Brussels Studies

La revue scientifique électronique pour les recherches
sur Bruxelles / Het elektronisch wetenschappelijk
tijdschrift voor onderzoek over Brussel / The e-journal
for academic research on Brussels

Collection générale | 2014

The competitiveness of Brussels in European research

La compétitivité de Bruxelles dans la recherche européenne

Concurrentievermogen van Brussel in het Europees onderzoek

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Electronic version

URL: <http://journals.openedition.org/brussels/1240>

DOI: 10.4000/brussels.1240

ISSN: 2031-0293

Publisher

Université Saint-Louis Bruxelles

Electronic reference

Nicola Francesco Dotti, André Spithoven and Bas van Heur, « The competitiveness of Brussels in European research », *Brussels Studies* [Online], General collection, no 81, Online since 10 November 2014, connection on 04 May 2019. URL : <http://journals.openedition.org/brussels/1240> ; DOI : 10.4000/brussels.1240

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Number 81, November 10th 2014. ISSN 2031-0293

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The competitiveness of Brussels in European research

What is the place of Brussels in the European research geography? Brussels is commonly recognised as the EU capital, but mainly for its political and administrative functions. As research is fundamental in a 'knowledge-based economy', this paper shows the performance of Brussels in terms of participation in EU R&D projects. Findings show a double role for Brussels: i) Belgian stakeholders perform well in the competition for R&D calls; ii) EU-related stakeholders contribute by establishing research networks, making Brussels the 'capital of the European Research Area'. The analysis is based on an innovative database of participation in Framework Programme projects from 1999 to 2010.

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Introduction

1. What is the role of Brussels in the European research geography? Who are the major Brussels stakeholders active in terms of participation in EU-funded R&D projects? Brussels is largely recognised as the EU capital, but this role derives mainly from the localisation of EU administrative and political functions with very little being said about R&D activities and the European research geography [Van Camp & Witmeur, 2009]. Research is a fundamental aspect in a 'knowledge-based economy' (e.g. the EU Lisbon agenda set 3% as the target for GDP expenditures in research), and its territorial basis has been recognised as fundamental to facilitate cooperation among R&D stakeholders enhancing innovation [Caniëls & van den Bosch, 2011; Cooke, Gomez Uranga, & Etxebarria, 1997; Fagerberg, Verspagen, & Caniels, 1997; Iammarino, 2005; Moulaert & Sekia, 2003; Nelson, 1993; OECD, 1997, 1999, 2005]. Accordingly, the capacity of Brussels to take part in EU-funded R&D projects should be analysed with regard to the whole 'innovation system', distinguishing typologies in what literature defines as a 'regional system of innovation' (RSI).

2. From a theoretical point of view, several definitions of RSI have been proposed [Iammarino, 2005], ranging from 'innovative milieu' [Maillat, Quévit & Senn, 1993], to 'triple helix' [Etzkowitz & Leydesdorff, 2000] and 'territorial innovation models' [Moulaert & Sekia, 2003]. Despite different terminologies, the common aspect across these approaches is the 'systemic' perspective, which emphasizes the importance of having multiple 'stakeholders' contributing to regional innovation through R&D. The basic idea is that the regional capacity to innovate depends on synergies among firms, governments and research centres as well as all the related intermediaries [Knockaert & Spithoven, 2014]. This 'system' is considered to be fundamental for the transition towards a 'knowledge-based economy' because it determines regional competitiveness. An aspect often under-considered is the importance of external linkages through the so-called "knowledge pipelines" [Bathelt, Malmberg, & Maskell, 2004; Maskell, Bathelt, & Malmberg, 2005]. In the policy debate, the major interest lies in the innovative performance of firms supporting economic competitiveness [(Cooke, Gomez Uranga, & Etxebarria, 1997; Fagerberg, Verspagen, & Caniels,

1997; Fragkandreas, 2013]; thus, the RSI's research performance is also crucial because it supplies the innovation process with knowledge, which is the major input for the whole system.

3. In this perspective, the understanding of Brussels' performance in terms of participation in EU-funded R&D projects provides a relevant indicator for three main reasons. First, projects are distributed after a highly competitive selection, which makes the number of participants an indicator of competitiveness. Second, EU funds provide extra resources to carry out R&D activities, thus increasing the input of the innovation system. Third, EU funds are granted only if there is a transnational project consortium, which implies the establishment of cooperative European and international R&D networks. Therefore, the participation in EU-funded projects for stakeholders located in Brussels provides an indication of the competitiveness of its stakeholders in comparison to other European cities and regions.

4. The objective of this paper is to map and understand the competitiveness of Brussels in the European competition for EU-funded R&D projects. The rate of participation indicates how many times R&D stakeholders located in Brussels were able to win these highly competitive calls for R&D funding. The analysis based on different typologies of stakeholders and different districts allows a deeper understanding of Brussels' performance, mainly distinguishing between EU-related stakeholders and Belgian ones. By this distinction, Brussels can be seen as both a competitive RSI and the capital of the European research geography. Furthermore, three more issues can be addressed which are specifically related to Brussels. First, which are the most competitive R&D stakeholders and how has their relative weight evolved over time? Second, where are FP participants located and how has their distribution changed within Brussels? Third, does the complex institutional framework of Brussels affect the performance of the whole system, determining a different evolution across territories and typologies of R&D stakeholders in terms of FP participation?

5. The paper is structured as follows. In Section 2, the main characteristics of the European research geography and the FP policy are presented. In Section 3, Brussels is described with a discussion of the different types of R&D stakeholders and their performance in terms of FP

participation. In Section 4, policy implications and open issues are derived from the empirical analysis. Section 5 presents conclusions.

1. The geography of participation in the EU Framework Programme

6. The EU policy for R&D provides a unique opportunity to understand the European research geography. While R&D activities are known to be unevenly distributed across space [Barber & Scherngell, 2013; Foray, 2000; Heller-Schuh et al., 2011; Hoekman, Frenken, & Boschma, 2012; Hoekman, Frenken, & Oort, 2009; Jaffe, 1989; Mattsson, Laget, Vindefjärd, & Sundberg, 2010; Must, 2010; Scherngell & Barber, 2011]¹, the EU “Framework Programme” policy (FP) is a unique opportunity to “test” the R&D competitiveness of European cities and regions. The FP policy is articulated in several sub-programmes, of which “FP Cooperation” is the most important since it covers about two thirds of the whole budget (which was € 50 billion for the 2007-2013 period).

7. The policy rationale is relatively simple: the EU defines a list of scientific themes and makes several calls for R&D projects related to each selected theme. These calls are open to any kind of R&D consortium involving universities, firms, governments, NGOs, etc. The only fundamental rule for the creation of these consortia is that at least one of the partners has to be located in one of the EU member states or in one of the ‘associated countries’². This requirement explicitly aims to encourage international R&D cooperation promoting European integration [Arnold, 2004; Defazio, Lockett, & Wright, 2009].

8. While the policy rationale is simple, the competition is very hard. This guarantees that only ‘excellent’ R&D projects are funded³, and only R&D stakeholders able to be part of EU-level consortia receive funds. This is a first important recognition of the quality of applicants. Once projects are selected and funded, FP participants have the opportunity to further reinforce their knowledge by carrying out cooperative R&D projects and share their research. This mechanism aims to stimulate knowledge flows across Europe and to fund R&D activities that enhance innovation and linkages among universities, industries and government bodies. Finally, FP projects receive a certain visibility and prestige at European level by EU and national policymakers that are funding them. This provides further incentives for participation.

9. From an analytical perspective, FP participation allows the mapping of the most competitive R&D centres that are able to win the hard competition for EU-funded projects. Specifically, participants in FP projects are able to develop high-quality proposals, to establish EU-wide networks and to carry out research at European quality standards. In this perspective, the CORDIS database provided by the EU Commission tracks all the projects and participants at their geographical localisation. Deviating from previous studies [e.g. Barber & Scherngell, 2013; Heller-Schuh et al., 2011; Scherngell & Barber, 2011], we can track FP participants at district level (NUTS3)⁴, which allows for a more detailed geographical scale. Once FP participants are mapped, those localised in Brussels can be extracted in order to know how many times Brussels stakeholders were able to win the FP competition and which typologies of stakeholders are the most competitive.

10. A significant limitation of this database is determined by the registration of FP participants according to the legal address of their head-

¹ A similar analysis was carried out by the French DATAR providing a general framework to understand the role of FP in the broader ‘knowledge society’. The report is available at the following link starting from page 55 http://www.datar.gouv.fr/sites/default/files/tel_11_b_0.pdf

² Albania, Bosnia-Herzegovina, Croatia (EU member state only from July 2013), Farøe Islands, FYROM, Iceland, Israel, Lichtenstein, Moldova, Montenegro, Norway, Serbia, Switzerland, and Turkey.

³ The rate of success for applicants is below 20%, which implies that 4 out of 5 applications are rejected after having passed the minimum quality threshold. In many calls, the success rate is even lower, about 5-7%.

⁴ In the case of Belgium, NUTS3 districts are equivalent to ‘arrondissements’.

quarters, which might be different from where R&D activities are actually carried out. As an example, the EU Joint Research Centres (JRC) are legally located in Brussels, but research centres are located in four different places outside Belgium (Ispra, Karlsruhe, Petten and Seville) and only one within Belgium (Geel, close to Antwerp). Similar problems exist for major national research centres such as the French *Conseil National de la Recherche Scientifique* (CNRS), the Spanish *Consejo Superior de Investigaciones Científicas* (CSIC) or the Italian *Consiglio Nazionale delle Ricerche* (CNR). These are legally located in their respective capital cities (Paris, Madrid, Rome), but have multiple research centres across their countries. Nonetheless, the availability of data at district level makes this database unique in comparison to the mainstream scientific literature based on regions (NUTS2). This scale allows for a more detailed analysis. Finally, in order to have full comparability and a clear focus, three FP themes have been selected: energy; environment (including climate change); and those under the EU label 'knowledge-based bio economy' (KBBE), which means food, agriculture and fisheries. These three themes guarantee a significantly large sample (about 20% of total FP projects) and, most importantly, full comparability from 1999 to 2010.

2. Performance of Brussels in the Framework Programme

11. How does Brussels perform in the competition for FP participation? First, a description of Brussels is necessary. For the purpose of this analysis, we propose a definition of the Brussels metropolitan area (BMA) consisting of the Brussels Capital-Region (BCR) with the two Brabant Provinces, consisting of four NUTS3 units: Brussels Capital-Region (BE100), Halle - Vilvoorde (BE241), Leuven (BE242) and Nivelles (BE310). This classification is consistent with the Regional Competitiveness Index of the EU Commission [Annoni & Dijkstra, 2013] and allows a broader perspective of Brussels. Specifically, the inclusion of the two Brabant provinces allows the inclusion of many firms located in the suburbs of the BCR and the two Catholic universities of Leuven and Louvain-la-Neuve, which are major R&D stakeholders. According to this definition, the BMA includes three regions in charge of economic poli-

cies and a broader perspective of the two linguistic communities that are mainly responsible for universities and research centres. This definition seems to be more adequate for a comparison with other metropolitan areas in Europe, at least according to existing limitations in the database; thus, for the local analysis, the four districts will be kept separate to provide a better understanding of internal dynamics.

12. Who are the R&D stakeholders? A common classification refers to the 'Triple Helix' approach [Etzkowitz & Leydesdorff, 2000] that focuses on firms, governments and universities. This classification is largely accepted by scholars and policymakers, although it is not exhaustive. Specifically, we propose two further distinctions to improve it. First, according to the systemic perspective on RSI, firms, governments and universities have set up stable and permanent platforms or consortia for joint R&D activities, which play a role in the RSI as intermediary, but hybrid, stakeholders. Despite different legal definitions, these R&D stakeholders will be defined as 'public-private organisations'.

13. The second distinction is specific to Brussels since there are both Belgian and EU-related stakeholders operating in its territory. In the case of FP participation, two types of EU-related stakeholder can be further distinguished. While the EU Commission and its related bodies, mainly the JRCs, can be considered similar to 'governments', there are also many EU-related associations that are located in Brussels only to be physically closer to EU policymakers, but not for the sake of being located in Belgium. This is mostly the case with scientific and industrial associations like the "European Automobile Manufacturers' Association", the "European Council of Chemical Industry", the "European Association for Food Safety" or the "European Wind Energy Association". These are just some examples of more than 70 associations participating in FP projects which are located in Brussels. Indeed, these associations do not carry out R&D activities directly, but work as intermediaries participating in FP projects providing administrative support, coordination and/or dissemination to their stakeholders.

Type		Definition	
EU Bodies	EU (JRC)	All the EU-institutions and related agencies, mainly the JRCs.	European stakeholders
European Associations	Eur. Ass.	All the European associations, delegations and branches representing any kind of EU-related network.	
Governments in Belgium	BE-Gov.	All the Belgian tiers of government (national, regions, communities, etc.) with related administrations and agencies.	Belgian stakeholders
University and Public Research Institutes	Univ. & PRI	All the Belgian universities (public and private) and any public research institute.	
Private Companies	Pvt. Comp.	All the firms with active branches located in selected districts (1).	
Public-Private Organisations	Pub.-Pvt. Org.	All the public-private consortia or research centres in Belgium established among firms, universities, research centres, etc.	
Others	Others	Anything that cannot be classified under previous categories.	

Table 1. Types and definition of stakeholders in the Brussels Metropolitan Area.

(1) This definition excludes branches of firms that are in Brussels only as lobbies to Belgian and EU policymakers.

14. All the selected types of R&D stakeholders are summarised in Table 1. The objective of this classification is to distinguish between types of R&D stakeholders located in the BMA that can apply for FP. By this classification, two functions of Brussels can be identified. First, Belgian stakeholders are part of the Belgian innovation system, although the complex governance divided across communities and regions make the framework quite complicated. Second, European stakeholders represent the function of Brussels as EU capital city providing 'R&D linkages' across Europe.

15. The performance of the BMA is measured as the number of FP participants localised in the four selected districts. This value is weighted by the total number of participants because this varies significantly over time and across disciplines. Through this indicator, it is possible to measure how many times Brussels stakeholders were able to win the EU competition for FP funds. Because in Europe there are around 1500 competing districts, of which the BMA accounts for only four of them, the values are indeed very small. Nonetheless, differences across areas are quite significant. The amount of funds collected by Brussels R&D stakeholders might be misleading since this varies dramatically across calls, disciplines and projects: a very expensive FP project does not imply better 'quality' since the amount of costs might depend on specific requirements, or since R&D activities in certain disciplines are more expensive than others (e.g. arctic research is more expensive than that which does not require special equipment). In Table 2, the top 10 performing areas are presented. Finally, metropolitan areas are defined for other cities as in the case of the BMA, considering limitations in available NUTS3 definitions.

16. From a general perspective, Brussels scores very well, being part of the European top 10 for share of FP participation since the first period of analysis (FP5)⁵. Furthermore, among top performers, Brussels heads the ranking in terms of increase from FP5 (1999-2002) to FP7 (2007-2010). This result is even more impressive when considering the negative trends of almost all competitors. This result posits Brussels as

⁵ The thematic specialisation (environment, energy, and food, agriculture and fisheries) has to be taken into account to understand the particularly high performance of Veluwe because in Rozendaal there is a major Dutch energy research centre.

one of the most performing area in terms of FP participation, and is even more impressive when considering the relatively small size of Brussels in comparison to bigger cities like Paris and London.

17. In a dynamic perspective, two factors are considered. First, all the major European urban areas are represented and collect the largest part of FP participation, mainly European capitals (e.g. Copenhagen, Madrid, Rome, Athens and Helsinki). Second, almost all of them have decreased their rate of FP participation. Since the indicator is not affected by the change of FP calls, this can be explained by considering

City / Metropolitan areas (2)	FP5 (1999- 2002)	FP7 (2007- 2010)	% FP5	% FP7	% FP7 – % FP5
1 Paris / Île-de-France	1166	581	7,1%	5,4%	-1,7%
2 Copenhagen	386	208	2,4%	1,9%	-0,4%
3 Madrid	382	240	2,3%	2,2%	-0,1%
4 Rome	361	256	2,2%	2,4%	0,2%
5 Brussels Metropolitan Area (BMA)	357	363	2,2%	3,4%	1,2%
6 London	330	205	2,0%	1,9%	-0,1%
7 Athens	318	171	1,9%	1,6%	-0,4%
8 Helsinki / Uusimaa	314	157	1,9%	1,5%	-0,5%
9 Munich	262	188	1,6%	1,7%	0,1%
10 Veluwe (Rozendaal)	253	266	1,5%	2,5%	0,9%

Table 2. Top 10 performing districts per FP participation (Environment, Energy, KBBE).

(2) In the CORDIS database there are some constraints determined by the change of NUTS classification over the last decade. In some cases, it was not possible to combine postal address with NUTS3 codes, so they were aggregated to have a proxy of each metropolitan area. Specifically, Paris, London and Copenhagen were grouped with the upper NUTS code available (respectively, FR100, UK100 and DK011+012). For all the other cities, the NUTS3 code can be considered a good proxy for the metropolitan areas.

the progressive increase in competition for FP projects, determined by the accession of new member states during the selected period. Against this general trend of decrease in FP participation for top-performing areas, Brussels is the most impressive exception since it is able to increase the rate of FP participation and, even more surprising, the growth is particularly significant with an increase from 2.2% to 3.4%, equivalent to about +50% in relative terms. This result further enhances the predominant role of Brussels in the European research geography. Specifically, during FP7, Brussels is second only to Paris.

18. Considering the specific performance of the BMA (Table 3), the increase in FP participation is very high and significant in all three themes. This growth is significant both in absolute terms and in comparison to the rest of Belgium, where Brussels plays a strong leading role. The analysis of FP participation by district shows a leading role for the urban core (the Brussels-Capital Region) that has been further reinforced over time from 1.5% in FP5 to 2.5% in FP7. A peculiar aspect is the progressive reduction of differences across disciplines within the BCR. While, during FP5, the participation in FP-energy was more than three times the participation in FP-KBBE, during FP7 those differences were levelled upwards.

19. The rate of FP participation in other districts is lower than the BCR. Nevertheless, Leuven is second, scoring 0.4% in FP5 and 0.5% in FP7, and Nivelles is a bit lower, but with very similar trends. A surprising result comes from the district of 'Halle - Vilvoorde': despite the absence of universities and public research institutes, this district has a small, but significant share of FP participation, which is progressively growing. This might be due mainly to the localisation of several large MNEs just out of the BCR (e.g. the Procter & Gamble).

20. In general, disciplinary differences are limited. Indicators do not vary significantly among themes meaning that there is no thematic specialisation in any of the three selected themes. This is expected, considering the size of the BMA that is able to cover all different research themes. Nevertheless, an interesting dynamic appears within the two 'university districts': while Nivelles has increased performance in 'food, agriculture and fisheries' (KBBE) and decreased in the other two themes (energy and environment), Leuven has a symmetric trend with

growing performance in environment and energy and a declining one in KBBE. While this seems to be an internal process of specialisation within the BMA, the overall performance is still strong and highly positive.

21. Moving from the general perspective to the analysis of which stakeholders are contributing to the good performance of the BMA, it is possible to split the rate of FP participation by stakeholder and by district as shown in Table 4.

22. The strong concentration of R&D stakeholders in the BCR is evident and includes all the different types. In the BCR, the most important stakeholders are the European ones, mainly EU bodies (namely, the JRC). European Associations have an extraordinarily high rate of participation and show very positive growth rates. Amongst Belgian

stakeholders, private firms have a major share of FP participation, both in the BCR and in surrounding districts. The rate of FP participation of universities is equally distributed across districts, with a leading position for Leuven. The participation of Belgian governments is clearly concentrated in Brussels, thus public-private organisations play a marginal role.

23. In terms of the relative variation in FP participation (right-hand columns of Table 4), European associations are a major factor in improving the performance of the BMA; whereas, the leading position of universities is declining. Specifically, within the whole BMA performance, European associations located in the BCR increased their weight by 112% in terms of FP participation. In all three districts Universities and PRI show a negative performance, reducing their relative weight in the

districts	Share in total European participation								Variations (percentage points)			
	FP5 (1999-2002)				FP7 (2007-2010)				% FP7 - % FP5			
	KBBE	Energy	Envir.	Total	KBBE	Energy	Envir.	Total	KBBE	Energy	Envir.	Total
Brussels Capital-Region	0,6 %	2,0 %	1,8 %	1,5 %	2,2 %	2,6 %	2,6 %	2,5 %	1,63 %	0,66 %	0,76 %	0,99 %
Hal-Vilvoorde	0,0 %	0,1 %	0,1 %	0,1 %	0,1 %	0,2 %	0,0 %	0,1 %	0,08 %	0,15 %	-0,04 %	0,05 %
Leuven	0,5 %	0,6 %	0,2 %	0,4 %	0,4 %	0,8 %	0,4 %	0,5 %	-0,12 %	0,21 %	0,18 %	0,09 %
Nivelles	0,2 %	0,1 %	0,2 %	0,2 %	0,4 %	0,1 %	0,2 %	0,3 %	0,19 %	-0,02 %	-0,03 %	0,06 %
Total BMA	1,3 %	2,7 %	2,3 %	2,1 %	3,1 %	3,7 %	3,2 %	3,3 %	1,79 %	1,00 %	1,79 %	1,19 %
Others in BE	2,1 %	1,1 %	1,3 %	1,5 %	2,5 %	1,4 %	1,1 %	1,7 %	0,41 %	0,28 %	-0,18 %	0,20 %
Total Belgium	3,4 %	3,9 %	3,6 %	3,6 %	5,6 %	5,2 %	4,3 %	5,0 %	2,20 %	1,28 %	0,68 %	1,39 %
Total (% & nb of participations)	100 % 5525	100 % 3828	100 % 7706	100 % 11534	100 % 4372	100 % 2456	100 % 4263	100 % 6719				

Table 3. General performance of Brussels Metropolitan Area districts

BMA Stakeholders	Brussels Capital-R.		Halle - Vilv.		Leuven		Nivelles		Change in the relative weight of each stakeholder within the BMA			
	FP5	FP7	FP5	FP7	FP5	FP7	FP5	FP7	RBC	H.-V.	Leuven	Nivelles
EU (JRC)	78	81							2 %			
Eur. Ass.	33	71				1			112 %			
Be-Gov.	26	29	1		3	3			10 %		-2 %	
Univ. & PRI	31	22	1		52	37	29	20	-30 %		-30 %	-32 %
Pvt. Comp.	60	46	7	10	10	11	4	8	-25 %	40 %	8 %	97 %
Pub-Pvt Org.	10	5				1			-51 %			
Others	11	18			1				61 %			

Table 4. Evolution of FP participation (3) in terms of number, by stakeholder and district.
 (3) NB it should be considered that the number of FP calls declined dramatically from FP5 to FP7. Therefore, absolute values in FP7 are lower, but in a context of increased competition.

Types of r&d stakeholders	FP5	FP7	FP5 (% l'UE)	FP7 (% UE)	Increase % FP7 - % FP5
Europeans (EU+ass.)	111	153	0,7 %	1,4 %	+ 0,73 %
Belgians (all)	246	210	1,4 %	1,9 %	+ 0,45 %
Total BMA	357	363	2,1 %	3,3 %	+ 1,18 %

Table 5. Performances of the Brussels Metropolitan Area by group of stakeholders

whole system by about one third. These results show an evolution in the structure of the BMA in favour of European stakeholders with a reduction for Belgian universities, while Belgian governments are substantially stable and private firms have trends that are more heterogeneous: a decline in the relative weight of the BCR, and an increase in all the three surrounding districts. All these results open questions regarding the nature of the BMA.

3. Policy implications and challenges

24. The starting point for the discussion is shown by aggregated values of FP participation in Table 5. While, it is clear that European stakeholders have played a key role, doubling their rate of FP participation (from 0.7% in FP5 to 1.4% in FP7); the contribution provided by Belgian stakeholders has grown as well, although with a lower rate (from 1.4% in FP5 to 1.9% in FP7). Based on this result, the overall performance of the BMA is very positive both when limited to Belgian stakeholders, but also when including European stakeholders. This finding points to an added value determined by the fact that Brussels is the EU capital city. Looking back at the top 10 performing districts (Table 2), when only Belgian stakeholders are considered, the performance of the BMA would still be in the top 10, although with a lower ranking. Within R&D stakeholders, Belgian universities and public research institutes experience a progressive reduction in terms of FP participation, while firms show a positive rate of FP participation with a constant performance by Belgian governments. Based on these results, three major issues can be identified.

25. First, universities and public research institutes have reduced their performance in terms of FP participation in a context of general increase of the BMA. This is clearly a warning signal since universities and public research institutes are fundamental in a RSI. On the other hand, coming back to the general performance of competing cities and metropolitan areas (Table 2), all competitors are declining, which changes the perspective on this negative performance. From an institutional perspective, it is important to highlight that these decreases are common across all three university districts of the BMA (BCR, Leuven

and Nivelles). The inclusion of both Flemish and Walloon Brabant provinces showing results similar to the Brussels-Capital Region points to the widespread nature of this trend. Therefore, in terms of FP-participation, both Dutch- and French-speaking universities and public research institutes are reducing the capacity to compete at EU level. This finding serves as a warning signal of a weakening RSI for both Communities operating in the BMA.

26. Second, Belgian private companies have a significant rate of FP participation, which is balanced in comparison to universities and public research institutes. This is an indicator of the strength of the BMA in terms of economic competitiveness, but the declining trends of universities and public research institutes might weaken the whole system in the long-term perspective. Moreover, the spatial distribution of private companies participating in FP projects tends towards a delocalisation out of the urban core of Brussels (the BCR). This aspect matters since economic development is a competence of the Regions and the BMA covers three different regions: while the FP participation of firms is declining in the BCR, it is increasing in both Flemish and Walloon Brabant. This means that private R&D functions are moving progressively from the Brussels-Capital Region to Flanders and Wallonia, which is not a problem for BMA as a whole, but might be problematic for internal economic balance. From an analytical perspective, this reinforces the choice of BMA as a unit of analysis, because otherwise there would be a misleading perception of decline in private R&D activities. On the other hand, the growth of Flemish and Walloon firms seems to be a zero-sum game in comparison to the BCR. A systemic perspective enhancing the knowledge economy would require the involvement of three different regional administrations to carry out a shared strategy. At

Table 6. The BMA challenge to the Triple Helix approach.

Stakeholders	Performance and trends in FP participation	Main tier of government
Firms	good and growing	Regional Governments (3) (territorial economic policies)
Universities & Pub. Res. Inst.	Medium and declining	Linguistic Communities (2) (university and research policies)

the same time, firms involved in EU-wide R&D projects are unlikely to be interested in such complex governance and would prefer a simplified one (apparently only in Flanders or Wallonia).

27. The complexity of BMA governance opens a theoretical question for the systemic approach (Table 6). Firms are playing a positive and growing role and have to comply with the regulation of the three Regional Governments. Universities and public research institutes have worsened their performance, thus, they are governed by the two linguistic Communities, which overlap and intersect the three Regions. This complexity undermines the possibility for a systemic and synergic approach due to the co-presence of several tiers of government. In the literature, the role of regional governments is unique, while in the case of Brussels this is split among several bodies. In this perspective, FP participation provides an indicator of European competitiveness of the whole system. This means that Brussels is competitive at European level despite the internal institutional complexity. While this analysis did not look at cooperation within Brussels, the acknowledgement of the positive European results could be an incentive to further promote synergies within the system.

28. The third challenge refers to the role of non-Belgian R&D stakeholders, specifically European Associations. These stakeholders have a hybrid nature and, generally, do not carry out R&D activities directly. In general, European Associations work as 'knowledge brokers', promoting the establishment of R&D networks, providing coordination and administrative support, as well as promoting the dissemination of results to stakeholders. In general, it can be said that European Associations 'collect' FP participation, but bring it somewhere else, where stakeholders are localised. This function is unique to Brussels since it is intrinsically related to its function as EU capital city. From an analytical perspective, this result shows the role of Brussels as 'EU research capital', in addition to a political and administrative capital. On the other hand, this opens a challenge because the spatial concentration of R&D flows in Brussels is an opportunity for Belgian stakeholders to tap into those flows. How this can be done, and which synergies can be activated across Belgian and European stakeholders, is probably the major challenge for research policymakers in Brussels as well as other Belgian

government levels. While this can be seen as a unique opportunity, the fragmented governance of Brussels risks undermining the possibility to exploit it by developing a holistic strategy.

29. In conclusion, it is necessary to highlight that this analysis considered just one performance indicator for an R&D system, which is the rate of FP participation in three selected themes. Indeed, other indicators exist, even at EU level such as the European Research Council (ERC) grants, the Joint Programming Initiatives (JPI) and Joint Technology Initiatives (JTI) calls or the distribution of 'Marie Skłodowska-Curie' scholarships. Future research should consider a broader sample of disciplinary themes, and compare Brussels with other urban areas in Europe in order to provide benchmarks and perspectives within different RSIs. Furthermore, these performance indicators need to be related to structural indicators and policy strategies pursued by R&D stakeholders in the BMA. Finally, the FP policy is just one of the possible research sources for funding and it cannot be considered a fully exhaustive measure of research activities.

Conclusions

30. The objective of this paper was to map the performance and characteristics of the Brussels Metropolitan Area (BMA) in the perspective of the European research geography. Research competitiveness is a crucial element for the general economic competitiveness of Brussels. In order to analyse the performance of the BMA, the competition for FP projects was used as an indicator. The empirical analysis showed a very good performance by the BMA, which is in the top 10 European districts and the only one that further reinforced its leadership. Within the BMA, there is an unbalanced situation with a growing role for firms and a relative decline in FP participation of universities and public research institutes. Furthermore, a specificity of Brussels is the presence of European stakeholders that further boost FP performance. Based on these findings, Brussels can be described as both a competitive regional system of innovation (RSI) and the capital of the European research geography.

31. Based on the mapping of FP participation, three major policy issues were identified. From a Belgian perspective, universities have weakened their position relatively, while they were expected to play a leading role for R&D. Second, Belgian firms are associated with a high rate of FP participation, at least when the districts surrounding Brussels are also considered. These two symmetric trends challenge the complex Brussels governance articulated among three Regions (BCR, Flanders and Wallonia) and two linguistic Communities (Dutch- and French-speaking), in addition to the national government. In this particularly articulated framework, the third challenge is represented by European stakeholders, localised mainly in the BCR, which represent a unique opportunity as a hub for R&D networks. While the overall performance of the BMA seems to be highly competitive, these three elements are a major conceptual challenge to understand the research competitiveness of Brussels.

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Acknowledgements

We would like to thank the participants of the workshop “Brussels in the European Research Area”, which was held at the *Vrije Universiteit Brussel* (VUB) on 26 November 2013.

Financial support

This paper is part of a broader research project on the ‘Europeanization of research and policy innovations in Brussels’ funded by *Innoviris* through the programme ‘Prospective Research for Brussels’. *Brussels Studies* gets published with the support of:

Innoviris, the Brussels Institute for Research and Innovation

University Foundation

To cite this text

DOTTI, Nicola Francesco, SPITHOVEN, André, VAN HEUR, Bas, 2014. The competitiveness of Brussels in European research, In: *Brussels Studies*, Number 81, November 10th 2014, www.brusselsstudies.be

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