University participation in Community Programmes:
How does the selection process work?*

Prepared for the conference "New Research Findings: The Economics of Scientific and Technological Research in Europe", University of Urbino, 24-25 February, 1995.

by

Aldo Geuna

MERIT, University of Limburg

February 1995

Abstract

This essay examines the internationalization of university cooperation, and in particular university participation in the European Community Framework Programme. We develop a theoretical framework for the analysis of the mechanisms that are driving the participants' selection into the Framework Programmes. As the quality of applicants is an unobservable characteristic we stress the relevance of information signalling. Furthermore, we highlight how the selection process is influenced in a distinct way by cumulative and self-reinforcement mechanisms. The description and preliminary analysis of the Higher Education Institutions (HEI) that have participated in at least one project of the Community Framework Programme enables us to identify a pattern of university financing that is consistent with the delineated theoretical framework.

1. Introduction

During the last ten, twelve years the growing links between university and industry have attracted the interest of many scholars[1]. The derived body of literature is mainly concerned with the analysis of cooperation within regions or nations. Only recently, in the nineties, have some studies started to take into account the international aspects. The reasons for this lack of interest can be found in the fact that the international dimension of university-industry cooperation is still a limited phenomenon.

As clearly stressed by OECD (1990), during the 80's the internationalization of university-industry cooperations was more the exception rather than the rule, however "over the years ahead the internationalization of university-industry relations will probably continue to grow and even to gather pace...". Indeed, in the recent years a series of new international agreements have started to spring up both in the US and in Europe. These new cooperations have taken different forms. They range from the long term basic research policy followed, for example, by the Hitachi corporation in its world-wide diversification of research, to the simple funding of university chairs in other countries.

Focusing attention on the European situation, it is possible to highlight two main forms of international relationships. First, there are direct links between university and industry, as in the case of Trinity College and Hitachi corporation, and in the case of University Louis Pasteur and Squibb company. The quantitative evidence on this kind of cooperation is still very scarce. Therefore, there is the need for more research as was called for by the 1990 OECD report. Second, there are the cooperative relationships formed under the aegis of the Commission of the European Communities (CEC) through the Community Programmes. In the period 1984-1994, during the three Framework Programmes, this type of cooperation has become more and more important due to the growing budget of the Framework Programme and to the increasing participations of Higher Education Institutions (HEIs) in each successive framework.

In this essay we shall focus our attention on the latter kind of international relation. In particular we shall present a theoretical framework for the analysis of the mechanisms that are driving the participants' selection into the Framework Programmes. Further, we shall carry out a preliminary study based on data about the of HEI that have participated in at least one project of the Community Framework Programmes.

The paper is subdivided into two main parts. In the first one we shall briefly consider

---

[1] Starting from the 1982 report of the National Science Board and the 1984 report of the OECD.

the literature dealing with international relations between university and industry (Section 2). Then, after a short introduction to the European Union Framework Programmes, we shall discuss the participation of universities in R&D cooperation projects (section 3). The analysis of the reasons why we have chosen the institution "university" as unit of study, together with the theoretical framework that we want to "verify" will be put forward in Section 4. In the second part we first focus our attention on the data description and on a preliminary data analysis (Section 5), then we shall develop a comparative study of university participations and publications records (Section 6).

2. Survey of the literature

In the introduction we mentioned that only recently have scholars turned their attention to the internationalization of university-industry cooperation. Excluding the articles appeared on Science[2], the body of English language literature consists of four reports and two articles. Of these only two are focused specifically on the international aspects.

In 1988 the General Accounting Office (GAO) conducted a US survey covering 134 universities. This report analyzes the higher education sector's foreign funding, noting that funding from non-US firms represented only 5% of university R&D funding from industry (quoted from OECD 1990). On the other side of the Atlantic, in 1989, Bossard Consultant carried out a report for the SPRINT Programme (Commission of European Community) on contract research organizations in the EEC. Part of this work tries to study the pattern of international cooperation by the industrial sector of the firms involved in such cooperation. In 1990 the attention of OECD was also attracted by the subject. The OECD (1990) report, even if mainly concerned with the national/regional university-industry relations, highlights the growing relevance of the internationalization process. In the Annex 2 there is an interesting attempt to present a framework for a future analysis of this new phenomenon. Finally, in 1991 Malerba *et al.* carried out a report for the MONITOR Programme (Commission of European Community) on the nascent globalization of universities and research organizations. This research tries to shed a better light on the differences between national and international cooperation. Of related interest, there are also recently published two case studies. In 1993, Etzkowitz discussed the problems connected with the internationalisation of science and business focusing the attention on the case of MIT. In the same year McBrierty analysing the policy of the Trinity College (University of Dublin) examined an other case of international cooperation.

---

[2] We do not mean, in anything, to diminish their relevance, but we consider them more like informative and opinion articles than scientific essays. Of particular interest are the following: F. Flam (1992), A. Gibbons (1992) and L. Valigra (1994).

The above studies have made use of both case studies and questionnaires giving an appropriate description of the specific examples taken into account. Yet, still there is a need for further research that will tackle the analysis of international university-industry relationships at a more general level.[3] Especially, in the European situation, where the process of unification is stimulating --*i.e.* it is making easier-- the establishment of international cooperations in many areas, there is the need for better information on this particular subject. Indeed, with the development of this new phenomenon the science and technology policy of the different European countries will be more interrelated. Hence, a precise knowledge, both in qualitative and in quantitative terms, of the different forms of cooperation is needed to be able to implement correct policy action both at National and Community levels.

3. University participation in Community Programmes

Recent efforts of the European Union (EU) to establish a targeted programme for improving industrial competitiveness through the mechanism of funded research officially began with the First Framework Programme (1984-1987). The Framework was set up with the goal of strengthening strategic areas of European competitiveness. The mechanisms selected for the Framework included a) funding the R&D effort of private firms, research institutes, higher education institutes[4] in the strategic areas, and b) attempting to allocate funding to stimulate the formation of research networks spanning organizational and national boundaries. With the Second Framework Programme (1987-1991) the Community decided to use the Framework as "..the basis and instrument of European research and technology policy....thus providing a clear structure for long term overall objectives".[5] A comprehensive political strategy on technology, enjoying equal status with other key Community policy areas, was set. The Third Framework Programme (1990-1994) is characterized by the regrouping of activities around only three strategic areas with 15 separate programmes and by the reinforcement of the aim of convergence among the member states of the EU.[6] Lastly, the Fourth Framework Programme (1994-1998) pursues the guide lines of the previous one, putting more emphasis on the consistency between national and Community policy.

---

[3] For example, in Europe is not yet possible to quantify the importance of the direct international cooperation.

[4] The Community reimburses up to 50% of project actual costs to companies or research institutes, and to universities and other higher education establishments it reimburses the 100% of additional costs.

[5] See Commission of the European Communities, 1992, *EC Research Funding. A guide for Applicants.*

[6] As is clearly stressed in Commission of the European Communities (1992a), "...where projects are evenly matched in qualitative terms, preference will be given to projects involving participants from technologically less well developed regions."

In the course of implementing the succession of Frameworks, EU's research and technological development policy has advanced in budgetary scope, as is illustrated in *Table 1*, and has developed a few key goals. In particular, the total budget of the Fourth Framework is more than three times that of the first in nominal value. Moreover, in the last

Table 1:   The Framework Programmes.

Programme	Duration	EU Contribution
First Framework Programme	1984-1987	3.750 MECUs
Second Framework Programme	1987-1991	5.396 MECUs
Third Framework Programme	1990-1994	6.600 MECUs
Fourth Framework Programme	1994-1998	12.300[*] MECUs

Sources: Commission of the European Communities (1994).
[*] It includes activities that were not encompassed in the other Frameworks.

ten years the main aims of EU's research and technological development policy have been clearly defined. Of particular importance are the following three (CEC, 1992a: p.8):

> i) Stimulus to "cross-border cooperation, coordination, and mobility between industry and science" to realize a scientific and technological cohesion among the European countries;

> ii) Support to "basic research...for which medium-sized companies frequently do not have the necessary personnel or capital";

> iii) Harmonization of "research and technology into the concept of completing the single internal market in Europe".

The European Commission classifies the institutions that participate in the Framework Programmes in one of five categories: *Big Companies* (*BIG)*, *Small and Medium Enterprises (SME)*, *Public or Private Research Centres (REC)*, *Higher Education Institutions (HEI)* and *Others*. In *Table 2* we have shown the distribution of the five types of institutions in terms of **(a)** number of participations and **(b)** funding for shared cost action for the Second and Third

Framework Programme.[7] Three main observations emerge from this table. First, BIG have suffered a decrease between the Second and Third Framework both in the number of participations and in their funding. Most of the 11 percentage point cut in BIGs' funding was redistributed to "research institutions", public or private research centres and higher education, with the result that the latter institutions' funding approached 50% in the Third Framework Programme, up from 40% during the Second Framework. Second, the share of HEI has increased, reaching a bit less then one third (31.5%) of the total number of participations. Universities, almost the totality of HEI, as we will show in the following sections, are then the largest single type of institution in terms of the number of

Table 2:   **Distribution of participations (a) and funding (b), by organizational type: 2nd and 3rd Framework Programmes.**

	a (%) 2nd	**a** (%) 3rd	**b** (%) 2nd	**b** (%) 3rd
BIG	21.9	17.2	41.1	30.0
SME	18.1	17.6	18.7	21.1
REC	29.5	30.3	20.8	23.2
HEI	29.2	31.5	18.9	21.8
Other	1.2	3.3	0.6	3.9

Source: David, Geuna and Steinmueller (1994).

participations. Third, in both periods "research institutions" have a markedly higher share of participations than their share of funds. This means that funds are more thinly spread, on average, across participating units in the research centres and higher education community than among participating businesses. For HEI, the difference in share of participation and funding shrank between the Second and Third Framework Programmes, but still remained about ten percentage points.

Nevertheless, HEI are continuing to play an important role in the EU's research and technological development policy. On the one hand, they are supplying basic knowledge needed by business enterprises, and, on the other hand, they are benefitting from gaining access to complementary expertise and instrumentation in BIGs' R&D laboratories. Moreover, for HEI, participation in a Framework project means not only access to EU funding, but also the opportunity to interact with industry in the formation of new, high

---

[7]   For the Third Framework Programme the figure refers to *circa* the 85% of the contracts.

quality research networks. This is extremely important, especially for those countries with lower scientific and technological resources, because it enables such countries to overcome the constraints imposed by the small size of their research community.

In *Table 3* we have shown the evolution of collaborative links by organization type for HEI and REC. In moving from the Second to the Third Framework programmes, the number of HEI links with other HEI and with research centres, both increased. Nonetheless, 29% of the links are still with either BIG, SME, or other industrial partners. The number of links are affected by the increasing numbers of HEI and REC participating in the framework. Despite this increase, university-industry collaborations remain important in the Third Framework. Indeed, when we look at the specifics of network formation, it is often the case that when there is cooperation between "research institutions" and industry, a larger number of universities/research centres are linked to a single firm. Thus, in the simple count of links, BIG and SME are contributing a smaller share than other organisations, but these organizations links often produce a multi-directional transfer of knowledge. Moreover, when we consider the total number of collaborative links, we can identify three relevant groups. First, the *industrial* group --*i.e.* collaborative links BIG-BIG, SME-SME and BIG-SME-- with about 30% and 19% of the links in the Second and Third Frameworks respectively.

Table 3:   Collaborative links involving HEI and REC, by Framework.

Organization type	2nd Framework		3rd Framework	
	HEI	REC	HEI	REC
HEI	25.6%	36.0%	29.8%	42.4%
REC	36.7%	28.6%	40.6%	28.5%
BIG	19.6%	18.5%	14.8%	14.1%
SME	16.6%	15.4%	12.1%	12.1%
Other	1.5%	1.5%	2.7%	3.1%

Source: David, Geuna and Steinmueller (1994).

Second, the *research* group --*i.e.* collaborative links HEI-HEI, REC-REC and HEI-REC-- which have not only the largest but also an increasing share of links, circa 39% and 50%. Third, the *hybrid* group --*i.e.* collaborative links across the institutions of the two previous groups-- with about 30% and 27% of the links respectively. The cooperation between "research institutions" and industry, characteristic of the *hybrid* group, although decreasing is nonetheless significant part of the picture.

6

Finally, to confirm the intuition that the cooperation between industry and research institutions is still extremely important, we have looked at the EU contractual funding across different programmes for HEI. On the one hand, when we consider the share distribution for each programme by type of participant we identify a group of programmes in which HEI have about 50% of the funds. They are Step/Epoch, Bridge and Science And Technology For Development,[8] in the Second Framework, and Environment, Marine Science And Technology, Biotechnology and Life Sciences And Technologies For Developing Countries, in the Third Framework. On the other hand, when we focus on the share distribution for each type of participant by programme the previous group of university-oriented programmes loses importance. The two industrially-oriented programmes, Esprit and Brite-Euram, and their continuations under the Third Framework Programme, are always the most important sources of HEI funding.[9] This result shows that the research university continue to play a major role in cooperation with industry.

4. Information signalling, and cumulative and self-reinforcement mechanisms.

The previous analysis enables us to highlight three main observations:

i) If the financial trend of the Third Framework Programme is continued in the Fourth Framework Programme,[10] the distribution of funds by type of participant will tend to become uniform. Each of the four main actors will succeed in getting about 25% of the available funds.

ii) The increasing share of HEI, within a Framework Programme characterized by a growing budget, implies a more important impact of EU funds on the higher education finance system. In particular, in a period of budget cuts, restructuring and internationalization of the European higher education system, the availability of a new competitive source can have

---

[8]   We do not take into account the programmes under the heading Improvements To European Scientific And Technological Cooperation due to their specific character.

[9]   Only Environment, among the programmes of the previous group, receives in absolute terms a relevant share of funds (16%).

[10]   As the Fourth Framework Programme pursues the guide lines of the previous one and as we can presume consistency in the policy behaviour of the Commission one may expect that the trend will be confirmed.

extremely important consequences.[11]

      iii) HEI, and in particular research universities, have developed varied ways
to draw upon the EU funds via cooperative projects. They range from grant to
university consortia for basic research to university/industry cooperation in
market-oriented research.

      Having stated that, it becomes crucial to understand why some universities and other
post secondary education institutions are taking part in international cooperation projects
within the EU Framework Programme while others are not. To put in another way, we think
that is meaningful to identify, if it exists, the set of characteristics that are peculiar to the HEI
involved in this kind of international cooperation.

      The unit of observation we have decided to take into account is the higher education
institution itself and not the research group within the institution that carries out the project.
This decision has been dictated by the following reasons. *First*, although the literature on
R&D cooperation emphasises the centrality of the research group, we believe that,
particularly in this special case of international cooperation, the identity of the institution --
i.e. Cambridge University versus De Montfort University-- plays an important role. In the
initiation of cooperation, the interaction among the various partners is relevant --*e.g.* the
complementarity of the scientific and technological competencies of the participants in the
research project. Nonetheless, the funding choice of the EU is decisive.[12] EU R&D projects
should be analyzed as a phenomena at the border between R&D funding and R&D
cooperation with its own peculiarities. In particular, because the funding agency --*i.e.* the
Commission of the European Communities-- is not perfectly informed, the institutional
reputation or "the name" of the institution become a substitute for missing information.
Second, to develop an international cooperation with a well known HEI means also to
originate positive image externalities for the institution involved. The literature recognizes in
the augmented image and prestige due to the link one of the main incentives for a
cooperation.[13] Then, again, the institution itself comes to the fore. *Third*, from a
methodological point of view, the macro analysis at the institution level enables us to draw
the background picture of this particular area of R&D cooperation. In future research, the
micro analysis at the research group level will be carried out on the base of the results of the

---

    [11]   Impact and unintended effects of EU funding upon the allocation of national public and private research
funding going to higher education institutions --*i.e.* university departments-- in UK are discussed in David, Geuna
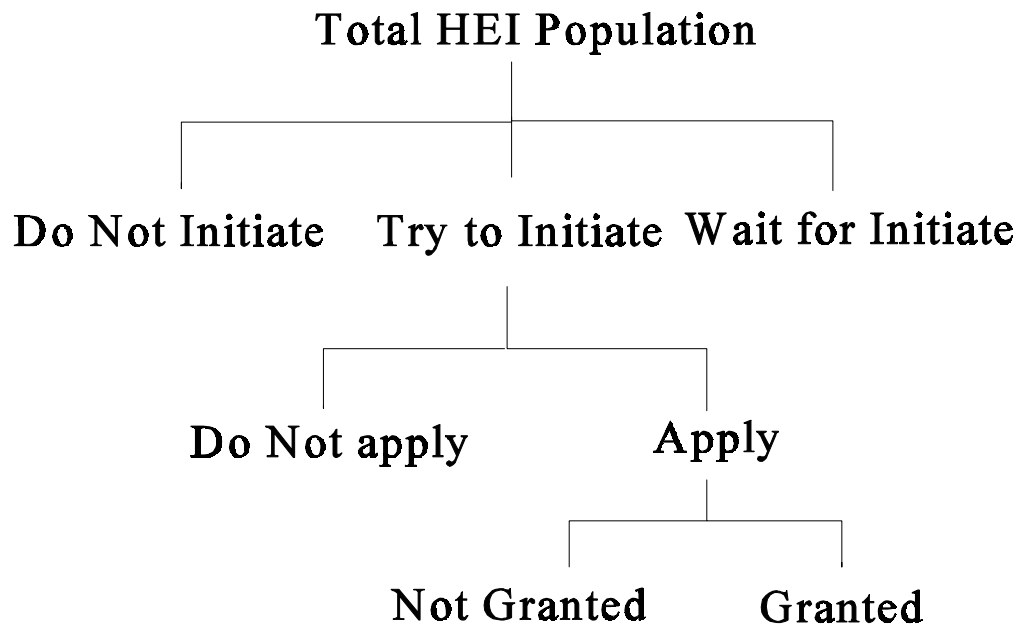and Steinmueller (1995: pp. 32-42).

    [12]   In the AXION (1995) report, synthesis of different national impact studies, is stressed the relevance of
Community funding. Community funding really has the effect of triggering research, a large number of projects
would have not started without this source of funds.

    [13]   See for example Malerba *et al.* (1991).

current work.

       HEI involved in EU R&D projects are a sub-group of the institutions that applied for EU funds. At the same time, the ones that applied are a sub-set of the HEI that tried to initiate a cooperative research project. These latter are themselves the cluster of the institutions that wanted to have a collaboration that together with those that did not try to initiate a cooperative program and those that waited --*i.e.* did not have information or they were uncertain on what to do-- constitute the total population of HEI in Europe (*Figure* 1).

Figure 1: Decision Tree for Initiation of Cooperative Agreement

Total HEI Population

Do Not Initiate   Try to Initiate Wait for Initiate

Do Not apply   Apply

Not Granted   Granted

The analysis of the population at the four levels of this "decision tree" would enable us to answer questions like:

      i) Which is the type of research --*i.e.* more basic or more applied oriented-- carried out by the universities interested in the EU Framework Programmes?
      ii) Are the universities that succeed in organizing a research network characterized by particular features -- *e.g.* being a new or old university or being industrial oriented?
      iii) What are the criteria that are leading the selection of the projects that are financed?

Unfortunately, the figures needed to assign shares to each level in this tree are not available at present. Those that are available are the identities of the HEI that have been involved in a R&D project (granted), and the total HEI population. We think that there is much to be gained by the study of this data. Indeed, by a process of backward inference we shall be able to shed a better light on some of the factors affecting HEIs' participation in cooperation projects within the EU Framework Programme.

We are concerned in particular with two phenomena that, in different but interrelated ways, have a strong influence on HEIs' participation in Framework Programmes. First, both at the level of building up of research networks and of the funding selection process, the lack of information, and the consequent presence of informational asymmetry, among different research institutions on the one hand, and between funding agency and research institution on the other hand, points to the extremely important role played by information signalling.[14] Second, the distinctively competitive character of the EU funding[15] system, together with an increased mobility of researchers, have raised the impact of cumulative and self-reinforcement phenomena.[16] In particular, the so-called "Matthew effect"[17] --*i.e.* research groups that are successful in finding external funding for their research have a higher probability of producing publishable research, which improves their probability of getting funds in the future-- that has less relevance in the less competitive national systems[18]

---

[14]   For the importance of precontractual informational asymmetries and market signalling see the original contribution of Spence (1974).

[15]   The funding and in general the management of the European higher education system, in both teaching and research, has been mainly driven by non competitive criteria. Only recently, in few countries --*i.e.* especially in the United Kingdom-- the system is undergoing a profound modification directed towards a more marked oriented approach.

[16]   A good researcher is usually attracted by centres/universities of excellence where she can find the human and physical capital that enables her to develop a high level research. Doing that, she will improve her quality and the overall quality of the institution, with the consequence of attracting new research funds and new high value researchers. This situation is characterized by two interrelated virtuous circles. First, a centre of excellence attracts high quality researchers that have high probability of doing valuable research increasing thereby the quality of the centre and therefore attracting new talented researchers. Second, a high level of human and physical capital implies a higher chance of achieving important research results, hence as a consequence of the high quality research there is an increased in the probability of having new research funds (Matthew effect) and therefore a possibility of expansion in the investment in human and physical capital.

[17]   For an economic analysis of the so-called "Matthew effect" and its implications for resource allocation see Dasgupta and David (1994), David (1994), Arora, David and Ganbardella (1994). For its original definition in the sociology of science see Merton (1968).

[18]   National systems are still (see note 15) characterised on the one hand by extremly high entrance cost but on the other by low or no competition for research funding when in the system. To obtain a tenure the candidate has to go through a vigorous selection process. However, when she has succeded in being selected, the competition for fund raising is extremly low. In practice, although it is starting to change, every year each professor is entitled to use a certain amount of research funds independently from her research productivity.

becomes crucial to understand the EU funding system.

We conceptualize HEI's participations in Framework Programmes as the result of the interaction among *n* suppliers --*i.e.* the different institutions-- and one consumer --*i.e.* the funding agency. We are then analysing a monopsony situation.[19] The exchanged product is, as first approximation, the result of the research project, and thus a non-homogeneous good. However, in most of the case, the real object of the agency is not to buy the research service but to succeed in reaching the policy goals through the tool of the research contract. The product *per se* looses importance. Then, a variety of institutions, although each offering a distinctive heterogeneous product, can satisfy the agency's potential demand. The emerging competition is based on the ability to perform research --*i.e.* the quality, the research productivity-- of the institution. In this situation the producers know their quality, whereas the consumer learns it only if it selects the "producer".

In implementing its policy the agency is using various research contracts. They range from the *tender* for a specific research service to the generic *grant* via the *open call* for proposal. The former is characterised by a needed service, well or less specified, and a call for suppliers. The price, if not yet fixed, represents a carrier of information and can be used to signal the quality.[20] In all the other cases, the difficulty of defining a product, previously described, limits the role played by price. Other ways should be used to infer the private information.

Although the agency does not know the quality of the applicant, it does have a number of sources of potentially useful information in the form of verifiable statements, observable characteristics, and actions of individual applicants. Action and statements, together with partially or completely controllable individual features are called *signalling*, while with the term *index* we refer to the unalterable characteristics (Spence, 1974). In the specific case we are now studying, the applicants can signal their quality at two level. First, the research group level. Signalling will be related to the recorded history of the researchers member of the group. Information like education, research experience, publications, patents, etc will be transferred from the applicant to the agency. Second, the university level. Being member of a particular institution exerts positive or negative externalities on a research group. It is possible to assume that the presence of a good research group in a department creates positive externalities, then there is a high probability that the average quality of the

---

[19]   Taken into account the fact that a university can apply non only at the European Commission, but, for example, also at its National funding agency, it is not any more correct to speak of monopsony. Indeed, as Community and National policy objectives are sometimes overlapping we can assume that for an institution to apply to the National agency is a non perfect, but still possible, susbstitute of the Community application.

[20]   The relevance of price as signalling device, does not mean that the other ways of quality signalling, described in the next section, are less important for this kind of contract.

11

department is high. In general, it is difficult, although possible, to have a good research group in a low quality university. With this, we do not exclude the possibility of a dynamic improvement of the university's quality. Indeed, it is possible to suppose that a single good research group is at the starting of the process of quality improvement. Nonetheless, the extremely high inertia and sclerosis of the university system tend to curb this kind of dynamic. The history of the university and its reputation are then signals of the potential quality of the applicant.

To "digest" additional information is costly for the agency. To evaluate in detail the signals received from the various research groups is not only time consuming, but it can also require specific competencies in the field of science related to the proposals. Usually these competencies are not present internally to the agency, which must then make use of external reviewers.[21] The agency can reduce the costs of the selection process using the information that is possible to extract from university signalling. Indeed, its general character implies low cost of evaluation. Clearly, a trade-off exists between the lower quality of the university signalling information and the higher cost of analysing the research groups' signals. The agency has then to go through a decision process focused on which type and how much of additional information to digest. In term of signals, the funding bureau has to decide how many signalled characteristics it wants to analyse. As first approximation, we can assume that it analyses both type of signalling, complementing the lower cost university information with the high value research group information.

From the point of view of a study of the EU funding system, the Matthew effect is characterized not only by an increased probability of producing publishable results, but also by the creation of asymmetry between selected and unselected institutions. The first cumulative effect, or virtuous circle, based on increasing productivity and consequently future funding has been discuss in detail in David (1994). We focus here our attention on the second one, the creation of asymmetries. The participants that have been selected to get funding and have performed well, have a higher probability of being funded again because their display of good performance is an indication of their high quality. As the funding agency is not able to observe the "real quality" of the applicants it has to base its decision on the signals received from the institutions and other sources of incomplete information. An institution that has been already chosen and has had a good performance is less risky than an organization that has never been funded. The latter, although the funding agency, with the information collected, can classify it as a high quality institution, has not yet been proven to be a good performer. It is, then, associated with higher uncertainty and higher risk. A new applicant must overcome this "barrier to entry". To be selected its signalled quality must be

---

[21]   For example, in the second call for proposals of the Brite-Euram Programme, 207 experts were involved in technical assessment of the proposals.

12

higher than that of the previously selected candidates.

This condition becomes harder to satisfy after each new call for funding. Indeed, in each subsequent turn there will be a lower probability of having chosen low performers. The agency may classify an applicant using two sources. The signalled characteristics, in the case of an institution that has not yet been chosen. The signalled characteristics and a performance indicator μ, when the applicants has already taken part into a project. The value of μ is zero at the starting. For each good performance of the institution μ raises, while it decreases in the opposite case. The probability of being selected for an institution that has already taken part into a project is thus proportional to the value of μ. In this way the agency tends to keep high performers and to reject low performers. Making the assumption that for each low performer rejected there will be a new applicant selected[22] at time $t + 1$ --*i.e.* new call for tenders--, and that the total population of potential applicants --*i.e.* in this case the totality of HEI in Europe-- is fixed, it follows that the probability of choosing good performers is increasing with time. The average "quality" of the participants is thus increasing. Moreover, also some of the good performers can be replaced by applicants with higher signalled quality, increasing then further the average "quality" of the selected institutions. Allowing for the entrance of higher quality applicants means to make the following two assumptions:

- The candidates enter in the competition whenever they prefer, they are not obliged to start at time *t*. Referring to the population of the decision tree in *Figure 1* it means that, for example at time *t*, there were institutions that did no try, did not know or did not succeed in organizing a cooperative research group, but in the following periods *t+1, t+2,...,t+n*, they do enter the competition.
- There is space for "quality" or signalling improvements. During time an institution can enhance its signalled quality.

With subsequent calls for tenders the process may arrive at a situation of lock-in in which a *"club"* of good performers is repeatedly selected by the funding agency. This situation is characterized by not being optimal. The best performers can be in the club, in which case we have an optimum solution, but they can be also not included in the club. Indeed, it is possible that the process dynamic leads to a lock-in situation in which there are *n* institutions not selected with a signalled quality $q_i = \mathscr{F}(q_i, q_2, .. q_p)$, where q_p are the"digested" signalled characteristics of the institution $i = 1,2,..,n$, higher than the signalled quality $Q_j = \mathscr{F}(Q_1, Q_2, .. Q_p)$, where $j=1,2,..,m$, of *m* organizations within the club. This is due to the fact that the accumulated experience of the institutions within the club has created a barrier to entry B_j that summed to the signalled quality of these institutions, $Q_j + B_j$, does

---

22   Here we make the implicit hypothesis that there is a fixed number of places.

not allow the entrance to the *n* organizations. A new applicant will succeed in entering the club only if it has a signalled quality $q_i > Q_j + B_j$. Therefore, the lock-in situation can be characterized by one or more institutions with a signalled quality Q lower than the signalled quality q of some organizations that have not been granted the support.

These mechanisms, in general, and the path to the lock-in situation, in particular, can be reinforced or weakened by the following three phenomena. First, the broad policy vision of the funding agency, in this case of the CEC and indirectly of the European Parliament, is shaping the approaches that are driving the sharing out of the funds. On the one extreme there is the pure quality oriented approach that, if followed, as described previously, creates a lock-in situation that can be non optimal. On the other extreme, the selection process can be based only on principles like countries cohesion, technological convergence, etc. that do not take into account quality. Each of the possible combinations of these two extremes has a different impact on the degree of diversity present in the output of the selection process. Second, every time that there is a process of selection for funding there is space for different kind of pressures on the selection committee. Usually, with this, we refer to the "accepted" form of lobbying. A strong impact of lobbying can cause an earlier sclerosis of the system with a lock-in situation at a lower level of quality. Notwithstanding that, if we accept a broad definition of signalling, we can consider lobbying as a peculiar kind of quality signalling and then we can reintroduce it in the previous analysis. Third, as clearly stressed by Peacock (1991) in the case of art subsidies, the officials in charge of the selection process were or will be members of a scientific community, and thus they have a specific reference group within the same community, or they are bureaucrats who "for understandable reasons wish to develop congenial relations with a few established clients". The risk that funding support only reaches a selected group of "incumbent" institutions, in our terms the institutions of the club, is then reinforced by bureaucratic inertia. In particular, a decision - making process can be strongly influenced by preference for the "status quo" (Lambert and Willinger 1994; Samuelson and Zeckhauser 1988). In our case, an official tends to replicate the same choice as before --*i.e.* selecting the same institutions-- due to the presence of psychological transition costs and to its natural loss aversion (Tversky and Kahneman 1991). To switch from the "status quo" to a new configuration, the official should perceive the new choice -- *i.e.* selection of new participants-- as a carrier of additional benefits and advantages that can compensate for the costs and disadvantages connected with choosing an alternative to the "status quo".

Finally, our attempt here is to better understand HEIs' participations into Framework Programmes via a theoretical framework for the analysis of the mechanisms that are driving the selection process. However, we think that with the same logic is also possible to explain the participation of research groups. In particular, the interaction and overlapping of similar mechanisms working at the two level may describe in a thorough way some of the most

14

important features of a selection process in a context of public procurement. Therefore, in future research we will develop the previously presented framework at both university and research group level.

If information signalling and cumulative and self-reinforcement mechanisms are relevant phenomena to explain the participation in EU R&D projects we should expect to have a small group of high quality well known institutions that obtain the largest share of EU R&D contracts. To verify that, in principle, we should have the population of HEI that have participated in the Framework Programmes' projects, but, as it usually happens in economic research, this is not the case. The data are available only for those Programmes that were managed by the DG XII --*i.e.* Directorate-General Science, Research and Development-- in the period 1984-1993. In the Second and Third Framework Programmes[23] about 55% - 60% of the funds were administered by DG XII therefore, even if biased, we have a quite relevant sample. In the next section, after the description of the database, we shall then analyse the main characteristics of the institutions involved in the Framework Programmes.

5. EU funding system and HEIs' characteristics.

The total HEI population in the EU[24] was *circa* 1429 institutions (IAU 1991 and 1993) in 1990-92. Of these, 514 were universities, 39 new universities[25] (NU) and 876 Post Secondary Institutions (PSI). Many of the PSIs, especially in France, also fall within the framework of one of the universities. In *Table 4* we have shown the count and share of universities and HEI (Universities+NU+PSI), broken down by EU country.

The problem with statistics of this kind is that in Europe there is no standardization on the definition of PSI and University. In the different countries this terms carry varying connotations. Although the International Handbook of Universities, the principal source of these data, is compiled on the basis of information given by the appropriate higher education

---

[23]   The information for the First Framework is a bit less reliable. For the analysis of the data source see Section Five.

[24]   We do not take into account Luxembourg.

[25]   The class new universities refers to the 39 UK Polytechnics and Colleges that have been granted university status in 1992-93. As they were mainly teaching institutions, it is important to differentiate them from the other UK universities.

Table 4:   Count and share of universities and HEI, by country

	B	Dk	F	G	Gr	Ir	I	NL	P	S	UK	TO
UNIV	74	7	98	110	17	8	48	15	21	43	73	514
%	14.4	1.4	19.1	21.4	3.3	1.5	9.3	3.0	4.1	8.3	14.2	100
HEI	76	41	535	270	17	34	69	32	57	48	250[*]	1429
%	5.3	2.9	37.4	18.9	1.2	2.4	4.8	2.2	4.0	3.4	17.5	100

[*] The UK value is an estimate.

authorities in the countries, it does not mean that there is homogeneity within the two categories. However, in all the EU countries, the institutions that have been granted the university status went through a national selection process that can be considered more stringent then the one for the granting the PSI status. Therefore, this category can be considered more homogeneous and then we have focused our attention mainly on university. Nonetheless, the figure of Belgium, France and UK are biased. An analysis of the 74 Belgian institutions with university status enables us to assert that only 30% of them really have that status, then the share of Belgian universities drops down to 4%-5%. The France case is the opposite. Some of the institutions with PSI status can be considered universities. Then its university value has to be upgraded. The estimate is not easy, as first approximation we can speak of about ten points percentage. Then, the new share of France universities is *circa* 22%. Finally, the UK case. To calculated the number of universities we have made use of information of the Universities' Statistical Record. The resulted value of 73 is due to fact that the University of Cambridge and the University of Oxford are considered as one institution, while the University of London is subdivided into 22 colleges. Moreover, the 39 NU are considered as different category and then not included. We think that the value calculated in this way is a under-estimate of the real number of universities. Then, we suggest a correction of about 25 points percentage, with a new share for the UK universities of *circa* 18%.

Having defined the total HEI population, we now turn our attention to the HEI that have been involved in a R&D project.   We obtained the original data from the DG XII of the CEC. They refer only to shared-cost actions funded by the DG XII under the First, Second and Third Framework Programmes.[26] However, the data for the First Framework Programme are not complete because the database of the DG XII has been created only after the end of the programme, then only a part of the data concerning the First Framework

---

[26]   In both the Second and the Third Framework the research concerned with information and communications technologies was under the supervision of DG XIII, therefore it is not included in the data set. Some other small programmes directed by DG VI, DG XIII and DG XIV are not included too. For the Third Framework Programme the information is up to 15/3/1994.

Programme have been stored in it. For each HEI we were provided with geographical information and with the *Number of Contract Partner Links*. The latter represents the number of times a HEI has been involved in a R&D project. That is to say, the number of participations for each institutions No time or programme information were released to us. For each institution we have gathered the following data:

- The number of researchers and students in 1985 and in 1992. These data were available in the two periods only for the universities. When available it has been transformed in a categorical variable to identify the dimension of the organization.
- The number of paper published under a certain institution --*i.e.* (co-)authorship of a paper of a researcher associated with a specific institution-- in 1993.[27] The data source is the Science Citation Index, CD-ROM version 1993, ISI. For humanities and social sciences there exists the specific Social Science SCI which, however, we have not utilized. Then these data are biased to the detriment of institutions with humanity or social science department. However, under the first three Framework Programmes only a minor part of the budget was indirectly committed to socio-economic studies, so that we do not consider this a serious weakness for purposes of the present analysis.
- The institutions' funding year. That has been turned into a categorical variable to classify the institutions in relation to their historical age.
- The scientific fields in which the institution grants a doctoral (Ph.D) degree. These are converted into a categorical variable so that we can work with a homogeneous classification of the different types of European HEIs.

The database constructed in this way comprises 428 HEIs. They are subdivided in 341 universities, 59 PSIs and 28 NUs. The HEI that participate in the Framework Programmes are 30% of the total HEI population. However, when we consider only universities the share raises to 66.4%. This difference is mainly due to the fact that large part of PSIs are mostly teaching oriented institutions, then not involved in research. Moreover, the one that are involved in research are generally more oriented to a regional or national type of networking. Only when their research quality is extremely high they are trying to access the EU funding system. The high share of universities taking part in Framework Programmes confirms the diffusion in the use of this funding system by this kind of institutions. In the following part of the paper we shall focus our attention only on universities.

---

[27]   For the analysis of all the problems connected with the data collection see CEC (1994) pp.38-40. Special mention must be made of the peculiar role played by hospitals. Their weight in the presence count is not just over-estimated because of the effect of co-authorship, it is also often unclear whether they are linked to the university or not. Then in some cases the publication is counted as university and other as hospital. This varies among the European countries due to the widespread institutional variety.

Table 5 illustrates the universities' share in terms of institution count (IC) and participation count (PC) broken down by EU country. The comparison with the total figures --*i.e.* Table 4 and estimate values for Belgium, France and UK-- enable us to highlight a group of countries that has performed better and another that has performed worst. France and Germany are the only two countries included in the latter. When we take into account the participation count --*i.e.* how many times the institution got funding-- the decrease of the France share becomes dramatic. Also Germany, Italy, Spain and Portugal have lower shares. On the other hand, Belgium and The Netherlands double their share with respectively 9.8% and 8.7% of the total participations. The UK approaching one fourth of the total participations has the largest share. The changes described can be explained on the basis of the following considerations. Firstly, a larger number of participations means a higher quality of the national institutions. This seem to be the case of the UK with a remarkably high quality university system. Secondly, the administrative and bureaucratic structure of the

Table 5:   Distribution of participating institutions and participations count, by countries (%).

	B	Dk	F	G	Gr	I	Ir	NL	P	S	UK
IC	5.0	2.1	17.6	19.7	4.1	12.6	1.8	3.8	4.1	9.4	19.7
PC	9.8	3.4	7.7	17.5	4.8	10.4	3.5	8.7	3.5	6.2	24.4

national university system, together with the novelty of a competitive system may constrain the process of initiation of application for EU funds. This seem to be the case of France. Although its university system has a high quality, it is extremely bureaucratic and it is not use to external cooperation and competitive funds raising. Finally, the diffusion of information about how, were and when to apply for EU funds has taken a relatively long period of time. Is therefore possible to assume that for some countries like Belgium and The Netherlands there has been a localization and information advantage that together with the quality of the university system can justify the high performance of these countries.

To analyse university participation from the point of view of institutional size, we decided to use the number of researchers as our measure. We have then subdivided this variable in four categories: Small University (S) from 0 to 100 researchers, Small-Medium University (SM) from 100 to 500, Medium-Large University (ML) from 500 to 1800, Large University (L) more than 1800. Furthermore, to take into account of the fact that some universities are more research oriented than others we divided the number of researchers by the number of students. As for the previous one, we transformed the weighted number of researchers in a categorical variable with four dimensional class. In *Table 6* we have shown institutions and participations count broken down by dimensional class. In the case of un-

weighted researchers number, the Medium-Large and Large institutions are performing better than the others. It seem then that the success in raising EU funds is connected with the

Table 6:   **Institutions and participations count, by dimensional classes (%).**

	RESEARCHERS		WEIGH. RESEARCHERS	
	IC*	PC	IC*	PC
S	4.8	0.9	9.7	9.3
SM	37.3	20.1	38.2	30.3
ML	45.4	53.8	40.3	51
L	12.5	25.1	9.7	9.4

* The share does not sum to 100 due to missing cases.

research dimension of the university. However, when we look at the weighted researchers number, variable that tries to catch the real research dimension of the institution, the previous observation is not any more true. Both Small and Large universities do not show relevant
changes, the share of participations and the share of institutions are more or less equal. Only Medium-Large universities have a higher participations' share. A tentative explanation is that in the case of un-weighted researchers count the higher success was due to management and organizational capabilities and not to the real research dimension. Large universities can cope with the international organization of a R&D cooperation, and with the related administrative charge, better then small universities. Then, while the entrance in the system depends on the real research dimension the repeated participation depends also on the organizational costs that are lower for large universities.

University participation in Framework Programmes can be analysed in relation to the age, or period of establihment of the institutions. For each university we have collected the founding year. Then, we have subdivided this variable in four categories. First, New University (NU), all the institutions established after 1945. Second, Modern University (MU), that includes the institutions created between 1900 and 1945. Third, Nineteenth Century University (NCU), as the name indicates, the ones founded between 1800 and 1900. Finally, Old University (OU) that includes all the universities that have been founded before 1800. As the previous tables, *Table 7* illustrates institutions and participations count broken down by historical class. While in institutions count New University ranges first, in participations count it is in third place. On the other side, in the second distribution Old University raises to the first position. Making the generally accepted assumption that the old

universities tend to be the ones with higher prestige, and hence they can maintain the higher average quality in their faculties, the previous figure enable us to confirm the idea that the success in EU fund raising is related to the quality and to the institutional reputation of the university.

Table 7:   **Institutions and participations count, by historical class (%).**

	IC	PC
NU	38.8	20.8
MU	8.0	10.5
NCU	20.1	31.3
OU	33.1	37.4

The widespread institutional variety of the European university system has always constrained the value of international comparisons. For example, the Rheinish-Westphalian Technical University in Aachen, Germany has few things in common with the Eindhoven Technical University in Eindhoven,[28] The Netherlands. The first one has faculties like philosophy and education, while the other is a engineering school. The same kind of diversity can be found between the Italian and the UK Polytechnics. Here we want to suggest a way to classify the different type of European universities. Starting from the fact that the requirements for the doctoral degree are approximately standardised among the EU countries, we have classified institutions according to the scientific fields in which they grant the Ph.D degree. In particular, taken into account the OECD classification for scientific fields --*i.e.* Agriculture, Medicine, Natural Sciences, Engineering, Social Sciences and Humanities-- we have created 28 categories. Six for the universities *Mono-discipline* (MOD), fifteen for the universities *Bi-discipline (BID)*, and seven for the universities *Multi-discipline (MUD)*. In this latter group are included all the institutions that award doctoral degree in three or more scientific fields. To better classify these universities we have controlled for the presence of Engineering, Medicine and Natural Sciences. We have then subdivided the group in seven categories. In *Table 1, 2* (see appendix) we have shown for both institutions and participations, count and share broken down by the 28 types of institution. Firstly, eight type of institutions are not present in the Framework Programme. Among the twenty that have succeeded in entering the system only thirteen achieve more than 2%. Only three (multi-discipline with medicine and natural sciences (MUDMN), multi-discipline with natural sciences and engineering (MUDNE) and multi-discipline with

---

[28]   The two towns are only 120 kilometers one from the other.

medicine- engineering-natural sciences (MUDMEN)) score more then 10%. These last three categories counts for 56.4% of the institutions. Secondly, the system is more concentrated in the participations count. Nine type of institutions have a share higher then 2%. The three multi-discipline categories previously in a dominant position are, in this case, responsible for 72.7% of the participations. They are performing much better then the others. The prior description points to the fact that although the system includes a large variety of institutions, a large share of the participations, then of the funds, is realized by a specific kind of institution. This institution can be described as a general university that always includes faculties of medicine and natural sciences and often also of engineering.

The analysis of the institutions that have taken part in a R&D project within the EU Framework Programme enables us to highlight two main observations:

- The wide participation of universities in the Framework Programme, including about 66.4% of the total university population, together with the high institutional variety -- *i.e.* diversity of the participants in terms of dimension, history an type of institution-- confirm the widespread impact of the EU funding system.
- It seems possible to identify the presence of a "best performer", an institution with a particular set of characteristics that has a participation record better than it was possible to expect only on the basis of the principle that the distribution of participations is proportional to entry in the system. Indeed, it seems plausible to think that a large university is also an old one and it is multi-discipline with medical and natural sciences faculties.

Starting from these observations, in the next section we shall develop a comparative analysis of the variables number of participations and number of papers divided by number of researchers. In this way we shall try to evaluate how important the "quality" of the institution is for the selection process.

6. EU selection process and university participations.

The sociology of science and more recently empirical studies in the "New Economics of Science" have made large use of bibliometric analysis. In particular, the idea behind paper or citation counts is that they can be used as an indicator of the underlying "quality" of the researcher. Applying this approach to our case, it is possible to depict the "quality" of the university as the ratio between the publications realized in one year and the number of researchers attached to that institution (RATIO). Moreover, if "quality" and, consequently, the mechanisms highlighted in Section Four are the basis of the EU selection process, we can

assume that the participations number (NPAR) is also an indicator of the underlying "quality" of the university. The comparison of the two variables will enable us to discern the actual output of the selection mechanism. Indeed, the dissimilarities between the two distributions can be interpreted as departure from the "quality" principle due to policy decision or to other mechanisms present in the selection process.

Due to the very high rate of co-authorship (and number of co-authors) for medical schools and hospital (see note 27) we decided to exclude them from the sample when possible.[29] The distribution of RATIO, as we expected, is positively skewed. A large number of institutions have an extremely low RATIO value. An analogous observation is also true for NPAR. With a range of 419, 31 lies at the 50% percentile. A first measure of similarity we have computed is the Pearson Correlation Coefficient. The value of .5048 (significance .01) confirms a positive but not extremely high correlation between the two distributions. Given the general similarity, we have identified, in percentile terms, the different positions that the same university has in the two distributions. Then we have computed the percentile difference. For the way the calculation has been done, a positive difference is equivalent to have an institution with more participations than papers *per* researcher --*i.e.* it has a percentile position higher in NPAR than in RATIO. On the other hand, a negative difference is associated with an institution that has more papers *per* researcher than participations. We have originated eight categories, two extremes and six of ten points percentage. Four for the negative differences and four for the positive. In *Table 8* we have shown their frequency.

Table 8:   Frequency of percentile classes %.

< -31	[-30 -21]	[-20 -11]	[-10 -1]	[0 9]	[10 19]	[20 29]	> 30
9.5	7.6	11.7	19.9	18.9	13.2	8.8	9.5

0.9 % missing.

We have focused our attention especially on the two central classes and on the two extreme ones. A large share of universities, about 40%, is included in the two central classes. Although there has been a change in the percentile position, it has been small and we can consider the institutions in these groups as stable. In this case "quality" and the associated self-reinforcement mechanisms are the driving principles of the selection process. Nonetheless, about 20% of the sample has modified its position in a significant way. On the one hand, *circa* 10% of the universities --*i.e.* the first class-- did not succeed in having a

---

[29]   In some European countries hospitals and medical schools are institutionally associated with universities. Then, as the currently available data format is not enought detailed, we have not been able to identify all hospitals and medical schools.

share of participations proportional to their "quality". On the other, another 10% performed better than what we could have expected only on the basis of their "quality".

Among the aims of the EU's research and development policy there is the realization of a scientific and technological cohesion among the European countries. If we believe that the European Commission is trying to implement this objective we should expect that, in our scheme, the countries of the European periphery have an higher share of better "performers" --*i.e.* a higher share in the last class. This hypothesis is confirmed in the case of Greece (22%), Ireland (33%) and Portugal (36%). Moreover, although Spain has only a slight increase in the last class (13%), it has high values in all the four positive classes. To further confirm the relevance of the cohesion policy we can highlight that while France and UK has higher shares in the two stability classes and low in the last, the previous four peripheral countries have lower or null value in both the stability and negative categories. Two main exceptions are present. Italy with only 6% in the last class and high values in the negative categories and The Netherlands with the last three positive classes that count for 85% of its participations. A tentative explanation of the Italian situation is connected to the fact that in the Italian system hospitals and medical schools are institutionally associated with universities. The publication count, therefore, over-estimates the "quality" of some institutions. The reverse situation is true for The Netherlands, where university Hospitals are easily identifiable institutions. Then, the under-estimate of the "quality" of some Dutch institution, together with the previously highlighted localization and information advantages can explain the high positive figures. The Dutch case can also be interpreted as an example of the importance of the "first entry advantage". In terms of our theoretical framework, the localisation and information advantages can be translated in the possibility of being among the first to enter the system. Consequently, the Dutch institutions have had a higher probability of building up "barriers to entry" and thus of being among the better "performers".

The percentile comparison has been carried out also in relation to the dimension, historical age and type of institution. The following conclusions can be drawn. First, the share of the percentile classes for un-weighted number of researchers points to two opposite circumstances. The Small Universities (<100) have extremely high shares in the first two negative categories (38% and 31%). Then, they did not succeed in having a quota of participations proportional to their "quality". On the other hand, Large Universities (>1800) have 68% of their participations in the last three positive classes. In particular, 29% in the last one. They have, therefore, performed better than what we could have expected only on

the basis of their "quality".[30] This observation tend to confirm what already stressed in the previous Section. Large Universities have organizational advantages, both in terms of capabilities of managing an international cooperation and of interacting with the CEC, that enable them to perform better than Small ones. Scale economies in the administrative and bureaucratic support function, as well as dynamic scale economies --*i.e.* learning--, tend to reinforce the advantage of large universities. Furthermore, these organizational advantages can be translated in ability to be among the first to enter the system. In terms of our theoretical framework, these institutions have, then, a higher probability of building up "barriers to entry" and thus being repetitively selected. Second, it seems that the funding year of the institution does not influence the distribution of the percentile categories. Finally, the analysis of the percentile classes in relation to the type of institution shows a singular behaviour in two cases. Both Mono-discipline-Engineering universities, with 36% share in the last class, and Multi-discipline-Natural Science-Engineering universities, with 16% quota in the last category, have performed better than what we could have expected only on the basis of their "quality". Again, a policy impact can be seen in this kind output of the selection process. The universities that are more technology-oriented have succeeded in obtaining a larger share of participations because their orientation tends to be more appropriate for the Framework Programmes' objectives, and it is the case that such institutions predominate among the mono-discipline category

The previous analysis confirms the idea that the "quality" and the mechanisms highlighted in Section Four are the basis of the EU selection process. The skewness of the participations distribution, with few institutions that succeed in having a lot of participations together with the fact that *circa* 40% of the universities are stable in the two distributions strongly support this hypothesis. However, the dissimilarities between the two distributions point to the existence of other selection principles. First, in the case of cohesion policy and technology orientation there is a clear intention of the CEC of influencing the process in a way that a share of participations is due not only to "quality" but also to other features of the participants. In this way, the CEC tries to pursue its policy aims both *via* a "quality" selection process and *via* mechanisms of correction that tend to grant a selection advantage to institutions with characteristics particularly suitable for the CEC policy goals. Second, the Dutch case and the dimensional bias seem instead to be good examples of un-intended consequences induced by the way the selection mechanism works. Due to the internal logic of the selection mechanism, and not to intended agency action, the output of the process is then different from what we could have expected only on the base of the "quality" principle.

---

[30]   Is important to highlight that this observation can be biased by the researchers count. Due to the heterogeneity in the definition of rsearcher, universities can count in different ways their researchers. Then, if the value of the Small institutions is an under-estimate and the figure of the Large is an over-estimate of the real value the ratio publications, researchers will change in opposite direction and the proposed dicotomy will be less sharp.

7. Conclusions

In this paper we have focused our attention on a specific aspect of the internationalization of the market for university research. From the starting of the First Framework programme of the Commission of the European Communities in 1984, Higher Education Institutions, and in particular universities, have increased their share of "participations" in R&D cooperation projects relative to other organizations.. They have taken part in collaborations with other universities and with public or private research centres --*i.e.* the "research group" cooperations. They have also interacted with industry joining R&D cooperation project with a mix of universities, enterprises and research organization --*i.e.* the "hybrid" group. During the mid eighties the "path to Bruxelles" was not a well-worn path for these institutions. In the nineties, by contrast, HEI rank first for number of participations in R&D projects under the Framework Programmes.

We have addressed the problem of why some of the institutions among the total HEI population succeed in entering the system and other do not, and connected to this, we have tried to understand the reasons for repeated participations. We have focused our analysis on the selection process. Assuming that the process is driven by a "quality" principle and acknowledging the fact that "quality" is not observable, we have put forward a theoretical framework. At its heart lies the importance of signalling mechanisms and the fact that the "quality" principle is intrinsically linked with various type of cumulative and self-reinforcement mechanisms.

The empirical analysis has shown that the participations distribution is extremely skewed. Many institutions are present in the system only one or a few times. Only few universities have achieved a high number of participations. This outcome is consistent with the "quality" principle. Furthermore, when we checked for the features of the institutions with better performance in terms of participations, it was possible to interpret them in a way that confirmed both the importance of "institutional reputation" and the relevance of "first entry advantage".

Finally, the outcome of the selection process can be seen as the result of the "quality" principle and of the underlying mechanisms, affected, however, by the priorities of the EU research and development policy. In particular, in the case of the cohesion policy, the final results reflect a balance between the two conflicting objectives of selecting on the basis of "quality" and strengthening the capabilities of the peripheral regions.

References

Arora, A., David, P.A. and Gambardella, A., 1994, *Increasing Returns to Knowledge Capital in Scientific Research*, presented to NBER Summer Workshop on Industrial Organization, Cambridge MA, July.

AXION, 1995, *The Impact of EC R&D Policy on the European Science and Technology Community 1987-1991 2nd Framework Programme. National Impact Studies Synthesis*, Study conducted on behalf of the European Commission, forthcoming.

Bossard Consultant, 1989, *Contract Research Organizations in the EEC*, Study and Directory carried out for the SPRINT Programme, Luxembourg.

Brierty Mc, V., 1993, The university-industry interface: From the lab to the market, *Higher Education Management*, Vol. 5, No. 1, pp. 75-94.

Commission of the European Community, 1994, *The European Report on Science and Technology Indicators 1994*, Report EUR 15897 EN.

Commission of the European Community, 1993a, *Catalogue of Research Projects in the Third Framework*, Report EUR 14937 EN.

Commission of the European Community, 1993b, *Working Document of the Commission Concerning the S&T content of the Specific Programmes Implementing the 4th Framework Programme for Community Research and Technological Development 91994-1998) and the Framework Programme for Community Research and Training for the European Atomic Energy Community (1994-1998)*, COM (93) 459.

Commission of the European Community, 1992a, *EC Research Funding. A guide for Applicants*.

Dasgupta, P. and David, P.A., 1994, Toward a New Economics of Science, *Research Policy* 23:487-521.

David, P.A., 1994, *Positive Feedbacks and Research Productivity in Science: Reopening Another Black Box* in *Economics and Technology*, O. Granstraad, ed., Amsterdam: Elsevier Science Publishers.

David, P.A., Geuna, A. and Steinmueller, W. E., 1994, *Additionality as a Principle of European R&D Funding*, A Study carried out for the STOA Programme of the European Parliament, forthcoming.

Etzkowitz, H., 1993, *Redesigning "Solomon's House": The University and the Internationalization of Science and Business*, in Crawford, E. *et. al.*, *Denationalizing Science*, Kluwer Academic Publishers, pp. 263-288.

Foray, D., 1994, *University-Industry Research Relations: Institutional Problems, Organization and Contractual Tools in France*, presented at The CEPR/AAAS conference "University Goals, Institutional Mechanisms, and the 'Industrial Transferability' of Research", Stanford University, March 18-20.

Flam, F., 1992, Japan Bids for US Basic Research, *Science*, Vol. 258, November 27, pp.1428-1430.

Gibbons, A., 1992, Biotechnology, Japanese in for American Expertise, *Science*, Vol. 258, November 27, pp. 1431-1433.

International Association of Universities, 1991, 1993, *International Handbook of Universities*, Stockton Press.

Lambert, G. and Willinger, M., 1994, *Status quo preservation and organizational inertia*, presented at the EUNETIC conference "Evolutionary Economics of Technological Change" European Parliament, Strasbourg, October 6-7-8.

Larédo, P., 1994, *Les politiques europ*éennes *de R&D au milieu de gué*, in Sachwald, F.,*Les defis de la mondialisation innovation et concurrence*, Masson, Paris.

Malerba, F. *et. al.*, 1991, *The Nascent Globalization of Universities and Public and Quasi-Public Research Organizations*, FAST Research in the Framework of the MONITOR Programme.

Merton, R.K., 1968, The Matthew Effect in Science, *Science*, 159 (3810), January 5, pp. 56-63.

National Science Board, 1982, *Industry-University Research Relationships*, 14th report of the NSB, Washington D.C.

OECD, 1984, *Industry and University: New Forms of Cooperation and Communication*, Paris.

OECD, 1990, *University-Enterprises Relations in OECD Member Countries*, Paris. Universities' Statistical Record, *University Statistics. Vol. 1 Students and Staff*, Various years.

Peacock, A., 1991, Economics, Cultural Values and Cultural Policies, *Journal of Cultural Economics*, 15, pp. 1-18.

Samuelson, W. and Zeckhauser, R., 1988, Status Quo Bias in Decision Making, *Journal of Risk and Uncertainty*, No. 1, pp. 1-59.

Spence, A.M., 1974, *Market Signalling. Information Transfer in Hiring and Related Screening Processes*, Harvard University Press, Cambridge, Massachusetts.

Tversky, A. and Kahneman, D., 1991, Loss aversion and riskless choice: a reference-dependent model, *Quarterly Journal of Economics*, pp. 1039-1061.

Universities' Statistical Record, *University Statistics. Vol. 3 Finance*, Various Years.

Valigra, L., 1994, Academic Biotech Deals Offer More Promise Than Product, *Science*, Vol. 263, January 14, pp. 168-169.

Table 1: **Institutions count and share, by university type.**

	Count	Share
ModHum	2	0.6
ModAgr	3	0.9
ModMed	14	4.1
ModNat	2	0.6
ModEng	16	4.7
ModSoc	11	3.2
BidNatEng	12	3.5
BidNatSoc	11	3.2
BidNatHum	10	2.9
BidNatMed	7	2.1
BidEngSoc	4	1.2
BidMedSoc	6	1.8
BidSocHum	16	4.7
MUDM	3	0.9
MUDE	6	1.8
MUDN	18	5.3
MUDME	7	2.1
MUDMN	66	19.5
MUDNE	48	14.2
MUDMEN	77	22.7

Table 2:   Participations count and share, by university type.

	Count	Share
ModHum	6	0
ModAgr	339	1.9
ModMed	150	.8
ModNat	20	.1
ModEng	1176	6.5
ModSoc	63	.3
BidNatEng	433	2.4
BidNatSoc	214	1.2
BidNatHum	196	1.1
BidNatMed	517	2.8
BidEngSoc	382	2.1
BidMedSoc	46	.3
BidSocHum	86	.5
MUDM	52	.3
MUDE	87	.5
MUDN	584	3.2
MUDME	604	3.3
MUDMN	4335	23.9
MUDNE	2311	12.7
MUDMEN	6564	35.1