All forms of innovation need to be promoted, for innovation comes in many forms other than technological innovation, including organisational innovation and innovation in services.'
	COM(2010) 546	'Pursuing a broad concept of innovation, both research-driven innovation and innovation in business models, design, branding and services that add value for users and where Europe has unique talents...Policies must therefore be designed to support all forms of innovation, not only technological innovation'
	COM(2011) 48	'It takes into account the fact that innovation requires many competences and activities other than research, which are non-technological in nature'
	COM(2014) 339	New processes and business models, non-technological innovation and innovation in the services sector, combined with and driven by creativity, flair and talent, or, in other words, from innovation in its broadest sense.
Consumers; users	1995	Relations with the users, taking account of demand expressed, and anticipating the needs of the market and society are just as important - if not more so - than a mastery of the technology.'
	COM(2006) 502	'the development of new products, services and business models and user driven refinement of their use'
		'Innovation depends on a strong demand from consumers and citizens for new and innovative products and services.'
	COM(2009) 512	'In order to ensure wide user acceptance and the prompt deployment of high-technologies, public understanding and knowledge of enabling technologies needs to be improved and any ethical, environmental, health and safety concerns anticipated, assessed and addressed at an early stage.'
	COM(2010) 546	'While some conduct R&D and develop new technologies, many base their innovations on existing technologies or develop new business models or services driven by users and suppliers'
	COM(2011) 48	'new combinations of existing technologies, new business models, user involvement'
COM(2014) 339	'R&I policy needs to incentivise and enable individuals to engage in innovation as co-creators and lead customers'	
Social Innovation	COM(2010) 546	'Involving all actors and all regions in the innovation cycle: not only major companies but also SMEs in all sectors, including the public sector, the social economy and citizens themselves ('social innovation)'
	COM(2011) 48	'capturing the many and diverse possibilities offered by social innovation'
	COM(2014) 339	'R&I policy needs to ... promote social innovation and social entrepreneurship, and allows innovative firms to test and roll-out solutions in real world environments.'
Open Innovation	COM(2010) 546	It is therefore more important than ever to deliver the so-called "fifth freedom", which is not only the free movement of researchers but also the free movement of innovative ideas...bringing together – physically and virtually – large companies and SMEs, universities, research centres and communities of scientists and practitioners to exchange knowledge and ideas'

		‘As the problems grow more complex, and the costs of innovation increase, firms are increasingly being driven to collaborate. While they still carry out in-house development, this is often complemented with activities to identify, recognize and transfer ideas from external sources, such as universities or start-ups. They sometimes co-innovate with users and consumers in order to better satisfy their needs or create new routes to market.’
--	--	---

### Appendix III

<b>Challenge-Led approach to innovation in EU policy making (intra-discursive)</b>		
<b>Concept of innovation</b>	<b>Year</b>	<b>quote</b>
Environmental technologies		
Eco-innovation (Green products + services)	2003	Europe is recognised as the global leader in environmental policy. Fulfilling its environmental commitments requires huge innovation efforts. The sustainability challenge creates not only new innovation pressures but also new markets for products and processes.
	2006	Europe’s citizens are concerned by important issues ranging from climate change and the depletion of non-renewable resources to demographic change and emerging security needs, which call for collective action to safeguard the European way of life that combines economic prosperity with solidarity. These legitimate concerns must be turned into an opportunity to enhance Europe’s global economic competitiveness. The quicker it can react, the higher the chance of success and the greater prospect that its approach will serve as a global model. From the protection of the environment through eco-innovation to the improvement of individual well-being through more intelligent infrastructure provision, the Commission is convinced that innovation in a broad sense is one of the main answers to citizens’ material concerns about their future.
	2006	Eco-innovation is an area offering promising prospects for the emergence of an innovation- friendly lead-market. The pull of eco-innovation can be enhanced by environmental policy, notably through a well-designed regulation and the development of market-oriented instruments.
	2010	By early 2011 the Commission will present an eco-innovation action plan building on the Innovation Union and focusing on the specific bottlenecks, challenges and opportunities for achieving environmental objectives through innovation
Societal Challenges	1995	Innovation can and must offer a response to the crucial problems of the present. It makes possible an improvement in living conditions (new means of diagnosis and of treating illnesses, safety in transport, easier communications, a cleaner environment, etc.).
	2006	A wide opening of the European Research Area to the world with special emphasis on neighbouring countries and a strong commitment to addressing global challenges with Europe's partners.
	2009	Indeed, the EU needs a strong innovative performance in order to equip itself with all the means needed to address major societal challenges ahead, such as fighting climate change, overcoming poverty, fostering social cohesion and improving resource and energy efficiency
	2010	Innovation is also our best means of successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and ageing, which are becoming more urgent by the day.
System Innovation	1995	To launch pilot schemes combining social and technological innovation in fields of specific interest to citizens (health, environment, municipal and local services, etc.).

## Appendix IV

<b>Policy instruments categorised according to their discourse</b>				
	<b>Policy instrument</b>	<b>Policy Objective</b>	<b>Level of Analysis</b>	<b>Category</b>
1	Strategies for Researchers' Training and Employment Conditions	Competitiveness	Science-base	A1
2a	International ranking system for Universities	Competitiveness	Science-base	A1
2b	Business-Academia Collaborations to develop new Curricula Addressing Innovation Skills Gap	Competitiveness	Systemic	A2
3	Development and Promotion of E-skills for Innovation and Competitiveness	Competitiveness	Systemic	A2
4	Delivering the ERA by cutting Red Tape and removing Obstacles to Mobility and Cross-border Co-operation	Competitiveness	Systemic	A2
5	European Research Infrastructures	Competitiveness	Systemic	A2
6	More Focus on Societal Challenges in European Research and Innovation Programmes	Societal challenges	All three	C1/2/3
7	SME's in R&I Programmes	Competitiveness	Systemic	A2
8	European Forum on Forward Looking activities	All three	Science-Base	ABC1
9	European Institute for Innovation & Technology	Societal Challenges	Systemic	C2
10	Access to finance - stimulate private sector investments	Competitiveness	Systemic	A2
11	Access to Finance – free movement of Venture Capital	Competitiveness	Systemic	A2
12	Access to Finance - matching innovative firms with suitable investors.	Competitiveness	Systemic	A2
13	Review State-aid framework for R&D&I	Competitiveness	Science-Base	A1
14	Adopt a EU patent	Competitiveness	Systemic	A2
15	Screening regulatory framework linked to eco-innovation and European Innovation Partnerships	Green prod/serv	Systemic	B2
16	Speed up and modernise standard setting	Competitiveness	Systemic	A2
17	Joint Public Procurement	Competitiveness	Systemic	A2
18	Eco-innovation	Green prod/serv	Systemic	B2
19	Set up a European Design Leadership board and a European Creative Industries Alliance	Competitiveness	Whole-of-Society	A3
20	Open Access to Research Results / Research Information Services	Competitiveness	Whole-of-Society	A3
21	Facilitating Effective Collaborative Research and Knowledge Transfer	Competitiveness	Science-base	A1
22	Develop a European Knowledge Market for Patents and Licencing	Competitiveness	Systemic	A2
23	Role of Competition Policy in Safeguarding Against the Use of IPRs for Anti-Competitive Purposes	Competitiveness	Systemic	A2
24-25	Maximising Social and Territorial Cohesion	Societal Challenges	Systemic	C2
26	European Social Innovation Pilot	Competitiveness	Whole-of-Society	A3
27	European Public Sector Innovation Scoreboard	Competitiveness	Whole-of-Society	A3
28	Research Programme on Public Sector and Social Innovation	Competitiveness	Whole-of-Society	A3
29	European Innovation Partnerships	Societal Challenges	Whole-of-Society	C3
30	Retaining and Attracting International Talent	Competitiveness	Science-base	A1
31	Scientific Cooperation with Third Countries	Competitiveness	Science-base	A1

32	Towards Global Research Infrastructures	Competitiveness	Systemic	A2
33	Member States R&I systems	Competitiveness	Systemic	A2
34	Development of a new Indicator to measure share of fast-growing innovative companies.	Competitiveness	Systemic	A2

## Appendix V. Allocated funding according to discourse

		Policy Objective	Level of Analysis	Category	€
<b>I</b>	<b>Excellent Science, of which</b>				
1	European Research Council	Competitiveness	Science-Base	A1	13 094,8
2	Future and Emerging Technologies (FET)	All three	Science-Base	ABC1	2 696,3
3	Marie Skłodowska-Curie actions	Competitiveness	Science-Base	A1	6 126
4	Research Infrastructures	Competitiveness	Systemic	A2	2 488
<b>II</b>	<b>Industrial Leadership, of which</b>				
1	Leadership in enabling and Industrial Technologies	Competitiveness	Science-Base	A1	13 557
2	Access to Risk Finance	Competitiveness	Systemic	A2	1848.3
2a	Access to Risk finance for Strategic Energy technology Plan (SET Plan)	Green products/services	Systemic	B2	994
3	Innovation in SME's	Competitiveness	Systemic	A2	616,2
<b>III</b>	<b>Societal Challenges, of Which</b>				
1	Health, demographic change and well-being	Societal Challenges	All three	C123	7 471,8
2	Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy	Societal Challenges	All three	C123	3 851,4
3	Secure, clean and efficient energy	Societal Challenges	All three	C123	5 931,2
4	Smart, green and integrated transport	Societal Challenges	All three	C123	6 339,4
5	Climate action, environment, resource efficiency and raw materials	Societal Challenges	All three	C123	3 081,1
6	Europe in a Changing world – Inclusive, innovative and reflective societies	Societal Challenges	All three	C123	1 309,5
7	Secure societies, protecting freedom and security of Europe and its citizens	Societal Challenges	All three	C123	1 694,6
IV	Spreading Excellence and widening participation	Competitiveness	Whole-of-Society	A3	816,5
V	Science with and for Society	Competitiveness	Whole-of-Society	A3	462,2
VI	Non-nuclear direct actions of the Joint Research Council	All three	Science-base	ABC1	1 902,6
VII	European Institute for Innovation and Technology (EIT)	Green products/services	Systemic	B2	2 711,4