

INDEX

Introduction.....	5
1 Unpacking the concept of Institutions: a system based perspective	7
1.1 Introduction.....	7
1.2 Unpacking the concept of Institutions: a system based perspective	8
1.3 Issues related to the definition of Institutions	11
1.4 Institutions as habits and shared routines.....	13
1.5 Institutions as Pragmatic result of formalised organic entities	15
1.6 Institutions as spontaneous order interactions	17
1.7 Institutions as units of transaction.....	19
1.8 Institutions as norms and laws constraining human actions	22
1.9 Unpacking the concept of Institutions: lessons form Old and New Institutionalism.....	24
1.10 Institutions within systems of production: the concept of social technologies.....	27
1.11 Conclusion: Social technologies, Institutions, and Policy	29
2 Methodology: The Narrative Approach.....	30
2.1 Introduction.....	30
2.2 Narrative approaches in economic analysis	31
2.3 Narrative I: Friedman and Schwartz [1963] and Romer and Romer [1989] Approach.....	32
2.4 Narrative II: Bates et Al [1998] Analytic Approach.....	36
2.5 Narrative Approach I and II : Common features, Advantages and Disadvantages	38
2.6 Narrative Approach I and II : An alternative proposal	40
2.7 Conclusions.....	43
3 A Narrative history of policy evolution	44
3.1 Introduction.....	44
3.2 System and Social Technology I: the Ervet system.....	45
3.3 System and Social Technology II: Ervet and the Real Services Centres.....	48
3.4 The emerging of a new system	56
3.5 System definition III: The Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT)	62
3.6 Conclusions.....	72
4 PRRIITT and Measure 3.1.A: Technical description and last narrative on policy implementation.....	73
4.1 Introduction.....	73
4.2 Structural description of Emilia Romagna economy before PRRIITT	74
4.3 The Industrial Structure	76
4.4 R&D investments	81
4.5 Employment in High Technology Manufacture and Service activities	84
4.6 Patents	86
4.7 Some conclusions on the regional system of Production at the moment of PRRIITT's implementation.....	88
4.8 The Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT): A Technical description of the Policy	89
4.9 Measure 3.1.A	91
4.10 Measure 3.1.A: A last narrative on the reaction of the regional system to the policy measure	96
4.11 Conclusions.....	98
5 Some considerations on PRRIITT as social technology	99
5.1 Introduction.....	99
5.2 The sampling process: characteristics of the Survey	100
5.3 Structural characteristic of the Sample	102

5.4	Production and Investments	105
5.5	R&D	110
5.6	Conclusions: Some observations about the responses in the Treatment and the Control Groups and the degree of fitness between Measure 3.1.A and the regional productive system..	117
6	Conclusions.....	119
7	References.....	122
8	Appendix I: Questionnaire submitted to Treatment and Control Group	138

LIST of Figures

Figure 1: Regional production system (1970s -1980s)	47
Figure 2: Physical technologies of production – Real Services Centres and Productive threads	60
Figure 3: Physical technologies of production – PRRIITT.....	71
Figure 4: Total Investments per Pavitt’s Sectors	83
Figure 5: Per capita gross investments by Pavitt’s sectors (2002).....	84
Figure 6: Patent applications – Per capita and per researcher (2003).....	88

LIST of TABLES

Table 1: Local system specialisations (1970s – 1980s)	51
Table 2: Identification of physical technologies – Patents, Research Laboratories and VI FP manifestation of interest.....	67
Table 3: Identification of Physical technologies – Matrix I and Matrix II matching	68
Table 4: GDP growth rates – Comparison (1971-1999).....	74
Table 5: GDP growth rates – Comparison (1999-2002).....	74
Table 6: GDP growth rates – Industry - Comparison (1999-2002)	75
Table 7: Firms and employees in Manufacturing by firm size (1981; 1991; 1996)	76
Table 8: Firms and employees in Manufacturing by juridical form (1981; 1991; 1996)	77
Table 9: Firms and employees in Manufacturing by sector (1981; 1991; 1996).....	78
Table 10: Investment per macro sector – Comparison (1997 – 2002).....	80
Table 11: Intramural R&D expenditures, by sector (2002-2003)	81
Table 12: Gross investments grouped by Pavitt’s sectors (2002-2003).....	82
Table 13: Manufacturing and Service activities - High technology employment (2004).....	85
Table 14: R&D Personnel per sector	85
In 2003, the Emilia Romagna percentage of R&D personnel is higher than the Italian value (1.31% versus of 1.13%). Important to mention, in Italy the highest percentage of R&D personnel is in the higher education sector (e.g., Universities), whilst in Emilia Romagna the highest percentage can be found in the business enterprise sector. However, the level of R&D personnel in the education sector of Emilia Romagna is still higher than Italy (0.57% versus 0.55%). Table 15: : Manufacturing and Service activities- R&D personnel (2002 -2003).....	85
Table 16: Patents application sto EU patent office – Total and High technology (2002-2003).....	86
Table 17: High technology patent applications – per sector (2002-2003).....	87
Table 18: Measure 3.1.A. – Structure of co-financing.....	94
Table 19: Measure 3.1.A – Projects submitted and financed.....	96
Table 20: Sample structure	102
Table 21: Sample structure - Treatment group	102
Table 22: Sample structure - Control group.....	102
Table 23: Firms – Year of constitution	104
Table 24: Firms – Legal entity	104
Table 25: Firms – Nace sectors	104
Table 26: Firms – Size per sector of performance [%]	104
Table 27: Activity of production: value chain	107
Table 28: Investments – Partition	107
Table 29: Investments – Investments and Employment trends.....	107
Table 30: Location of the main client	108
Table 31: Investments – Investments and Turnover trends	108
Table 32: Investments – Investments and Export trends	108
Table 33: Investments – Investments and investment partition trends	108

Table 34: Employment – Employment and Turnover trends.....	109
Table 35: Employment – Employment and Export trends.....	109
Table 36: Share of turnover related to the main client.....	109
Table 37: R&D – Years of activity and Internal units	112
Table 38: Investments – Investments and Research Investments - Comparison	112
Table 39: R&D – Typology of research activity.....	112
Table 40: R&D – Total R&D expenditures as a share of total expenditures.....	113
Table 41: R&D – R&D personnel as a share of total personnel	113
Table 42: R&D – R&D personnel specialisations	113
Table 43: R&D – R&D external personnel.....	114
Table 44: Patents – Patent production.....	114
Table 45: Patents – Patents purchased	114
Table 46: R&D expenditures and Performance – trend values.....	115
Table 47: R&D expenditures and Export – trend values	115
Table 48: R&D expenditures and patents registered	115
Table 49: R&D internal unit and turnover performance.....	116
Table 50: R&D personnel and turnover performance.....	116

LIST of ITEMS

Item 1: Friedman and Schwartz’s analysis of monetary shocks after WW I [1963]	34
Item 2: Types of Narrative approaches - Comparison	39
Item 3: Narrative methodology - Proposal.....	41
Item 4: Ervet’s universe of Centres for Real Services	50
Item 5: Real Services Centres – formalisation of spontaneous and pragmatic type institutions	52
Item 6: PRRIITT - Process of selection of the physical technologies	64
Item 7: PRRIITT – General Structure.....	90
Item 8: Measure 3.1.A - Structure.....	93

Introduction

Since the Industrial Revolution, the Smithian growth postulate traces the wealth of a nation according to its capacity to extent the market and to specialise its skills of production [Smith 1776]. Mokyr among others [Landes 1969, North 1990, Porter 1990, Grief 2005] observes that the comparative advantages enabling Britain to originate Industrial revolution were related to a fairly stable society but, most important the characteristic distinguishing Britain was the agility, solidity and strength of its institutions: a healthier financial system, well developed internal transports, a property system on lands, no internal tariff barriers and weaker guilds [Mokyr 2005 and 2008].

The increasing wealth of Britain rested with the political and institutional capability to change its rules, with advantages laying in the flexibility of legal and economic assets adapting without social costs. In this sense, the pattern of economic growth was dependent on the infrastructures underpinning social relations in a system marked by a capacity to co-adjust socio-economic arrangements [Metcalf 2001].

Institutional variables are still employed as the factors explaining economic change, as different socio economic paradigms are developed according to different institutional settings shaping the pattern of evolution of national economies [Perez 1983, Freeman and Perez 1988, Freeman 1988, Lundvall 1992, Nelson 1993].

However, although a common understanding has been achieved about the importance of institutions, there is no specific agreement about what are institutions and how they work.

This thesis is aimed to analyse what are institutions and their role within a local system of production. Specific research question involves investigating the process of evolution of an institution as a social technology according to the transformation of the capabilities, or physical technologies, of its system of reference.

To develop this analysis, we will employ as an example some of the industrial policies supported by Regione Emilia Romagna from 1970s to 2003.

Fundamental to the scope of the work is to find a suitable definition of institution.

We will first develop a theoretical framework to formulate a coherent definition of institution. In our perspective, an institution emerges as a spontaneous element of coordination of habits and social routines, developing according to the characteristics of its system. Once such coordination mechanism becomes standardised, we observe its transformation from an informal organic-type into a formal pragmatic-type institution. In this light we can consider a policy action an institution as the element employed to pragmatise a spontaneous process of coordination among agents belonging to a same system [Chapter 1].

As institutional change is a difficult to isolate and analyse, the methodology we propose to test this definition is a Narrative Approach, composed of qualitative and quantitative aspects able to capture the emerging of an institution. This method enables the decomposition of institutional change according to official and historical records which will guide the process of establishing and understanding of the emerging of new institutions [Chapter 2].

We will employ this technique in a description of the evolution of the physical and social technology of the regional system. Specifically, we will describe the stages of transformation of the system focusing on the different industrial policies developed according to the evolution of the physical technologies [Chapter 3]. Afterwards we will concentrate on a more focused analysis about the quantitative characteristics of the system, tracing back its process of evolution in terms of physical technology of production [Chapter 4].

Finally, we will examine the Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT) as example of industrial policy action undertaken by Regione Emilia Romagna. We will provide a technical description of the policy and we will analyse whether the policy developed with PRRIITT can still be considered a form of social technology.

We will develop such analysis with particular regard of investigating the correspondences between the firms participating to the Measure 3.1.A. and the predictions made during the development of PRRIITT by the regional government to gauge at which level PRRIITT is representative of evolution of the regional system and can be considered a pragmatic-type institutions according to the physical technologies of production of the system [Chapter 5].

1 Unpacking the concept of Institutions: a system based perspective

1.1 Introduction

The chapter will elaborate on the evolution of the notion of institutions, from its origins to the utmost recent debates, trying to unpack the concept in its different connotations.

Purpose of the next sections will be to isolate a theory of institutions as standardised social technologies aimed to the pragmatic coordination of the physical technologies spontaneously emerging in a system.

Two elements will be regarded as fundamental in the analysis. Point of departure will be finding a suitable definition for the notion of institution. Indeed, despite a common agreement on the importance of institutions in the process of economic change, no common understanding has been reached on what institutions are. We will propose a definition of institutions based on the development of interaction mechanisms among different agents sharing a same environment. Specifically we will advance the hypothesis that necessary pre-condition for the emerging of an institution is that the agents develop relationships. Therefore, pre condition for the arising of institutions is in our view the development of a system, and specifically of a place structured by the relationships of the agents sharing the same space.

In the first section of the chapter we will contextualise the role played by a specific system in the process of institutional development, employing the idea that different typologies of system have different outcomes in terms of institutional development.

Having focused on these factors, we will then open the black box of institutional theorizing. We will analyse some of the most employed definition in the literature about the role of institutions, trying to define the different characteristics underpinning economic change and the factors which can lead to define policies a form of institution according to these characteristics.

1.2 Unpacking the concept of Institutions: a system based perspective

Any definition of institution assumes that institutions are structures embedded in a framework. Necessary premise to the development of the concept is therefore proving a clarification of the notion of environment and system, specifically on the level their characteristics can affect a process of institutional change.

Several classical studies have established a role for the environment where firms organise their production. Such a role is not of a static nature but active element enhancing firms' characteristics and capable to empower the access to new information and knowledge. Firms indeed do not act as isolated units but as a place where the production is organised in response of internal and external feedbacks [Coase 1937; Marshall 1920, Hirschman 1958, Krugman 1991]. Different modes of organizing the production are the result of different ways in which rules have been set up in the environment. In this sense, the external dimension should be considered as a resource rather than a framework to outsource the productive process. As in fact the firm has the capacity to absorb and learn, the environment has the potential to be not just a passive element [Amendola and Bruno 1990, Coriat and Weinstein 2002].

The idea of an active role of the environment in influencing firms' life cycles is already accepted when the focus is on the selective process: multiple selective environments are the places where the choices of firms' survival are determined and where being or not being placed in a specific context is itself a determination of success or failure [Alchian 1950; Levinthal 1990, Loasby 2000, Maskell and Malmberg 1999]. As Cohen and Levinthal [1990] pointed out, among the most important components to exploit capabilities is the firm capacity to establish linkages to access the knowledge accumulated in the space outside. This ability explicates in an absorptive capacity enhancing not only the survival but also the success of the firm. However, prior condition to this process of absorption is the ability to interact and to establish linkages with other actors sharing the same space.

Crucial factor becomes the level of interaction which occurs in the environment. It is possible to distinguish two levels of external framework.

We could define the environment an *ecology* when a number of agents is set in specific place generating the potential for multiple sources of knowledge. Whereas these connections develop into a repetitive and structured relationships we could consider the ecology a *system* [Metcalf 2005, Metcalfe and Ramlogan 2006]. According to this definition, not every ecology is a system but just

some of them which develop a specific kind of intermediary components defined in terms of connections.

According to Ingelstam [2002] a system is defined as:

1. Consistent of specific components and relations among them. The components and relations should form a coherent whole (which has its own properties different from the properties of the constituents).
2. According to a function – that is, it is performing or achieving something.
3. A finite entity, therefore it will be possible to identify the boundaries of the system discriminating between the system and other systems outside.

A definition of a system therefore includes a definition of its components and of the relationships among them: together these elements define the attributes and therefore the function of a system and its boundaries [Carlsson et Al 2002, Edquist 2005].

The difference between ecology and system lies in the nature of the interactions developed and if these interactions become a resource. The ability to learn from the interaction with the external dimension has carried to specific forms of systems, resulting in a continuous modification of organization of production whatsoever is the dimension observed: geographical [Freeman 1998, Lundvall 1992, Nelson 1993], organizational [Aoki 2001], sectoral [Malerba 2004].

Our analysis will focus on a particular kind of system where the interactions among the actors are particularly strong: a local system of production.

A local system of production is defined through a spatial and a relational connotation. Its characteristic is to be a specific space where production is boosted by complementarities and contiguity. Production in this framework is seen as a collective process enhanced by the interaction of heterogeneous agents sharing the same environment.

The literature on local system of production is vast and does not allow us to provide an exhaustive review of it here. However, we will list some of the main contributions focusing in particular on the characteristics of the relationships developed in a local system of production.

The seminal contribution to the literature is provided by Marshall [1920] with the identification in Northern England of “large numbers of small businesses of a similar kind in the same locality” [1920: pp 277] named by the author industrial districts. According to Marshall, characteristic of these districts was to be a place where the physical agglomeration of specialised activity of production was generating external economies, thanks to the local availability of tangible as well as

intangible inputs: the so-called industrial atmosphere [Marshall, 1927], described by the author as << The mysteries of trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously>> [1920: pp 271].

This last concept is capable of many different interpretations. Nevertheless it has been commonly interpreted as <<the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region>> [Bathelt, Malmberg and Maskell, 2004: pp 38].

The characteristic introduced by the work of Marshall attracted the attentions of several scholars who developed the marshallian notion in terms of: an alternative division of labour among firms [Brusco 1982, Piore and Sabel 1984]; a system to overcome outsourcing coordination problems [Pini et Al 2007]; a place where social linkages favour cooperation between firms and mitigate the negative aspects of competition [Dei Ottati, 1994]; a system where locally concentrated tacit knowledge is freely available [Becattini 1979 and 1990]. Moreover, in such a framework, the systematic nature of the relationships is profoundly rooted into a common background which allows the agents to share not only an economic but also a social context of values, and establishing systems of relations build on informal ties [Granovetter 1985, Putnam et Al 1993, Dasgupta 2003, Durlauf and Fafchamps 2004].

Thus, it is possible to affirm that today these characteristics are treated in the literature as a stylised fact [Asheim 1996].

A context characterised as a local system of production is sustained in its process of development by an internal combination of factors increasing its propensity to generate coordination. This is of course not to say that every system with such characteristics has the potential to generate the same kind of linkages. However, according to the literature these specific typologies of systems are based on social and technical condition more likely to integrate and develop among the agents an attitude favourable to networking.

In the next sections we will confront these elements with our idea of institutions trying to eviscerate the reasons at the basis of the importance of system-factors and institutional change.

1.3 Issues related to the definition of Institutions

As mentioned above, a system type environment has the characteristics to favour the establishment of linkages among actors sharing a same space and consequently increases the chance to develop a networking attitude on a area perceived as common.

In the light of these considerations, we would like to start our analysis of institutions as that element generated by a systemic attitude to cope with elements perceived as shared within a system.

Our definition of institution developed with the idea of system.

However, in the economic scenario although a common agreement has been reached on the importance of institutions, no common understanding has been achieved about what institutions are and how they work. Such ambiguity could be seen as the result of divergent ontological and methodological commitments to the subject, producing uncertainty rather than clarifying how institutions fit a model of socio economic evolution [Samuels 1995, Langlois 1986, Hodgson 1998 and 2000, Williamson 2000, Lawson 2005, O'Hara 2007, Nelson 2008].

Institutions could be referred as formal or informal rules; as pragmatic or organic entities; as forms of spontaneous order; as norms and laws constraining interactions, as the result of purposeful individual action; or - as Hodgson [2006] recently argues – institutions are a balancing process between individual instances and collective needs.

As pointed out in Potts [2007: pp 342] four elements connect these different analytical perspectives. First, institutions are both artificial as human artefacts, and natural in being self organising and emergent. Second, institutions are individual because they relate on the human action, but also social as a result of the transaction among systems of agents. Third, institutions are the coordinating structures of a system but also processes existing in a specific historical time and subjected to evolution and entropy. Finally, institutions shape the economy respectively acting as markets, organisations and behaviours or as the legal, social and political rules of the game.

Two different general approaches emerged in the analysis of institutions. We could distinguish the first one as focusing on habits and behaviours as the explanatory element of the social evolution, and the second one adopting as unit of reference the transaction and its coordinating role in building the rules of the game played by society.

These two approaches are referred to correspondingly as Old and New Institutional Economics: although both assume institutions as the main unit of analysis of social change, profound differences mark the two school, in particular about the notion of individual and the formation of its preferences. Whereas Old Institutional Economics has a holistic perspective, assuming that preferences are shaped by socio economic conditions, New Institutional Economics is mainly

related to a methodological individualism where individual preferences are taken as given. In such a perspective the result of their analyses is completely divergent: in the former approach institutions are a mechanism of coordination of shared routines, whilst in the second case they are more constraints of human actions according to a methodological individualistic perspective.

The term Institutional Economics appears for the first time in 1919 in the speech given by W. H. Hamilton at the annual meeting of the American Economic Association [Rutherford 2001].

At that time is traceable the flourishing of the debate among the American Economic Association due to a group of scholars formed in German universities, where Economics was a complementary subject taught in combination with Law. Back to United States, these scholars founded the American Economic Association [Coats 1960], a network dominated by the idea that institutions are the core of economic change¹.

In his 'Institutional approach to Economic Theory', Hamilton [1919] synthesis the main points of the institutional program within economic theorizing: unify social sciences; be relevant to the problem of control; be concerned with matters of process; be based upon an acceptable theory of human behaviour².

Indeed as main element of reference, the Institutional approach had a different understanding about the assumptions at the base of economic disciplines, specifically: the psychological assumptions about human behaviour. In the Old institutional school, economic was considered a science of human behaviour and fundamental importance was devoted to the development of an appropriate psychological base linking conventions and norms to the shaping of the economic environment³.

At the time, economic agents were regarded as maximising given objectives synthesised in utility levels with respect to a set of fixed preferences. In the light of the Institutional approach, such an assumption diminishes both the criteria underpinning decision-making processes, and the role of the environment where the agents are embedded. Essentially, such a notion implies economic agents are radically detached from their history and they cannot change their preferences because human behaviour cannot be influenced nor modified. In such a framework institutions are simply not existent because not necessary at all.

¹ Precisely, R. Ely and H. C. Adams were the founders of the American Economic Association in 1885 while attending the second annual meeting of the American Historical Association. Richard Ely taught Commons and both taught Hamilton at Michigan University.

² American Economic Association, Thirty-First annual meeting, March 1919.

³ In particular, 'An introduction to Social Psychology' by William Mc Dougall (1908) and the work by J. B. Watson on behaviourist approach [Rutherford 2001].

Starting from this bases, in the next sections we will provide a description of the main contributions to the debate introduced by Veblen and Commons as the firsts attempts to introduce institutions and their role in moulding economic systems in the picture of economic analysis.

1.4 Institutions as habits and shared routines

Veblen defines institutions as a settled of habits of thought common to the generality of men [Veblen 1919]. He developed a complex theory involving habits, rules of cumulative causation and considering the role of technical progress as the factor pushing towards the evolution of market structures.

This original perspective results in a combination streaming from Veblen's original background as a philosopher, plus from his involvement in other sciences such as biology (with reference to the idea of evolution), and psychology (with regards to the concepts of instincts and habits).

Veblen's composite idea underpinning his institutional theory is synthesised in the famous statement criticising the standard economic assumptions of the time:

<<The hedonistic conception of man is that of a lightning calculator of pleasures and pains who oscillates like a homogeneous globule of desire of happiness under the impulse of stimuli that shift him about the area, but leave him intact. He has neither antecedent nor consequent. He is an isolated definitive human datum, in stable equilibrium except for the buffets of the impinging forces that displace him in one direction or another. Self-imposed in elemental space, he spins symmetrically about his own spiritual axis until the parallelogram of forces bears down upon him, whereupon he follows the line of the resultant. When the force of the impact is spent, he comes to rest, a self-contained globule of desire as before. Spiritually, the hedonistic man is not a prime mover. He is not the seat of a process of living, except in the sense that he is subject to a series of permutations enforce upon him by circumstances external and alien to him>> [1898: pp 389-390].

In this famous sentence lies all the issues Veblen addressed to economic theorizing about the conception of human agent in economics.

First, the '*lighting and calculating nature*' of human behaviour, reflecting the rejection to the idea of human agents capable to process all the levels of information they posses, as if they were lightened in all their decision. Secondly, Veblen refutes the notion of society as the sum of isolated agents who ignore the environment in which they operate, either in social, cultural or historical terms: the *definitive datum* with *neither antecedents nor consequences*. The economic agent that Veblen is criticising is an automatic agent who does not make direct choices, except for the *buffets of the impinging forces that displace him in one direction or another*. Overall, one might say, an

economic agent thus described has not much left of his human nature: *he is not the seat of a process of living.*

Conversely, according to Veblen, every human agent belongs to a specific environment which differs in terms of customs and beliefs from the others, being part of the process of change in the society occurred over time. Human history is a process driven by choices among different options and as a reflection of human interactions, economics should be considered a process of evolution and transformation of social systems itself [Veblen 1954].

The unit of analysis to study the evolution of society is therefore embedded in the study of institutions because the establishment of an institution reflects the way in which a society has absorbed previous transformations, determining and regulating the conduct of the relations among individuals.

At the core of Veblen's theory stands the reappraisal of individual conduct, understood in terms of relations and connections among agents who share the same environment, and where relationships among individuals are patterned into social behaviours which once standardised mould human interactions.

Institutions indeed are described in terms of different sets of habits: particular ongoing actions to avoid the continuous rational assessment. Habits adapt as a response to modifications of the external environment, and their analysis as behavioural units could lead to understand the dynamic and the directions of the changes occurred in a society. They shape themselves within a specific system developing specific behaviours in correspondence with external set of choices requested by the environment. Once these choices are shared among agents, habits become the founding part of social institutions. By analogy this suggests that institutions are the mechanism which drives the evolutionary nature of social life as observed in the emergence of different organizational structures according to different systems [Hodgson 1988 and 1989].

Veblen developed a theory where everything originates from the basic unit of instincts. At micro level human action is completely depended on instincts, instinct then mould habits and social plans. These three elements are in a cumulative causal relation state: instincts are the source underpinning human action, social habits condition actions and human objectives and plans are ways by which individuals can change or channel their habits into specific actions. The connection or cumulative causation among the three elements shapes institutions providing the engagement of habits into social routines and institutions as regular social patterns [Lawson 2005, O'Hara 2005].

We can observe the phenomenon as described in *The theory of Leisure Class. An economy study of institutions* [1899]. In the essay Veblen examines the changes occurred in the American society after the beginning of mass industrialisation. New technologies not only allowed new standards of

life but acted directly on the way of thinking and behaving. The institutions of the title are the social values evolving through the increasing importance of business values (such as pecuniary success) which adapt and select new shared habits: new forms of interactions becoming shared in a common environment originate new institutional systems.

1.5 Institutions as Pragmatic result of formalised organic entities

Major contribution of Veblen's institutionalism was the persistence over concepts such as habits and social routines as the elementary unit shaping institutions: engraved into social life, processes of institutional nature are restless and spontaneously structured [Lachmann 1986]. However, another fundamental contribution rests in the distinction between pragmatic and organic institutions. This core concept developed by Menger was a new notion of value as composed of a subjective and objective element, changing according to the causal relationship between human needs and their different levels of satisfaction. Menger formulated a new corpus of theories, involving the importance of time, the formation of value, and his idea of production and organisation of social phenomena, published as '*Principle of Economics*' [1931].

The focus of the present analysis is on the significance and role of institutions in Menger's perspective.

In chapter VIII of the *Principles* Menger elaborates a description of the origin of money. As originally consisting in an interchange of goods in the form of barter, trade was rather difficult. First, it was necessary to rely on a level of trust among the agents involved in the exchange. Second, time and space produced strong price differences according to the diverse supply of the area where the barter was taking place. As explained by Menger, money was the natural form of replacement of an indirect form of payment with a direct one, emerged to avoid the problems related to uncertainties and value differences. The author's hypotheses about the process of substitution are two: a small group of individuals find commodities more tradable with an indirect barter; second, other groups imitate the first one recognising the reduction in effort and costs. This process lead finally to the progressive selection of the most tradable indirect good: money. In this sense, Menger founds his explanation on the origin of money as an institution. The process described is a process where habits of behaviour shape social routines generating standardised practice in the social system: as Menger defines it is a spontaneous process of emerging of an *organic* institution.

According to the author, money is an example of organic institutions: the result of human interaction but not the result of human design: they are the unintended result of human efforts aimed to individual goals. Conversely, there are institutions which are the result of a purposeful human

action. Menger refers to them as *pragmatic*, as the result of an explicit common will directed towards their establishment.

Menger elaborates his distinction along the debate between natural and mechanic organism. The analogy of social phenomena and natural organisms refers only to a part of the former, namely to those which are the unintended product of historical development. The rest are the result of human calculation, and thus are not comparable to organism but to mechanism [Menger 1963, Vanberg 1989].

Social structures can be considered for a large part not the result of a natural or organic process, but the result of a purposeful human action directed towards their establishment, the result of the agreement of the members of the society.

Therefore institutions such as money or language could be referred as an organic development of human coordination and interaction. Conversely other institutions such as law or norms, although based on an organic mechanism of emerging have to be intended as pragmatic because resulting in a formalised human design action.

Menger describes the process transforming law from an organic condition into a social phenomenon of pragmatic organization. At the beginning of civilisation the integration among different communities was imperfect, and at that time it is not possible to discuss of a concept such as law or will of a nation. The process of aggregation and coordination of individuals into bigger and bigger communities however developed in the emergence of law and norms [1963: chapter 3].

As in the origin of money, the organic and spontaneous process of coordination among agents of a same system end to become a pragmatic institutionalisation of social rules.

As Menger points out referring to the building of the State <<the development of new localities arose unintentionally, with a starting activation of individual interests [...] without any intention really directed toward this [...] Thus, there gradually comes into being an economic organization which is to a high degree of benefit to the interest of the members of the community [...] Yet, in its origins this organization is by no means the result of the activation of the common will directed toward its establishment >> [1963].

Menger does not express any judgement about the superiority of organic or pragmatic institutions, and he rather considers the two institutional forms complementary in setting social structures. For the understanding of social phenomena in their entirety the pragmatic interpretation is in any case just as indispensable as the organic.

However, the necessity to mould pragmatic institutions suggests there is a requirement to codify them: organic institutions are therefore necessary but not sufficient condition to the entire development of a socio-economic system.

Menger's contribution develops on Veblen's one. As Veblen, the author pictures a landscape dominated by individuals which overcome a problem of interaction through the coordination of their habits. The beginning of the process is of a spontaneous type, organic to the enlargement of the society. Once such a process is settled, to become effective to a larger extension of the system it has to be formalised and therefore the institutional forms arising organically need to be pragmatic and formalised.

1.6 Institutions as spontaneous order interactions

In its explanation on the origin of money, Menger states a clear point: arising as organic institution, money was the response to a problem of uncertainty and evaluating issues. The matter with the process of barter was its subjectivity: once the extension of the market was not any more the one of the same small community, problems related to the recognition of value were arising.

The emergence of an institution such as money solved the issues related to tradability, specifically establishing a more recognisable object of exchange therefore formalising the knowledge embedded in it. In this sense, institutions not only arise as spontaneous processes of coordination among agents of a same system, but are an instrument to create and process knowledge into society [Hayek 1937].

The role of knowledge in the process of institutional building is central: is the engine of social evolution and is through the emergence of new knowledge that society changes its rules in a trial and error process of selection of new systems. In Hayek two questions are central to understand the effects of knowledge on the whole system: how knowledge is created and diffused, and how knowledge influences social evolution through the production and learning of rules.

Central point, in the environment knowledge is too complex and articulated to be processed by a single individual: thus, it is necessary to generate a mechanism coordinating this dispersion towards order. The process creating this mechanism is dynamic and occurs through selection. Such a process is unplanned and takes the form of learning, involving as an outcome the emergence of rules [Hayek 1949; 1967; 1973].

Hence, social order is a mechanism arising as a spontaneous response to the fragmentation of knowledge and lack of capacity of any individual to process all the knowledge available in the system. The resulting of this mechanism are shared habits which lead to the creation first of a coordination mechanism then of formal institutions.

Although the process driving to the creation of rules is spontaneous response to an individual incapacity, it is possible to distinguish between rules which are deliberately created to serve the

social order and rules which are *'products of human action but not of human design'* [1973: pp 35]. As Hayek points out, some norms result as a conscious design, a planned action. Conversely, other norms are completely spontaneous in their nature and result as the outcome of an historical selection process occurred through the accumulation of knowledge.

Hayek's idea is related to Menger's: institutions arise not only as organically but also as a pragmatic and intended response to human needs. The social system where the agents act is dominated by a natural condition of chaos which evolves and needs to be directed:

<<According to the second law of thermodynamics, the very regularity of the behaviour of the elements produces 'perfect disorder' as codified as the entropy principle [...] A change of environment may require if the whole has to persist a change in the order of the group and therefore in the rules of conduct of the individuals. A spontaneous change of the rules of individual conduct and of the resulting order may enable the group to persist in circumstances which without such a change would have lead to its destruction>> [1973: pp 67].

In this sense, spontaneous order doesn't have a specific aim. It arises as a natural or organic response to coordinate and solve conflicts in complex societies. As the response to this problem institutions become problem solving mechanism: their role is to organize and solve those tasks far too complex to coordinate for a single individual.

In Hayek the explanation of institutions is of mechanisms aimed to the coordination of fragmented knowledge and to the reduction of complexity. The repetition of this mechanism generate a process of learning in the system: it is specifically the accumulated knowledge embodied during previous times the condition enabling new forms of problem solving in the system. In this sense, rules and institutions are a product of a process of evolution of coordination mechanisms subjected to selective competition over time.

This view is complemented by Hayek's notion of cultural evolution: a process of selection and competition among rules and institutions. In Hayek the rule of institutions is related to their solving nature towards problems of interaction and cooperation among individuals. Such institutions may occasionally arise naturally as a product of unintended forces, but there is always an indispensable role of constructive institutional design [Sugden 1989; Boettke 1990 and 1999; Birner and Zijp 1994; Feser 1996; Gloria Palermo 1999]

1.7 Institutions as units of transaction

A different approach is the one considering institutions as mechanisms arising to regulate transactions and which is part of the New Institutional programme.

Although institutions are still considered shaped by human interactions and preferences, New Institutionalism does not share the behavioural assumptions of the Old school but rather addresses hypotheses of methodological individualism. Specifically, the nexus between human interaction and institutional building is of a negative fashion: institutions are constrained to overcome problems of market failures. As economic agents have a set of not modifiable preferences, the process of arising of institutions cannot be regarded as a positive spontaneous mechanism formalising an organic phenomenon [Hodgson 1988].

In assuming transactions as unit of analysis New Institutional economics directly recalls Commons as its inspiring author. However, Williamson's transaction cost approach has several differences with the transaction approach developed by Commons, in the unit of analysis as a start.

The key concepts in Commons' theories are working rules, transactions and going concerns, and the interaction of these three elements is the founding mechanism of collective action.

As the author states, his definition of institution is the one of << *a collective action in control, liberation, and expansion of individual action*>> [1931; 1934;1950]. Institution is then collective as opposed to an individual behaviour, it is an action as opposed to a static behaviour, and its peculiarity is that as collectively shared it acts in control, but also liberation and expansion of the individual sphere.

At the origin of Commons' definition is the relation individual-collective which is shaped employing customs as elementary forms. In modern society individual actions arise from unorganised forms such as customs. As units of individual action, customs tend to be common and shared in the society, becoming 'going concerns' in need of regulation through a collective action organising them.

Customs are the founding unit of individual action and they are the working rules of a system. Once regulated through a collective action, they become institutions and their role is not only to control but also to free and expand individual action, removing the uncertainties to which every individual is subjected in having to deal with society. In this sense, the action becomes a *trans-action*: a unit of activity transforming from a singular concern into a community response [1931: 652].

In this sense a transaction is not an exchange of commodities but an exchange of property rights and liberty created in the society.

Commons distinguishes among different types of transactions: a first distinction is between Bargaining and Rationing transactions, the latter involving the sub type of Managerial transactions. Bargaining transactions involve a transfer of ownership by agreement between two equals, whilst Rationing transactions involve a relationship between a legal superior and a legal inferior. The sub category of Managerial transactions specifically refers to a superior-inferior relationship where the superior is a manager of the other and where the relationship is aimed to the creation of wealth. Both these transactions imply the use of legal authority but this authority is limited in its individual form by customs and in its collective form by law, what Commons define the working rules of the system. In this sense, working rules identify and determine the types of transactions undertaken and by defining legal and economic powers and the limits to their use, working rules have a strong effect both on the production and on the distribution of wealth.

The need for institutions and collective action to regulate these transactions is related to a problem of scarcity: collective action is a constraint on individual action to avoid social chaos and disorder generated by a problem of scarcity [Rutherford 1983 and 1994 Elgar Companion].

The development of Commons' theorizing is in Williamson's work. As Commons, the author refers to the transaction as the main unit of analysis to understand institutional change. Notwithstanding, Williamson's definition of transaction is different by the one developed by Commons' and focuses specifically on the Managerial type of transactions.

Williamson describe transaction as occurring when a good or service is transferred across a technologically separable interface [1996: pp 58]. However, due to a combination of environmental and human factors transactions are costly to write, execute and enforce [1975: pp9].

The environmental factors considered by Williamson are of both related to the dimension of uncertainty: a bounded rationality a la Simon [Simon 1961] composed of neuropsychological and language limits; and opportunistic behaviour which refers to a lack of candour or honesty in relationships. These factors are normal components of the human behaviour and every transaction is affected by them in different measures. They might not have any effect if taken separately, but pairing them creates the condition for a failure in the market. In such a framework, the process of decision is very risky and as a result transactions become extremely difficult to undertaken.

Adopting these hypotheses, Williamson identifies in the organisational structure of the firm a governance solution, recalling the seminal work of Coase [1937].

Coase's famous contribution start by provocatory questioning the reason of existence of the firm in an scenario where economic system works itself, attempting to understand <<why a firm emerges at all in such a specialised exchange economy>> [Coase 1937: pp 387]. The answer is that there is a

cost of organising production obliging to the activation of two coordinating mechanisms: the market and the firm.

In Williamson's theoretical framework, the firm becomes the place where a certain number of transactions is internalised and simplified by an inclusive mechanism eliminating to some extent levels of uncertainty. Whether a set of transaction is executed in a firm or outside depends on the level of relative efficiency of each mode and on the characteristics of the human decision makers involved. [Williamson 1971; 1973; 1975; 1985].

Firm and market are two governance structure created to overcome these uncertainty problems related to environmental and human factors. The choice between market and other hierarchical forms of governance will absorb those uncertainties and information issues affecting transactions. Specifically, it will be necessary to have more hierarchy in situations where these problems are very persistent and ungovernable and the only solution is internalising the transactions in a structure acting as a guarantee mechanism, as the firm. Conversely, whereas these problems are less prominent, the signals exchanged in the market will be enough to cope with the uncertainties related to transactions. In Williamson's contribution the conceptualization of the firm as a governance structure is instrumental to encompass the problems generated by transactions, considered as the principal unit of analysis.

As in Commons, Williamson recognises the strong relation between economic and contract laws and collocates its contribution outside the conception of economic activity either as production or consuming function. His institutionalism is connected to the idea of an economic activity shaped by a set of relations among different types of agents with different objectives explaining together the functioning of the market.

However, conversely from the Old Institutionalism and from Commons as well, Williamson is too involved in a cost minimisation problem. The economic agents he describes are looking for the maximization of their utility through the minimisation of costs. As not able to obtain this result they need to rely on a superior structure which will process these costs. The problem is then about resource allocation and scarcity which agents struggle to process.

This stress on cost minimisation problems is the first discrepancy with the Old Institutionalism and its assumptions on behavioural attitudes.

Furthermore, Williamson regards transaction as equal to contracts, but this is not Commons' notion of transaction. As mentioned above, transactions in Commons are unit of activity passing from a singular to the community, and consisting of individual customs shaping first working rules which later as going concerns are regulated through a collective action.

The result is a hybrid institutionalism where the positive role of the transaction is lost: in Williamson a transaction is just a regulation tool and it is not anymore a proper institution generated by the interaction of shared habits into a community.

This leads to the last difference with the Old Institutional school. Williamson fails in incorporating cultural learning in his model and the trade off between market and hierarchy appears an institutionalism of artificial structures created to compensate the incapacity of the individuals [Dugger 1994]. Individual preferences are not touched by the economic environment where the agents are embedded. Institutions cannot result as composed of habits and beliefs or as Commons put it, as a going concern taking form from collective action, because they result detached also by the environment where the agents are developing their choices.

1.8 Institutions as norms and laws constraining human actions

Among the most employed definition of institutions is the one developed by North, according to whom institutions are the *rules of the game in a society or more formally the humanly devised constraints that shape human interaction* [North 1990]. They comprise formal and informal constraints, such as sanctions, taboos and traditions or formal rules, such as law and property rights. Institutions are regularities in repetitive interactions among individuals, human devices which constraint political, economic and social interaction. Their history itself is a history of institutional evolution in which the performance of economies can be understood only as a part of an institutional sequential history. In this perspective, institutions structure incentives in human exchange whether political, social or economic.

North build his theory around four building blocks [North 1986, 1990, 1991].

First, a theory of institution has an individualistic behavioural assumptions as a base which implies individual maximise their own utility; second institutions arise due to the cost associated in processing information and attributes of goods and services; third institutions are necessary for the cost of enforcement of a collective action; fourth and final, as involving coercion and structures to deal with costs, an institutional analysis is an analysis of political structures such as the state [1986: pp 232-233].

North also develops a crucial distinction between institutions and organizations and their conjunct action in moulding the social environment.

Institutions are the rules of the game that structure the interactions among the agents in the system, whilst organizations are a *group of individuals bound by some common purpose to achieve*. These purposes can have a political, economical or social nature, and the way organizations evolve depend on the institutional framework in which they are embodied. Thus, organizations can be seen as the

agents of the game governed by institutions. Organizations however, have a direct effect on institutions as the influencing force producing a norm, they mutually evolve according to the institutional change process, example which results particularly clear re calling in our mind North's statement about political structures.

Major role of institutions in the society is to reduce uncertainty by establishing stable structure for human interaction. Institutions create the opportunities in a society (create capabilities) whilst organizations are created to take advantages of those opportunities. As organizations evolve, they alter institutions.

As a result, the divergent patterns of evolution of societies, polities and economies are determined by the efficiency of institutions, that mould and modify social, political and economic organizations.

Although developing a definition of institutions taking crucially into account the role of interactions of human behaviours, North's definition is still rather distant from the positions of the Old Institutional school. Main divergence, as in the case of Williamson, the behavioural assumptions over the economic agents, and specifically the stress on cost minimization problems.

Once again, the institutions arising from this first definition are originated as a coercive process of institutional building not from a cooperative evolution of shared behaviours and norms. Although North is referring to customs as the basic unit of emerging of institutions, the fashion is very different from the once developed by Veblen or even Commons. In Veblen habits and routine do not have any positive or negative connotation: it is simply their standardisation the element shaping institutional change. Commons as well employs customs as basic units developing working rules and then collective actions towards an objective represented by a trans-action.

These strict assumptions on human preferences however can be found just in the first North: we could indeed separate his theoretical contribution in two moments. The first one regarding institutions as constraints moulded on individualistic assumptions and we just described it. The second one developing in the late 1990s sees North's view on human behaviour substantially changed.

This shift is mainly related North's new ideas on uncertainty, inefficiency and cognitive constrains. Specifically, North admits the failures of some assumptions related to methodological individualism. Rather than a matter of cost reduction adjustments, the dynamic of social system is the subject behind the process of change. Moreover institutions are not seen any more just as constrains but also as cultural, social and cognitive processes which provide a norm structure and thus guide the human interaction [North et Al. 2004, 2005a, 2005b].

The idea behind North's concept is now closer to the older institutionalism rather than to the New institutional school. Accepting the limitations of the New Institutionalism, North embraces a different perspective for his analysis, abandoning the standard mechanical vision of maximizing rationality. A broadest definition of institutions is given embracing collective learning as a factor shaping institutional performance, accompanied by a loss of interest in how efficient are the transactions among the actors of the economic system [Hodgson 1998; Vandenberg 2002; Fiori 2002].

1.9 Unpacking the concept of Institutions: lessons form Old and New Institutionalism

In the sections before we reviewed some of the definitions of institution provided in the literature with the aim of focusing on their characteristics and their process of emergence.

From old institutional economic we derive important instruments of analysis. Veblen developed the idea that an economic theory should be about the evolution of social behaviours, whilst Menger elaborate the necessity to distinguish between organic and pragmatic type of institutions, integrating into the analysis the necessity to differentiate institutions which arise spontaneously and institutions as result of human design. We completed these contributions with Hayek's perspective of institutions emerging as a response to the incapacity to process for a single agent all the knowledge produced in the social environment.

Key argument of the first part was that Old institutionalism offers a completely different perspective on the nature of human agents. However, these core ideas are not developed to build a general theory. Instead Old institutionalism employ them as explanatory factors to understand on an historical base the evolution of economies and societies. In this sense we can find the affinities and influences on those authors of other social sciences such as biology or psychology: the idea that a changing system of institutions select and mould the social environment as a whole, thus as a system in its entirety.

Old institutionalism moves from the general idea that the evolution of institutions explains the evolutionary nature of the economic process according to the idea of an interactive and selective environment emerged according to historical patterns of habits and social routines. In this perspective, institutions affect the environment in terms of adapting behaviour to new components.

This circumstance leads to historically and institutionally specific studies which are arguably of more operational value than embracing any general theory of price formation but a set of guidelines approaches to specific problems [Hodgson 1989, Langlois 1986]. In this sense the Old institutional school considers economic as a process influenced both by history and learning: these elements are

per se factors generating a process of emerging of new forms of behaviour and therefore leading to institutional change [Lachmann 1986]

Conversely, New Institutionalism is specifically aimed to build a general theory based on price formation and costs absorption, stating among its specific objectives the will of providing a general theory of conversely from the Old School [North 1986]

The differences between the two approaches are wide. First and most important the assumptions on human behaviour and preference system. These differences lead to move the focus from the habits and spontaneous emergence of social phenomena, to the assumptions of transaction as main unit of analysis or the restrictive fashion assumed by norms and laws.

In the New institutionalism an initial institution free state of nature is assumed, and the arising of institutions is the regulatory mechanism in response to the needing of fixing rules of interaction. This perspective follows the behavioural assumptions that agents are moulded by individualistic forces with the exclusive aim to minimize the costs connected to their interaction.

Conversely in Old Institutionalism's perspective, individual preferences should not be taken as given. Individuals are both producers and products of their circumstances, and the interactions of individual preferences mould socio-economic conditions according to a set of choices developed via an organic process and a collective action. Essentially, Old Institutionalism regards preferences as endogenous whilst in New Institutionalism as exogenous.

However, in both the approaches institutions are:

- i. objective structure *out there*
- ii. subjective springs of human agency *in the human head*

This lead to the distinction between institutions and organisations.

According to North [1994] the distinction between institutions and organizations resides in the fact institutions rule the game, structuring the interactions among the agents in the system. Conversely , organizations are groups of individuals bound by some common purpose to achieve and ruled by institutions. It is their interaction the element shaping the evolution of the economy.

Hodgson [2006] defines organizations a special kind of institutions that involve:

- i. Criteria to establish their boundaries and to distinguish members and non members
- ii. Principles of sovereignty concerning who is in charge
- iii. Chairs of command delineating responsibilities

Institutions are objective structures socially embedded, and organisations a special kind of institution. Organisations are particular social systems involved in the production of institutions as they are systems arose pragmatically for the coordination of the relations among some agents sharing a same system.

In our opinion, both the Institutional approaches can be summarised as

- i. Regarding institutions as the key elements of any economy, and so the economy has to be understood in terms of institutional change
- ii. Assuming the individual interactions as the nexus of origin of institutions
- iii. Having an interdisciplinary structure

In our perspective, institutions are closer to open systems affected and embedded in social, cultural, political and power relationships. Furthermore, we consider the emergence of institutions as a process of interaction which cannot be regarded just as aimed to the reduction of social costs. We will assume agents not moulded by a set of fixed preferences toward utility maximisation but as shaped by historical and cultural patterns. Therefore, to an extension of the system of reference does correspond a re-assessment of preferences which might end in a process of institutional change as well.

The inadequate notion of agents as utility-maximising is also at the core of the differences between Old and the New tradition of institutionalism. Old Institutionalism does not take the individuals as given but as affected by their institutional and cultural situations. Hence individuals do not simply (intentionally or unintentionally) create institutions to maximize their utility levels, but because through ‘reconstitutive downward causation’ institutions naturally affect individuals [Hodgson, 2000; Lawson 2005].

Hodgson [2006] defines institutions as durable systems of established and embedded social rules that structure human interactions. All institutions depend on previous institutions, which is to say that institutional change is a process based on historical patterns of behaviour. Of course institutions have different forms: they might assume the shape of organisations or more importantly, they might be organic, as self organizing and arising spontaneously, or pragmatic, as designed by human action [Menger 1963].

In this sense institutions become particular social systems relatively enduring and collectively recognised as such: some of these structures are formally instituted, whilst other are non-planned

'spontaneously' emergent forms that with time are found to be relatively enduring [Lawson, 1997 and 2003].

According to these developments, a comprehensive definition of institutions could be of particular forms of emergent social phenomena, mostly social systems, or structured process of interaction that are either intended or are discovered to be, and are recognized as relatively enduring through time [Langlois 1986, Lawson 2005].

With this last review we aimed to summarise the different perspectives developed to this point. The rationale was to focus on a concept of institution more suitable for our purposes in terms of methodological assumptions. In the next section we develop from these assumptions to elaborate on a more comprehensive idea able to integrate the element of systems of production with the institutional one in a definition embracing both the dimensions.

1.10 Institutions within systems of production: the concept of social technologies

As final outcome of this survey, we propose a definition of institutions based on the concept of social technology [North and Wallis 1994, Nelson and Sampat 2001].

Social technologies are part of a process of production. The notion elaborates from the idea of economic activity which can be decomposed as the multiple set of interactions occurring in the operationalisation of most economic activities. A process of production can be decomposed in a combination of different phases: some of them are consistent with an idea of physical production whilst other are consistent with the process of interaction among the parts involved in the production: a social rather than a physical engineering [Nelson 2008].

These different characteristics can be *<<anonymous with regards of any division of labour [or] a division of labour plus a mode of coordination*” [Nelson and Sampat 2001 pp: 44]. The former are physical technologies, and the latter are the social technologies involved as rules of coordination in the production.

The concept of social technology is close somehow to the concept of tacit knowledge introduced by Polanyi [1974] and explicitly refers to the idea that to obtain an outcome by a process of production it is necessary to combine a codified set of knowledge plus an un-codified one which define the pattern of human interaction. In their coordination role, social technologies promote the interaction among the agents. In this sense social technologies are a set of habits of action shared in a system. It is possible to regard social technologies as institutions whereas social technologies represent a standardised pattern of coordination collective to the relevant part of the agents. They result

essential to the creation of physical technologies because they form the nexus linking the different nodes of production in the system.

The concept of social technology indeed embraces several of the characteristics listed in the institutional approaches, such as Veblen's idea of habits as generators of actions patterned into standardised behaviours, and also North's of institutions as rules of the game, norms and laws for human action.

However, with respects of these two definitions the idea of social technology has more flexibility, as social technologies define a structure of behaviour, but not rigidly locked into the idea of constraint. Moreover, social technologies can be also viewed as widely employed "modes of governance", which is Williamson's notion of what institutions are about [Williamson, 1985]. In the language of transaction costs, we could see generally used "social technologies" provide low transaction cost ways of getting something done.

This conception of institutions as social technology is closer to the idea of governing structures, sometimes embodied in particular organizational forms, or cultural beliefs and norms which organise the process of production.

Matching this definition with the notion of system, different physical technologies have different requirements for their implementation and therefore employ different social technologies to coordinate them.

Therefore, the concept of social technology is broad enough to encompass both ways of organizing activity within particular organizations and ways of transacting across organizational borders. Thus, markets and other widely employed procedures for collective choice and action are defined by social technologies. This is to say that some of these social technologies are particularly standardised not only among different physical technologies, but also among different systems of physical technologies. In these contexts they become institutionalised, and once institutionalised they coordinate physical technologies of production in a repeated form, such as in organisation of labours or of markets or sometimes institutionalized social technologies take the character of norms.

1.11 Conclusion: Social technologies, Institutions, and Policy

Specific aim of this work is to investigate the development of an institution assuming it is a social technology acting within a system with specific characteristics and actors.

To this point, we outlined the difficulties related to a conceptualisation of institutions and the principal definitions the notion has taken during the years.

Our perspective is that institutions are social technology employed as necessary mechanisms of coordination in every system of production. Whereas these social technologies become standardised, they arise as institutions acting on coordination and networking of a system.

Hence, in our view standardised social technologies can be regarded as the moment of formalisation of organic-type structures: they evolve becoming a pragmatic-type institutions as already shared and embedded among all the actors of a same system. In this light, a norm or a law or a policy can be regarded as institution as the element able to network and coordinate formally the actors of its system of reference [North 1994 and 2004 Nelson and Sampat 2001].

Moreover, a formulation of institutions as social technology is our mind useful in two ways.

First, this formulation explicit the relationship between institutions and production. In our mind, the concept of social technology allow to refer not only to institutions in a broad sense, but also to decompose the process at the base of institutional building, such as the process emerging from coordination of the actors of the productive system. Moreover, this formulation naturally induces to consider prevailing institutions not much as constraints but rather as defining the effective ways production is networked and standardised: to view social technologies as constraints on behaviours will then be analogous to seeing prevailing physical technologies as constraints.

Secondly, employing a concept of institutions built on the social technologies, allow to separate the process of institutional building according to the evolution of the physical technologies. The result is a co evolution between social interactions and system of productions where the generation of new knowledge rest upon a specific history and upon a localised and specific context [Hayek 1937; Atkinson and Stiglitz 1969].

2 Methodology: The Narrative Approach

2.1 Introduction

In the previous sections we elaborated on the notion of institutions and specifically on the difficulty to find a definition able to capture the different aspects of the concept. Such difficulty is paired with the problem of representing from a methodological viewpoint a process of institutional change.

Aim of this chapter is to propose a methodology to analyse a process of institutional evolution.

According to our perspective, institutions are complex phenomena and their investigation involve to take into consideration elements which to some extent cannot be completely captured by a traditional economic analysis. These elements are mainly related to the hypotheses that institutions arise from a mix of habits and behaviours shared into a community or system and then formalised as institutions.

The methodology we propose in the chapter is therefore oriented to overcome these problems and the solution in our mind is to employ a Narrative approach. This approach is composed of qualitative and quantitative aspects allowing to study the framework of shaping of the social technologies according to the evolution of the system where they are embedded.

Specifically, a Narrative approach employs on a scientific base the use of historical records and official documents to overcome the gap created by a pure quantitative analysis. In the next sections, we will explain the reasons enabling this perspective to integrate the investigation of a process of institutional change, compensating the difficulties to quantify social evolution.

2.2 Narrative approaches in economic analysis

The Narrative Approach is a non econometric evaluation method incorporating quantitative and qualitative aspects surrounding an event.

By the use of plots, diagrams or tables, a narrative creates an historical decomposition of the episodes surrounding a research topic. Its aim is to provide a framework to analyse the development of a specific phenomenon consistent with a comparative historical analysis of the facts around a specific event.

Using other forms of narrative of events such as formal records or historical documents, it becomes then possible to contextualise different variables influencing the observed episode. Thus, the technique enables the reconstruction of the institutional framework embedding the phenomenon.

Several examples of Narratives have been presented in different fields of social science research: from macroeconomics [Friedman and Schwartz 1963; Romer and Romer 1989, 2002, Acemoglu et Al 2004,] to Political sciences [Bates et Al 1998, 2000a, 2000b] and Management studies [Chandler 1964; Pettigrew 1985] to innovation literature on national systems of innovation [Freeman 1988, Lundvall 1992, and Nelson 1993].

The number of scholars employing a comparative historical approach is far more extensive than the list above. However, it is not our intention to review extensively the literature on the theme, but to assess the elements which structure a narrative approach as a methodological framework able to capture institutional change dynamics.

Each of the authors above have in common the idea of involving history and an extensive case study approach to the disclosure of economic change, investigating specific interactions occurred in the system.

In each of these contributions there are two common elements.

First, the importance of the role of the system played in the analysis. The narrative is in fact a system level method: it assumes as fundamental the interactions occurring among the agents and the development of linkages among them as the factor producing the institutional change.

The second element common to the Narrative Approach is that its main aim is to explain institutional change through an historical analysis.

The contribution of Bates et Al [1998, 2000] explicitly refers to Douglass North's seminal work on institutional change; Romer and Romer [1989 and 2002] clearly point out the importance of the historic method as the instrument able to explain the connection between institutional and economic change; Acemoglu et Al [2004] attempt to explain differences in economic growth through a

comparative history of institutions. On the innovation literature side, Chandler [1964] and Pettigrew [1985] draw their research on the evolution of industrial structures according to a documented analytical case study analysis. Freeman [1988], Lundvall [1992], and Nelson [1993] describe the development of specific national system according to different sets of resources, ecology combinations but above all according to the historical different institutional building experiences.

We will now review some of these contributions, and specifically the ones by Friedman and Schwartz [1963] and Romer and Romer [1989]; and Bates et Al [1998].

The choice of these authors among the others is mainly motivated by two elements:

1. A clear reference in both the groups towards the construction of a Narrative based methodology.
2. The explicit intention to build a methodology to compensate and integrate the lack of some of the requirements of pure quantitative methods.

In particular, element of interest about these two approaches was the motivations behind the authors intentions. In both cases the Narrative Approach has been developed and employed to support quantitative inadequacies, in one case of econometric modelling [Romer and Romer], and in the other of game theoretical modelling [Bates et Al 1998].

After discussing the principal characteristics of the Narrative Approach, we will formulate advantages and disadvantages and propose an alternative solution employed in this work to overcome those difficulties.

2.3 Narrative I: Friedman and Schwartz [1963] and Romer and Romer [1989] Approach

We will start the discussion with the seminal work of Friedman and Schwartz [1963] openly recalled by Romer and Romer [1989 and 2002] as their inspiring methodological structure.

In 1963 Friedman and Schwartz pioneered an historical based technique to study the evolution of monetary policy in 'A Monetary History of the United States, 1867 - 1960'.

The book is considered a milestone of macroeconomics theory, and explains the role played by monetary policy in shaping United States economy from the end of the Civil War to the beginning of the 1960s.

'A Monetary History of the United States' is structured as a vast collection of data to analyse the fluctuations of the United States economy, connecting real economic variables to monetary policies. Friedman and Schwartz's methodology isolated according to official documents moments where the Federal Reserve Board took monetary policy decisions 'of major magnitude which cannot be regarded as necessary' [pp 688]. In the around of such periods, they then looked for other elements able to explain the decisions of the Committee and the effects on the real economy.

Observing these elements, Friedman and Schwartz came to the conclusion that before World War I all shocks in the United States economy were related to financial panics. They than proceed isolating other four shocks occurred after World War I: three of them related to explicit actions taken by the Federal Reserve Board whilst the last one dependent on the Federal Reserve lack of action after the severe crisis of 1929.

The four episodes identified by the authors as direct actions were:

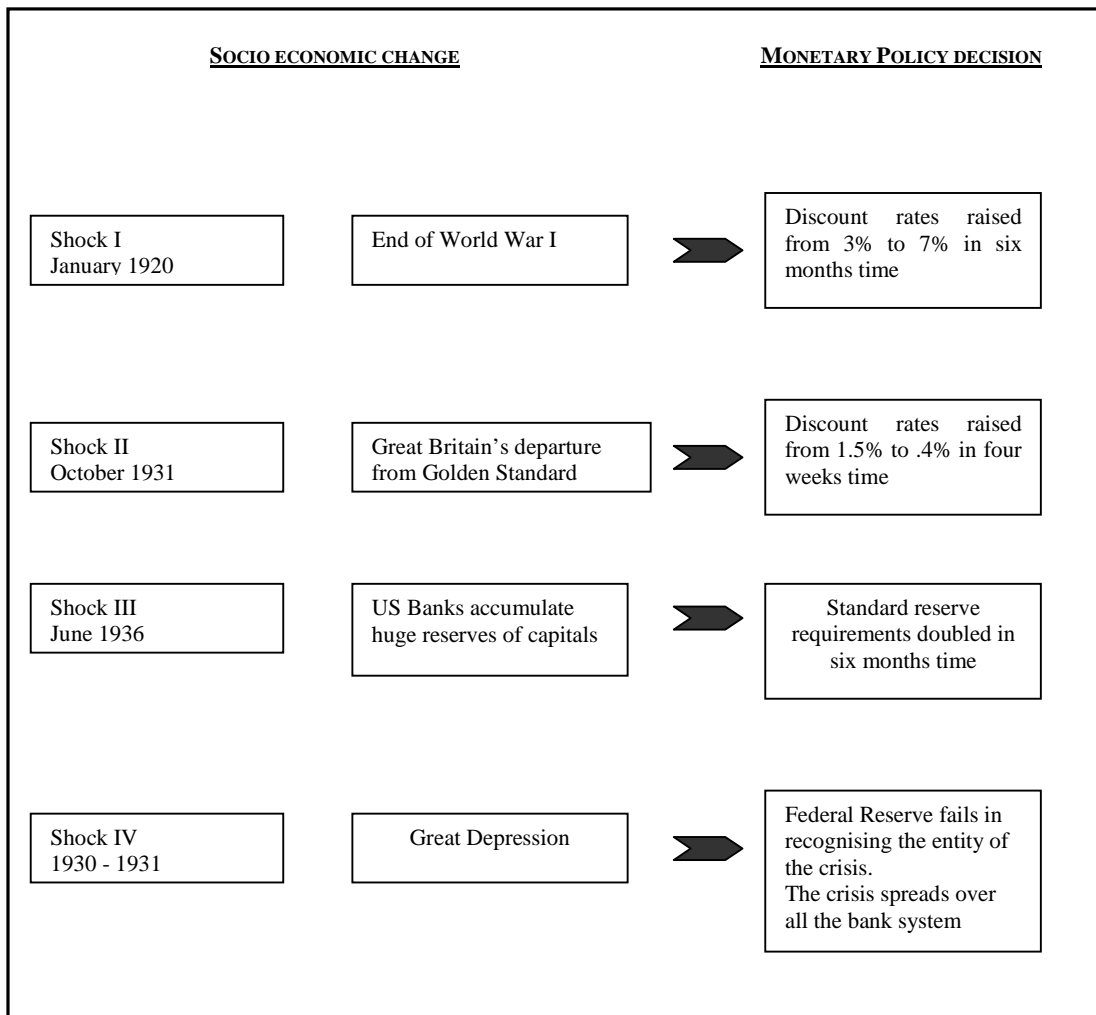
1) January-June 1920: at the end of World War I the Federal Reserve was more concentrated its concerns on its own reserves of money. In six months the discount rates were raised from 3% to 7%.

2). October 1931: Great Britain's departure from the golden standard. The feeling of the Federal Reserve was that also the United States might have left the golden standard with a consequent outflow of gold. As a consequence, the Federal Reserve raised the discount rate from 1.5% to 3.5% during the four weeks of October.

3). June 1936 – January 1937: as a consequence of the vast reserves accumulated in the banks, and believing they were reflecting a low demand for loans, the Federal Reserve doubled reserve requirements for the banks. The effect was a huge contraction in lending.

4). The fourth effect identified by Friedman and Schwartz was not related to an action but conversely to a lack of action by the Federal Reserve and precisely the absence of any reaction for the first year and half of the Great Depression which allowed the crisis to spread on all the banks system first and then to the economic system in general.

Item 1: Friedman and Schwartz's analysis of monetary shocks after WW I [1963]



The conclusion of this process of historical analyses is a multivariate synthesis of the interactions between the monetary policy actions and the rest of the economic system which explain the American economic evolution in a different light.

The interesting perspective of the book is in fact its emphasis in explaining unnecessary monetary policy actions as related to expectation misjudgements through historical evidences to prove to which extensions social and institutional change affects policy decisions.

Specifically, Friedman and Schwartz's attempt establishes a direct causal relation between policies and economic system, developing a methodological foundation for a model where indirect activities affect monetary policy shaping resulting into an institutional change.

According to this framework, Romer and Romer [1989] tested the contribution of Friedman and Schwartz. They reproduce the exercise taken in 1963 adding more historical evidences, and an econometric evaluation to estimate the robustness of Friedman and Schwartz conclusions based on the historical records.

In their work they identify with the name of Narrative Approach the procedure developed by Friedman and Schwartz to classify a phenomenon observed through non-statistical procedures ‘using historical record, such as the descriptions of the process and reasoning that led to decisions by the monetary authority...that were not driven by developments on the real side of the economy’ [pp2]

Friedman and Schwartz in fact never referred to their historical analyses as a narrative, but just as a description of events (or episodes) leading to a deeper understanding of the correlation between monetary policy decisions and their influence on the real economic system.

Romer and Romer name this methodology of historical based description shaping it as a specific method to rule the analysis, and with the outspoken intention to improve its employment ‘carefully and systematically’ [pp 36].

One of the main point of Romer and Romer’s work was explicitly to improve the structure of the Narrative Approach as a methodology to be used for enriching and engraving pure statistical methods.

They first re examine the evidences produced in ‘A Monetary History of the United States, 1867 - 1960’ deciding to include in their analysis the already reviewed four shocks between the two wars. Then they pursue the Narrative Approach extending the historical records after the post second world. Finally, testing the results of the new cases and of the Friedman and Schwartz ones with an econometric model, they prove the assumptions made in the 1963’s book were actually robust.

Specifically, the results of Romer and Romer prove the correctness of most of the hypotheses based on historical records.

However, in their work Romer and Romer pursue for a more consistent definition of the concept of shock. Specifically they recall as a fallacy in Friedman and Schwartz the lack of specification of the phenomenon under observation.

In this critique lies the core contribution to this methodology by Romer and Romer: the condition of strong specification upon the phenomena to investigate is the core element to narrow the research question and hence to find the precision required to an analysis based on historical comparative.

In their work the specification of the phenomenon is the key to analyse the historical records and to restrict the facts which need to be taken into consideration. As they explain, the rigorous definition of the phenomenon is in fact conducive to:

1. An improved understanding of the historical records which leads to a more exhaustive analysis of all the possible information.
2. An improved capacity to isolate other factors influencing the observed phenomenon and therefore the other aspects of the system we can relate our observation to.

2.4 Narrative II: Bates et Al [1998] Analytic Approach

The second major contribution to the narrative methodology we are discussing is the Analytical Narrative Approach, and its origin is traced to the work of Bates, Greif, Levi, Rosenthal and Weingast 'Analytic Narratives' published in 1998.

'Analytical Narratives' analyses in five chapters different historical episodes of institutional change, each of whom developed with systematic explanations based on case studies.

The Analytic Narratives project represents an effort to clarify the method adopted by numerous scholars trying to combine historical and comparative research with other different methods. In the words of Bates et al., Analytic Narratives combine 'analytic tools that are commonly employed in economics and political science with the narrative form, which is more commonly employed in history' [1998: pp 10-11].

The methodology starts isolating the actors involved into the object of research, clarifying the sequences of their behaviours to describe structures and patterns of their interaction. The result of this process is a game theoretic model based on the hypotheses that every actor will develop its choices on rational assumptions [Levi 2002].

The word *Analytic* does in fact define the specific feature of this approach according to its principal characteristic: the construction of a model of analysis for the agent behaviour rising from a stylisation of episodes. Procedurally, this implies extracting from the narratives of historical events key actors, their objectives and preferences and the effective rules influencing the actors' behaviours. On the base of such information it will be possible to elaborate the patterns of strategic interactions among them.

Moreover, the authors disentangling preferences and modelling choice outcomes, 'aim to offer both a recognizable historical representation and an explanation of significant institutional arrangements and changes' [Bates et al. 1998: pp 13-4; 2000: pp 700].

This intention is also clarified in the set of rules stated to conduct an Analytical Narrative [Bates et Al 2000]:

1. 'Avoid the use of inappropriate models'

Every model should be designed over a specific event. Testing already built models will not help the spirit of the approach which is to discover and theorise patterns of institutional change through a narrative of behavioural change.

2. 'Build a model reflecting the set of historical circumstances in which the event is embedded.'

The specification of this rule develop as follows. First, there should be comparative static results that suggest what might have happened in different circumstances. Second, the model should contain assumptions that can be challenged to gain further insights. Furthermore, a third desirable characteristic is stated: as a game theoretic rational choice determined model, a special attention should be put towards the out-of-equilibrium behaviours, because 'what happens along a path not taken often determines which paths are taken' [Bates et Al., 2000: pp 693].

3. 'Take the narrative seriously: getting the details as correct as possible and providing richness to the extent appropriate'.

The authors' emphasis is here on evidences: it is essential to capture the key components of problems, places, and time around the phenomenon under observation. This aspect which may require a combination of quantitative and qualitative evidences.

4. 'Iterate between theory and data'.

Begin the research with some basic information and some theoretical priors, and then accumulate new information to formulate new models to progress with.

According to Bates et Al, the advantage pointed out by Analytical Narrative is to provide a discipline to the research on institutional change.

Two remarks should be stated about the Analytic Narrative.

The first one is that tests and predictions that flow from this technique will not normally be of a statistical nature.

Second and more important, although rooted in a game theoretic - rational choice tradition, the objective of Analytic Narrative is not to provide a universal theory. Analytical Narrative is by definition context-driven and strongly historically specified, and therefore not suitable for general theorising.

2.5 Narrative Approach I and II : Common features, Advantages and Disadvantages

The two narrative methodologies reviewed show a set of common characteristics, distinguishing features and also disadvantages.

As mentioned above in the chapter, main reason of interest for this narrative approaches is their explicit attempt to compensate pure quantitative methods.

This feature is a common characteristic to both the narratives which explicitly refer to history and historical comparison as the element to overcome the issue related to pure quantitative analyses. Moreover, in both the approaches a relevant role is assigned to the concept of system and to the idea that is a systematic historical understanding the methodology leading the way to a correct and robust explanation of institutional change.

Notwithstanding in both cases Narrative is fundamental., it is possible to identify two distinct attitudes for its implementation.

In Romer and Romer the narrative technique is instrumental: the aim of adopting a narrative approach is to focus on a specific episode without losing any possible information in the scenario surrounding it. Conversely, Bates et Al consider the Narrative an instrument opening instead of focusing the action.

This diversity also reflects the different set of rules the two approaches employ to lead the analyses: in the first case very practically defined upon the phenomenon to observe, in the second case general and of a theoretical authority.

However, both the methods present disadvantages mainly related to the specific condition under which they were developed and employed.

The item below shows a summary of the strengths and weaknesses of the two Narratives.

Item 2: Types of Narrative approaches - Comparison

Types of Narrative Approach		
	Narrative I	Narrative II
	Narrative Approach [Romer and Romer]	Analytical Narrative Approach [Bates et Al]
Advantages	<ul style="list-style-type: none"> • Narrative adopted for the analysis of policy interventions • More flexible: the assessment of a specific of the observation make the investigation easier to rule • No model or behavioural assumptions behind the narrative investigation 	<ul style="list-style-type: none"> • Explaining institutional change as a process of rise, evolution and decline • High consideration of all the possible causes of disturbance within a system
Disadvantages	<ul style="list-style-type: none"> • Applied for evaluation purposes and not for evolution 	<ul style="list-style-type: none"> • Too related to rational choice assumptions • The methodological rules are too rigid for the assessment of some phenomena

There are several advantages in using the approach to narrative developed by Romer and Romer. First, the narrative is adopted to explain the endogeneity of a policy intervention: policy interventions are evaluated according to the environment surrounding their development. As related advantage of this characteristic, the possibility to include in the analysis a wider range of variables without other intrinsic assumption: the focus is in fact given to the definition of the object of investigation and of its relations with other elements in the system is a sufficient condition to embrace them into the picture. The result of this hypothesis is a more flexible approach without too strict model specifications and therefore not suffering of misspecification problems as well.

The set of all these characteristics enable the narrative of Romer and Romer as an ideal framework to evaluate the impact of a policy intervention on a system. However, this specific methodology does not apply to evolution issues, such as the study of the interchanging relations within the system.

The Analytical approach by Bates et al is indeed specifically developed with this objective: to analyse the rise, evolution and decline of institution according to the process of change occurring in the variables of the system.

According to this hypothesis, there is no specific phenomenon under observation, as in Romer and Romer. The focus is not on a single event but on a series of events which rise and evolve according to the evolution of the relations of several agents. The change of behaviours in the system is than conducive to the institutional change described through historical records and documents.

The rules stressed in Bates et Al collocate their work on a different perspective from Romer and Romer: their attempt is in fact to observe the process of evolution of the interactions within a system of several agents explaining the institutional change occurring as the outcome of it. The interest of Bates et Al is in fact on the dynamic of specific environments whereas different actors perform to modify rules according to their expectations.

Hence, in our perspective both the Narrative Approaches discussed have elements of advantage and also of disadvantage. Romer and Romer is focused and clear but lose the evolution momentum. Bates et Al is conversely rich and articulated but too involved in rational choice explanation for the purpose of building a model of rational behaviour risking to forget the irrationality associated to episodes of institutional change.

2.6 Narrative Approach I and II : An alternative proposal

Highlighted advantages and disadvantages of each, we would like to propose an hybrid model of Narrative developed on the basis of the approaches considered before.

Indeed, in our perspective both the narratives have relevant elements for our analysis and should therefore be merged to provide a more complete instrument for the investigation of the evolution of social technologies and institutional change.

First, the focus on the evolution side of the process. Fundamental for assessing institutional transformation is in fact dealing with the changes in the relations among the agents which affect the institutional pattern of the process and therefore mark with their actions its direction.

Second, very important is a precise definition of the object of analysis. According to the theoretical premise that nothing is isolated in a system, it is fundamental to have a definite idea of the phenomenon under observation, or the risk will be to lose the focus of the analysis in the complex set of mutual relations among the agents involved in the observed episode.

Item 3 proposes an overview of the alternative methodology we will employ further in this work.

The methodological alternative results as an hybrid narrative approach from the combination of Romer and Romer [1989] and Bates et Al [1998].

Specifically, as in Romer and Romer we would like to begin with a precise statement of the object of analysis. In our opinion is in fact, starting element for the implementation of a narrative is to elucidate and assess the phenomenon under observation. This will consequently provide the elements to restrict the boundaries of the system and to clarify the number, role and relations among the agents composing the system itself.

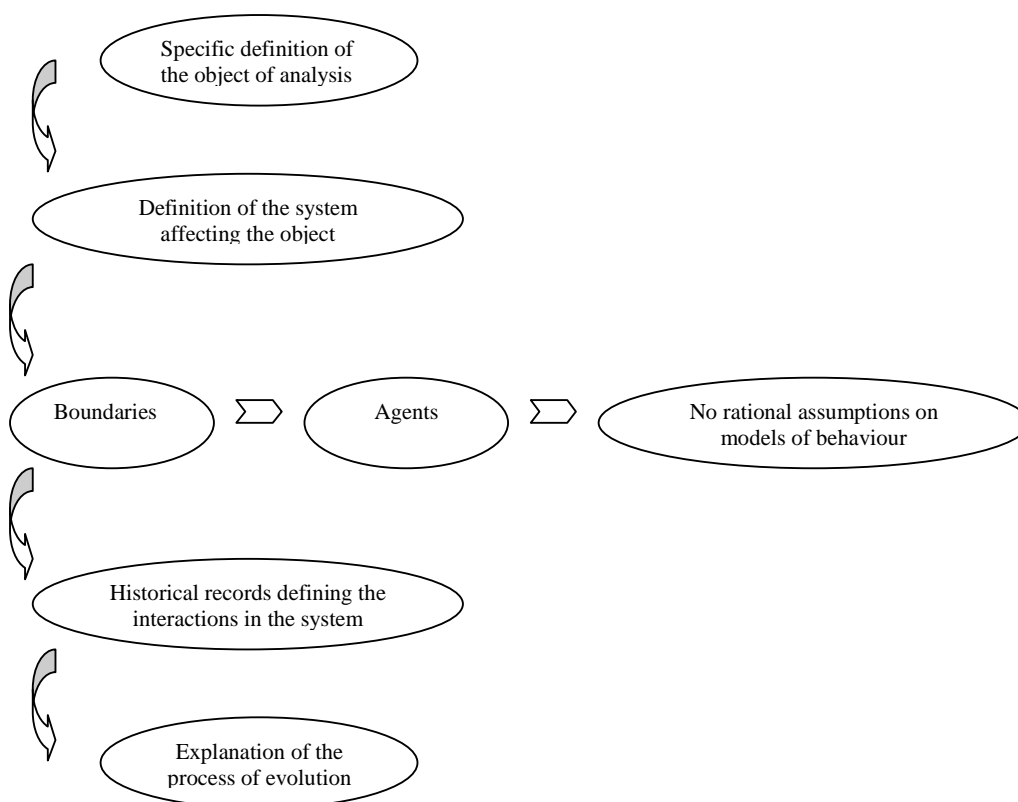
Once established the systemic framework for the analysis, we will develop the analysis according to historical records and documented proves of facts, employing a combination of narrative and

quantitative description of the evolution of the system under observation. We will not make any assumption of rational choice behaviour among the agents as we will not attempt to build any model.

Aim of the narrative we will employ is in fact to create an instrument capable of capture the differences in terms of physical technologies in the system that have lead to the modification of the social technologies and therefore to the institutional change.

We do indeed agree to the rule stated by Bates et Al about the importance of realising the uniqueness of every process of institutional change and this is the element we will focus on.

Item 3:Narrative methodology - Proposal



The hybrid approach we employ will as a start provide a specific definition of the phenomenon we investigate. According to the characteristics of this phenomenon, it will be than possible to circumscribe a system in terms of boundaries and agents affected and affecting the evolution of our phenomenon. Afterwards, through the investigation of direct and indirect historical evidences we will propose an explanation of the process of evolution in term of emergence, adoption and diffusion of new institutional patterns It is however necessary to specify one more element.

The role of narrative analyses is to integrate a systemic and historical based dimension into the framework of investigation. In both the approaches we reviewed this appealing characteristic is

explicitly used to compensate the inefficiencies of a pure quantitative method which cannot be easily engaged in an analysis involving institutions. However, the use of narrative will be further integrated with a quantitative description employed to design the characteristics of the regional system where the evolution of our social technology takes place in terms of changing boundaries and actors.

2.7 Conclusions

Earlier in this work, we developed the difficulties related to the definition of a concept of institution, and the peculiarities associated to its process of change. These elements are in our mind the main characteristics to enable a narrative approach to become the most suitable instrument for embarking in an institutional type investigation.

The following chapter will deal with a narrative description of the system and the institution we analyse according to the different forms of physical and social technology the system assumed during the years.

According to a Narrative methodology, we will apply for the analysis direct and indirect historical evidences and specifically: historical records and literature comparable to a second degree source of historical information.

We will start with a contextualisation of the institution and its stages of evolution into the final social technology further described of PRRIITT.

3 A Narrative history of policy evolution

3.1 Introduction⁴

The first formal act mentioning the Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT) is dated 1999⁵. However, the origin of this policy can be traced further back and related to the peculiar relations among the agents of the system where the policy developed as a mechanism of mutual evolution and social learning.

In this chapter we will analyse the development of the policies looking at the development in the system of different physical technologies through time. Moreover, we will propose three moments where the policy actions can be regarded as social technologies standardising the productive technology of the system. As standardised social technologies can be regarded as institutions, we will examine whether the policy actions can be regarded as pragmatic type institutions formalising the already existing organic types.

As we are referring to a local system of production, we will stress the role in this process of the high degree of trust, civic engagement and reciprocity enhancing the spontaneous emergence and diffusion of physical technologies. Moreover, these characteristics led to the creation of forms of social technologies spontaneously arising as well within this framework.

We will observe in the next sections how the industrial policies of Emilia Romagna can be regarded as a moment of formalisation of spontaneously arising social technologies, and therefore as an attempt to transform an organic type of institutional system into a pragmatic type.

We will divide our analysis in three moments. The first one associates to the local system of production the Regional Agency for the Economic Valorisation of the Territory (ERVET) as first policy instrument built on the characteristics of the regional system. The second phase will analyse the establishment of the Real Services Centres as policy action specifically implemented to formalise the informal productive networks of the system. Finally, we will investigate on the evolution of the physical technologies of production and the social technology networks at the base of the development of the Regional Programme for Industrial Research, Innovation and Technology Transfer.

⁴ This chapter has greatly benefited of several interviews of the author with Dr. Silvano Bertini, regional responsible for PRRIITT policy development, who helped me in the process of understanding and reconstruction of the events: I sincerely thank him for his time and support. The usual disclaimers apply.

⁵ Regional law 3/1999 'Reform of the local and regional system' art. 57.

3.2 System and Social Technology I: the Ervet system

The system we are analysing starts its development in 1970, when the regional reform planned in the Italian Constitution became effective.

According to article 117 of the Constitution, Italy is composed of ordinary and special regions and some of the national power on specific subjects had to be delegated to the regional governments.

Specifically, ordinary regions have the power to promote law on: agriculture, health, housing, public works, artisan and professional training, and territorial development. Important to notice, industrial policy is not mentioned as one of the subject delegated to regional authority. Hence, after the regional reform in 1970, the determination of the strategic economic planning was still up to the central government.

However, according to the national legislation as well it was also instituted one more instrument for the regional governments: on the basis of article 10 Law 281/1970, every region had the power to develop its own financial agency as ‘development and promotional boards’ of the territory.

In December 1973, Emilia Romagna created Ervet, its own Agency for the Economic Valorisation of the Territory⁶.

Ervet born as a public-private organisation aimed to provide services to the regional industry. It was a holding company with capital subscriptions by Emilia Romagna region, as majority shareholder, by banking institutions and the Federation of Chambers of Commerce [Bianchi and Giordani 1993]. Notwithstanding its creation as a financial agency, Ervet’s tasks was to carry out research studies and specific projects with the aim of providing services to the firms of the territory [Bellini 1990, Ervet 1974].

From 1975 regular consultative sessions were established between regional government, local governments, and professional associations. The outcome of this process resulted in the creation and consolidation of a common agreements, the creation of a shared consensus, the involvement of other regional group of power in the decision process and above all a common industrial development plan [Leonardi 1990].

Ervet reflects the ratio of the local authority which was trying to overcome the constitutional obstacle about local industrial policies.

The process of realisation of this objective was also favourite by some key capabilities already well settled in the regional system, and which were the constituent elements of a ‘network paradigm’ [Cooke & Morgan, 1993, Cooke 1996].

⁶ Regional law 44/1973.

As a broad strand of literature shows [Putnam 1983 and 1993; Best 1990; Capecchi 1990; Leonardi and Nanetti 1990; Capecchi and Pesce 1993; Sapelli 1995; Amin and Thrift 1994; Amin 1999; Belussi 1999; Russo et Al 2000; Patrucco 2005], this process was made effective by the active role played by the culture of social inclusion and participation, and the consolidation of civic engagement values which enabled the shaping of an embedded regional system [Asheim and Gertler 2005].

These elements can be summarised in:

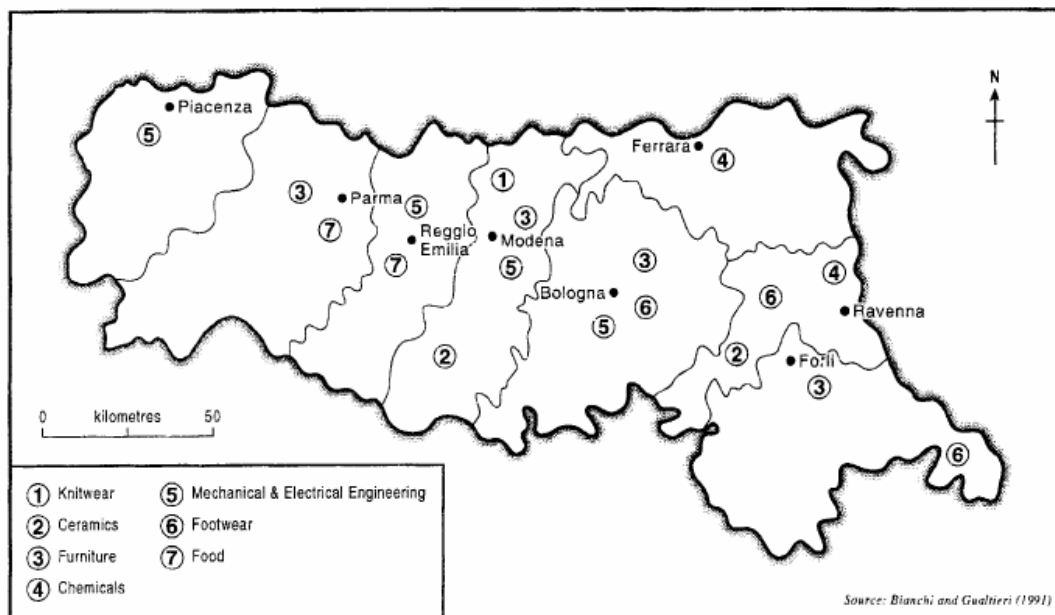
- (1) Reciprocity: a predisposition towards exchange rooted in the strong associationalist tendencies of the territory.
- (2) Trust: faith in the reliability of others, directly linked to the atmosphere, not just industrial, of the regional system.
- (3) Learning: know-how easily transferable as shared in an environment of trust and reciprocity.
- (4) Partnership: establishment of reciprocal relationships, developed on a face to face basis and dependent on the trust element characterising the system.
- (5) Empowerment: social inclusion in processes of deliberation and promotion of laws, due to the strong perception of those citizenship rights historically tailored in Emilia Romagna civic heritage.

At the beginning of the Seventies, when the constituent phase of the regional system was still ongoing, the local productive system in Emilia Romagna was characterised by areas affected by well defined local production specialised upon a complementary set of artefacts able to substitute a scale intensive firm production [Brusco 1982; Piore and Sabel 1984].

The flourishing of small firms, usually family owned, due its origin and development those cultural factors traceable into civic and self enforcing political attitude, which during the years were also supported by the local governments.

The table below shows the different productive specialisations of the territory as they were during the Seventies.

Figure 1: Regional production system (1970s -1980s)



(Source: Bianchi and Gualtieri 1991).

The productive sectors listed as productive agglomerations include: Knitwear; Ceramics; Furniture; Chemicals; Mechanical and Electrical engineering; Footwear; Food.

Two characteristics emerge looking at the picture.

First, the diversification of activities in the regional system. The territorial specialisations are rather different, and although mainly devoted to traditional manufacture, they also have aspects related to the agricultural vocation of the region in its foodstuff processing industry.

Second, a rather homogeneous distribution of the agglomerations which, although concentrating more around the regional administrative capital, span on the rest of the territorial system.

Moreover, the productive system was characterised by some common features as [Bardi and Bertini 2004]:

1. The majority of firms were of first generation firms with an owner-entrepreneur possessing a basic education level and pure technical competencies.
2. The public or private of technology services supply was limited in the regional system.
3. There was no communication between firms and public research institutions such as universities or research centres, due to a lack of resources and a cultural inaptitude to it.
4. Although the cluster-type agglomeration, there was no formal identity representing the local system but just informal- type institutions lying upon common interests, mutual values and shared objectives.

At the moment of constitution of the regional authorities, the space for public intervention was than rather wide.

The choice fell into creating a mechanism shaped on those informal institutions already settled in the system which had spontaneously flourished by common habits, shared social routines and collective actions.

3.3 System and Social Technology II: Ervet and the Real Services Centres

Exploiting its powers, at the beginning of the Eighties the regional government employed Ervet to plan a coordinative intervention.

The target of the action was focused according to some principles perceived as very relevant for the development of the regional system and that can be summarised as:

1. Identifying new means for implementing innovation policies: the main concern was to set up a different kind of mechanism to reduce the importance played by public grants.
2. Valuing and exploiting the role of production-related services for the structural readjustment of production cycles.
3. Overcoming the increasing difficulties encountered by small firms in responding to the challenges presented by technological revolution, in the absence of environmental conditions establishing the bases for the a learning mechanism among the agents of the regional system.

The emerging solution of this action matured in the establishment of several 'Centres for Real Services', some reflecting the local industrial specialisations and others with a multi sectoral focus. Main aim of these centres was to promote technology transfer, offering to an increasing number of small firms an easier access to both new technologies and other general services such as: information, training, quality certification, scouting of territorial areas for industrial settlement, applied research.

As defined in Bianchi and Gualtieri them, the Real Services were:

<<...those service activities whose provision modifies in a structural, non-transitory way the firm's organization of production...The inclusion of these services in the production process allows a structural change—e.g. the reshaping of processes, or the differentiation of products, or a change in market coverage>> [1993: pp 33].

The specific aim of these centre was therefore to operate on concrete level for firms' structural change and to generate capabilities in the regional systems for the improvement of production capacity.

In this sense, it is possible to define the activity of the Centres for Real Services an instrument of industrial policy towards the system innovation looking at its characteristics of adoption of new strategies for the emergence of instruments for the diffusion of services.

Moreover, the Centres were geographically distributed and emerging from the specialisations of the local economies. Their action can therefore be summarised as a collection of the physical technologies of production in the region, plus a formalisation and enhancing of the already existing network among the firms.

The next item illustrates the Centres for Real Services and the universe of other agencies rotating around them [Item 4].

The Real Service Centres leaded by Ervet were eight, divided into Sectoral and Functional. Sectoral centres were defined upon a specific objective related to the modification of production, therefore their aim was to provide to single firms applying for it a specific help to improve their production process, or an already existing technical or technological capacity. They were the firsts centres set up by the regional planning between 1980 and 1985 as direct expression of the specific productions settled in the local system, such as shoes, machinery for farming, textile, and construction.

Functional centres were conversely aimed to the implementation of intangible elements related to production, and their enhancing and diffusion, such as networking activities, export and technological development.

The Functional centres were four. Two of them providing transversal assistance indistinctively to all the sectors such as Aster (technological development), and Svex (export development). The other two were indeed focusing on very scale intensive sectors such as Metals (Cermet) and mechanics (Resfor) but according to the same functional principle, offering technological consultancy and networking development.

These eight centres can be defined the core of the Ervet system.

Item 4: Ervet's universe of Centres for Real Services

Enlarged: Ervet participated Service Centres

Core: Ervet led Service Centres						Development Agencies
	Year	Location	Category of production	Mission	Service	
Sectoral						
Cercal	1983	Forlì	Shoes	Upgrading of Shoe industry	Training; Fashion trends	Ase – Ravenna
Cesma	1983	Reggio Emilia	Agriculture, Machinery	Services for farming	Studies and Researches	Promo – Modena
Citer	1980	Modena	Textiles, Clothing	Textile information Centre	Information, Research, Fashion trends	Salino – Piacenza
Quasco	1985	Bologna	Construction	Development of Building industry	Training, Information, Research	Sipro – Ostellato
Functional						
Aster	1985	Bologna	All sectors	Technological Development	Planning, databank access, Documentation	Soprip – Parma
Cermet	1985	Bologna	Metals	Technological Consultancy, analysis	Quality certification, quality system processes certification	
Resfor	1986	Parma	Mechanics	Network service for upgrading subcontracting	Information, promotion, networking	
Svex	1985	Bologna	All sectors	Export development	Information, promotion, networking	

Fit - Parma Regional holding company for technological innovation	Cetas - Bologna Training agro-food experts for developing countries	Democenter – Mo Circulation of industrial automation	Spot – Modena Upgrading of metal and mechanical industries	Cemoter – Fe Earth moving machines and off road vehicles	Centro Ceramico-Bo Ceramic research and testing
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Ervet Shareholdings <u>Sectoral Services</u> Agenzia Polo Ceramico [Analysis/research on advanced ceramic products] Idroser [Analysis/research on Water resources] Leonardia [Scientific park for industrial automation] Bologna Innovazione [Regional scientific park] Promorestauro [Promotion of artistic property]
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Personal elaboration on Bellini [1990], Cooke and Morgan [1996] and Ervet [www.ervet.it].

The Ervet universe however, was not just limited to these eight directly led centres. Other two groups of activities were falling under the regional agency participation.

We will call enlarged system the group of those centres composed of other Sectoral centres and Local Development Agency participated by Ervet.

The spirit leading the action of Ervet was than actually to create a pole of coordination among the local systems. Through its own centres, developed as the core competencies, plus the shareholding of other service centres and research agencies, Ervet was de facto organising the service provision for the regional physical technologies of production. To obtain this result, Ervet acted upon already existing but not formally institutionalised networks to consolidate a level of informal interactions into organised structures.

Table 1: Local system specialisations (1970s – 1980s)

Structural Service Centres		Local System Specialisations						
		Ceramics	Chemicals	Foodstuff	Footwear	Furniture	Mechanical and Electronic Eng	Textile
Ervet leaded	Sectoral			•	•		••	•
	Functional*	•	•	•	•	•	•	•
Ervet participated	Sectoral Territorial Centres	•						
	University and Research Centres	•						
	Centres for Promotion, Development and Training			•			•••	

* Functional services were encharged of the technological and networking development of all the regional system

In the table above, a brief exercise to match the action of the regional government through Ervet and the characteristics of the system [Table 1].

In the top row, the sectoral specialisation as recognised in the literature, and on the left the Real Service Centres divided into Ervet leaded and participated.

As we observe in the table, four over six of the Sectoral centres led by Ervet covered one of the local production specialisation, and specifically: foodstuff (Cesma), footwear (Cercal), Mechanical and Electronical engineering (Quasco and Cesma), and textile (Citer). Excluded from the list ceramics, chemicals and furniture.

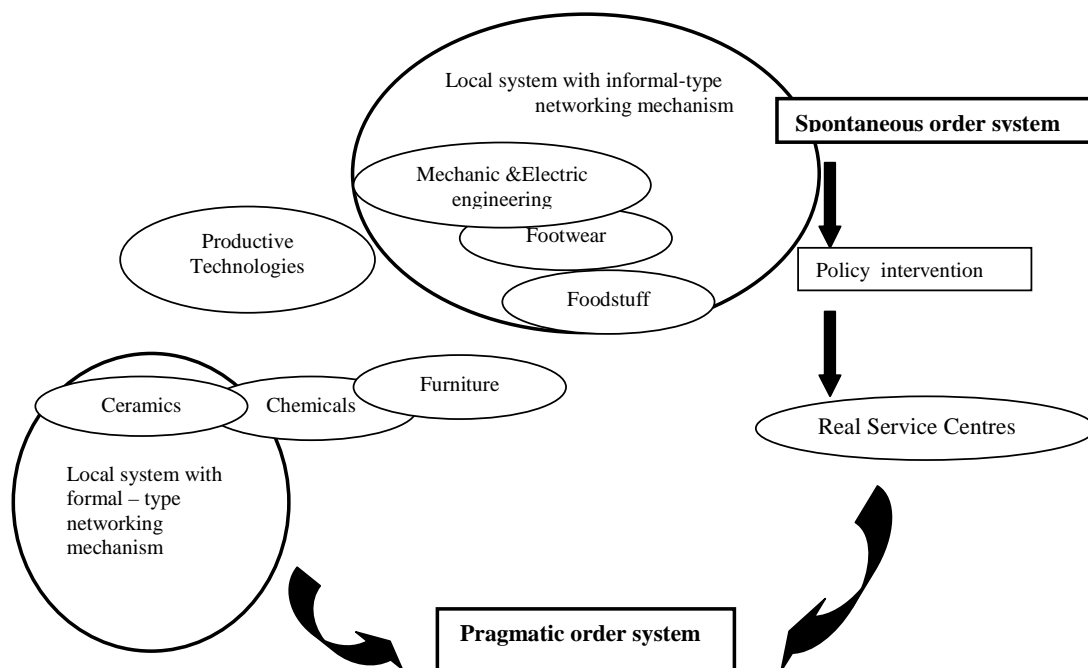
This exclusion however is compensated by the enlarged system participated by Ervet. Specifically, the ceramic sector was already enclosed in a previous similar action taken by Ervet in 1974. At the time the demand of the local system was so intense to push the regional agency in opening a university consortium based centre (Centro

Ceramico) in accordance with the national and regional ceramic association (Assopiastrelle) and the University of Bologna. Centro Ceramico carried out on behalf of firms applied research and testing of new materials compensating the competitive disadvantage of the small medium sized enterprises belonging to the sector. Moreover, in 1988 one more consortium type agency opened with the participation of Ervet and the National Body for Energy and Environment (Enea), this one focusing more on the research frontier of advanced materials (Agenzia Polo Ceramico).

Interesting is also the concentration of Real Service centres for machinery and electric engineering. Again, the concentration could be explained through the versatile characteristics of this sector. Indeed as we observe by history not only this sector was one of the leading among the regional economy, but its development was also related to other auxiliary sectors benefiting by its expansion such as: agriculture, metals, construction.

In Item 5, we propose a synthesis of the intervention focusing on the shaping process operated in the regional environment.

Item 5: Real Services Centres – formalisation of spontaneous and pragmatic type institutions



The industrial policy started considering some the productive sectors with definite characteristics. Specifically, the initial condition was to focus on local systems of production and therefore a systems with:

1. A productive specialisation
2. Flexible processes of production
3. The presence of a spontaneous networks of interaction among the agents
4. An atmosphere of trust and social routines conducive to the sharing of knowledge and learning processes

The initial condition which characterised this system is spontaneous order: informal institutional behaviours arise unplanned and are generated autonomously through the relationships among the agents sharing the same environment.

The local systems of productions identified in the regional system were several.

In some of these systems, the social routines and trust relationships among the agents had already moulded a formal networking mechanism. In others the networking mechanism generated by the system was at an earlier stage and therefore the network resulting of a more informal type. The policy response was than different but always aimed to the generation of formally institutionalised networks.

In the right side of the picture, the local systems of production with informal type of networking mechanism. The creation of Real Services Centres for them has enabled a process of formalisation toward a pragmatic order type of institution as already happened for the ceramics sector (left in the picture).

It is quite difficult to evaluate the performance of these Real Service Centres. Main reason is the heterogeneity of the experiment, which has involved different forms of structures, at different times and with a different missions. However, at the beginning of the Nineties major events affected the existence of the Real Service Centres.

In 1991, over the influence assumed by local productive systems in the Italian economy, national government started to modify its attitude toward the regional

involvement in industrial policies⁷. This process led to the introduction in 1993 of a legislative definition for industrial districts⁸.

This modification opened new possibilities for the regional authorities in terms of providing instruments to develop specific district policies at a regional level and most of the Italian regions formalised their local systems of production into industrial districts according to the legislation.

The response of the Emilia Romagna government was however different from the expectations and rather than assimilating the national directive, local authorities decided to develop their own definition judged more descriptive about the regional economic environment [Messina 2001].

In 1993, the regional government reorganised Ervet focusing its role on innovation and internationalisation. Although the strategies adopted by Ervet were still engaged with a Real Services policy, some differences can be highlighted [Amin, 1999, Rinaldi 2005].

First, the new focus was on providing firms services with a high innovative content. The Real Services Centres became outdated to the level of specialised agencies in a complex system of service provision. The new strategy for Ervet was to allocate its action into areas whereas there was not business association operating in.

Moreover, Ervet mission changed starting its new role as organisation assisting to the inducement of a flux of resources by helping local firms in participating in European projects and tenders, and by developing activities aimed at attracting foreign investment (Mazzonis, 1996).

Ervet increasingly became a service provider with a major role in the region but now into a regional network among other public and private service providers and therefore losing its previous planning function⁹.

Among the practical implications of this reform there was also a change in Ervet's relation with firms. The idea was that Ervet had to act as a second-level structure, providing services to business associations, chambers of commerce and private sector organisations that in their turn provided services to the enterprises.

⁷ National law 317/1991.

⁸ Italian official gazette 118/1993.

⁹ The changes of governance structure involved also changes in the budget structure. Specifically, the agency's financing became more project-oriented from a variety of sources, including the EU.

Given this new objective plus the innovative nature of its services, only more knowledgeable and sophisticated firms were expected to directly apply for Ervet intervention.

As a consequence of Ervet's new governance structure, Real Service Centres changed their structure as well: some centres were closed, others were merged, while the most effective ones (as Aster, Citer, and Democenter) were reinforced.

Final result of this reorganisation process was a reduction of Ervet's role on the industrial policy scene.

However, the region as well was re placing itself according to the changes in the policy perspectives, as it was no more so tight the constraint for regional industrial policies.

In 1998 a major change occurred in the Italian legislative system when the process of decentralisation became effective¹⁰. A transfer of new competencies, assets, and financial resources switched from the national state to the regional governments, leading every region to develop different plans about industrial policies.

In 1999 Emilia-Romagna was the first region in Italy approving an internal law reorganising its new competencies in terms of industrial policies as envisaged by the national law.

¹⁰ Bassanini Law: 59/1997.

3.4 The emerging of a new system

In November 1999 with the regional law 3/1999 the local authority elaborated its first formal industrial policy act, with the new role of the regional government in terms of industrial policies enclosed in three articles: 53, 54 and 60.

The plan was articulated in three years and named Regional Three year Industrial Plan and defined the competencies in terms of areas of intervention but above all of in terms of a new definition of the industrial system according to the evolution of the regional environment.

The Regional Three year Industrial Plan was articulated in six axes of intervention, each containing several priorities and guidelines targeting the action of governance towards new objectives and new actors.

Such goals were defined as follow.

1. Support to investment in innovation and competitiveness.

This axis was divided into three main lines. The first one regarded funding to integrate firms' resources for improving the competitiveness. Firms may apply for funding to a bank and the regional government acts as a guarantor for credit provided. The companies become then eligible for favourable interest rates and other interest account benefits for certain types of expenditure, as provided by Italian legislation. The second one was about the quality certification plus the adoption of complex quality control systems, in particular for subcontracting company networks. The third one was an attempt to bring together manufacturing industry and the research field, introducing a tax bonus for consultancy investment, as well as training courses or the temporary employment of university researchers by small and medium-sized companies. Finally, funding was made available for consortia consisting of small and medium-sized companies together with public/private joint-ventures.

2. Promotion of new entrepreneurship and new employment opportunities.

This axis aimed to foster the construction of new manufacturing plants or the setting-up of new companies (especially in the high-tech sector), the turnover of the labour force, and the creation of cooperatives. Furthermore, an effort was made to support the 'second generation' self-employed and professional categories. Funding in this

line was also available for spin-off projects of high-tech industries or research centres and universities.

3. New funding for business enterprises.

This axis concerned the improvement of the relationships between banks and industrial firms defining different measures with regard to firms' capitalisation. Moreover, the regional government established a special fund for granting companies and other credit institutions which aimed to purchase minority shares of small and medium-sized companies.

4. Support for the internationalisation of the production system.

This axis involved on one side the setting-up of a regional office for internationalisation in agreement with the Ministry for Foreign Trade, ICE (National institute for Foreign Trade), SACE and SIMEST, and on the other side the supplementing of nationally-available funds with regional capitals devoted on the promotion of Small and medium enterprises.

Indeed, despite regional companies were actively present in foreign markets, it was recognised that small and medium-sized firms had a difficult access to available national opportunities of financing.

5. Support for local production systems.

This axis aimed to foster the development of local production systems by introducing special area programs.

The approach presents one principal novelty: the back-up measures are elaborated on a territorial basis and not separately for each sector. Each program contained measures to strengthen the weak and consolidate the strong points of each area through: re-qualification of urban areas; intervention in the mountain areas, plus the identification of areas with special needs, such as: the Adriatic coast towns, the port of Ravenna and the setting-up of a new industrial estate to locate the expanding facilities of the motor producers around Bologna and Modena.

6. Improving the relationship between companies and the public administration.

This axis aimed to push each municipality to activate its own 'Sportello Unico per le Attività Produttive' a national instrument designed to guarantee a fixed and homogeneous term for the administrative procedures involving firms' activities.

As we notice examining the articulation of priorities contained in the Regional Three year Industrial Plan, Real Services Centres completely disappeared as a strategic axis of the region's industrial policy. The Real Services Centres led by Ervet and private ones were consequently considered equally relevant to the regional authorities as if they had the same nature and could carry out the same functions, marking again a change of importance of their role in the regional system.

Such change is due to the transformation processes occurred during the 1980s and 1990s, whereas some of the conditions defining the regional systems of production were modified both in terms of territorial specialisation and in terms of the characteristics of the local systems and its agents of production [Brusco et Al 1995; Russo et Al. 2000; Whitford 2001; Rinaldi 2005].

According to the re shaping of the regional system, the law 3/1999 elaborated its own definition for the regional productive system, not conforming to the industrial district one proposed by the national legislator.

According to the Italian definition, to be identified as district a local system of production should respond to specific level in four criteria related to: manufacture industrialisation; entrepreneurial density, productive specialisation, Small and medium enterprises density¹¹.

The government of Emilia Romagna found this description restrictive and not fitting the realities developed in the regional context where differentiations in industrial relations and organisation of subcontracting were diverse and a single definition of industrial district was considered flattering the articulated reality of spontaneously cooperating productive networks.

Hence, the region never proceeded in the registration of its local systems of production, and the choice was conversely to shape a triple classification of system of production according to the regional environment.

¹¹The criteria are summarised in the ministerial decree 118/1993, actuation of the article 36 law 317/1991.

In the law 3/1999 the regional authority differentiated the notion of industrial district, sectoral cluster and productive threads, recognising in the last one the core of the new regional industrial model.

In Emilia Romagna local systems of production through a growing networking integration became productive threads: inter sectoral value chains following a complex set of relations along all the productive cycle, from the raw materials elaboration to packaging and commercialisation.

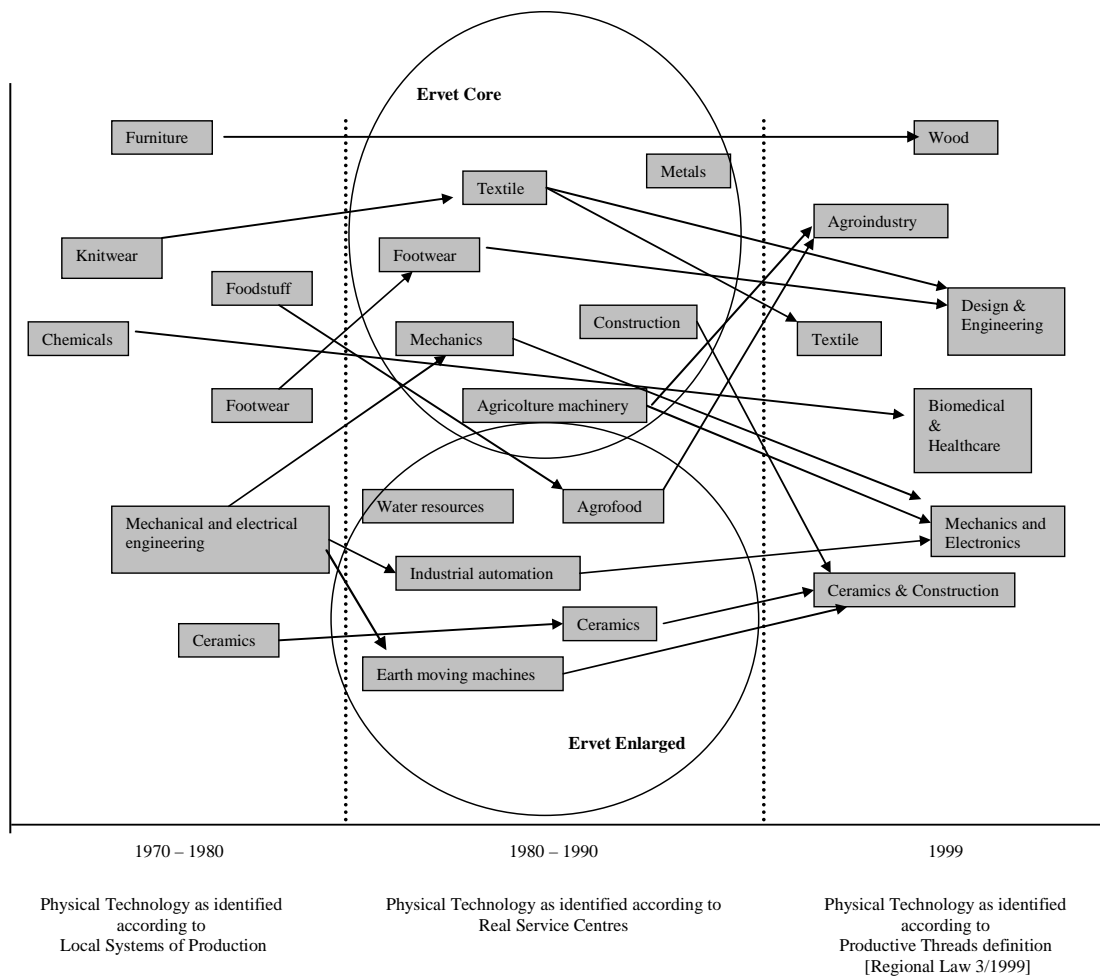
According to the definition of productive threads, the Regional Three year Industrial Plan identified new industrial macro sector central for the regional economy. These sectors were: agro industry; wood; design and engineering; textile and clothing; construction (including ceramics); chemistry and plastics; mechanics and electronic; healthcare (including biomedical).

Together these threads explained more than the 90% of the regional export and were grouping the capabilities developed by the local system of production but with the characteristic of a network¹².

The following figure pictures the transformations of the system throughout the years [Figure 2].

¹² Regione Emilia -Romagna (1999), 'Crescita, qualità e innovazione delle imprese e del lavoro in Emilia-Romagna. Programma regionale triennale per lo sviluppo delle attività produttive. 1999-2001', Assessorato alle Attività Produttive: Bologna.

Figure 2: Physical technologies of production – Real Services Centres and Productive threads



The item shows the evolution of the physical technologies in Emilia Romagna. The figure is organised around the technologies represented according to the productive sector. In the first part of the graph (far left) the technologies according to the local systems of production identification as they appeared during the 1970s, when the regional authority started to be implemented. In the middle section the sectors after the constitution of the Real Services Centres. Finally, at the right of the graph the production technologies as defined by the Productive threads definition in the Regional Three year Industrial Plan (Law 3/1999).

The figure is aimed to picture the recombination of the competencies in the regional system of production. As we observe, a process of diffusion and merging of physical technologies develops from the left to the right side of the object. The arrows identify the re-shaping of existing sectors into new ones which include a different level of technology conducive to the a different production in term of specialisation.

Thus for example the mechanical and engineering local specialisation emerged during the 1970s (far left) develops into mechanics, industrial automation and earth moving machines (middle), to be finally re shaped in mechanics and electronics and construction (right). Or the Knitwear sector which transforms its competencies into textile and then into design.

The circles in the middle section highlight the system designed by Ervet with the Real Services Centres during the 1980s. As we notice, the Real Services Centres captured the regional specialisation and according to their mission, developing networking and communication activated a process ended in the moulding of a new system based on threads rather than single specialisations.

This process of evolution of the physical technologies of production embedded in the local system as shown in the item above kept changing and constitute the basis for a new regional system which three years afterwards was fixed into the second industrial policy act.

3.5 System definition III: The Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT)

The second Industrial Policy Act started in 2002 with a reconsideration of the composition of the regional economic system as happened for the previous action¹³.

From a governance perspective, the objectives to reach were recognised in: industrial and strategic research [art 4]; technological transfer [art 5]; and creation of innovative networks [art 6].

The overall plan was therefore explicitly about the promotion of the competitiveness of the regional system with regards to the structural elements of the regional economy.

The plan was divided into four lines:

1. Implementation of innovation capacity and networking among firms and between networks of firms through investment in innovation, quality, efficiency, environment, conditions of labour.
2. Promotion of strategic industrial research and implementation of the relations between industry and research through the increasing of technological transfer, new profession and product and process innovation.
3. Support to the industrial dynamic through the enhancing of the credit system
4. Internationalisation and increasing of export capacity.

The role of innovation in the second Industrial Policy Act is particularly prominent in terms of investments in process and product innovation, and the implementation of cooperation among firms (especially Smes) and public and private research laboratories.

The operative decree for the exploitation of the innovation policy line of the Industrial act is the Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT), and its focus is on the ‘improvement of applied research, firms’ pre competitive development, the increasing of the technological content for the production and the development of the knowledge economy’ .

¹³ Regional law 7/2002.

PRRIIT is the operative branch of the regional policy and contains the specific directions addressed in the regional industrial. It develops on the bases of the local system specialisations considering as crucial points: sectoral differences within the system, and the networking capacity among the firms and between the different networks of firms.

More specifically, the program focuses on:

1. Stimulating cooperative investments in R&D within firms, firms and research laboratories or every other supplier of technology.
2. Supporting the creation of intra firm industrial R&D laboratories.
3. Promoting the creation of technological spin offs
4. Developing a network of industrial laboratories in applied research

The process of creation of the innovation Programme involved the major stakeholders of the regional system, such as: regional and local authorities, firm organizations and universities.

Two elements were preliminary to its implementation: investigating about the modifications occurred in the industrial structure and the research capacity of the system. According to these two aspects was in fact possible to understand the evolution of the regional systems in terms of agents involved and therefore to address the policy.

To come to this result a three fold perspective was employed. First, the university specialisations and agenda of the regional research laboratories was used to test the research capacities and capabilities. Second, methodology was developed to analyse the production system in its elements of excellence. The result of this process was a set of two matrixes of matching criteria conducive to the definition of the new system of production upon which the policy was going to impact on.

Item 6 shows the process of selection developed for the analysis.

To methodology applied to study the evolution of the regional system of production was composite¹⁴.

¹⁴ Programmi 525 e 526 per l'attuazione della Legge Regionale 7/2002, Bologna: Aprile 2003.

As a start, it was necessary to assess the changes occurred in the productive system in terms of specialisations. Furthermore, to enhance the competitiveness of the system it was needed to relate this changes to the research frontier at an international level.

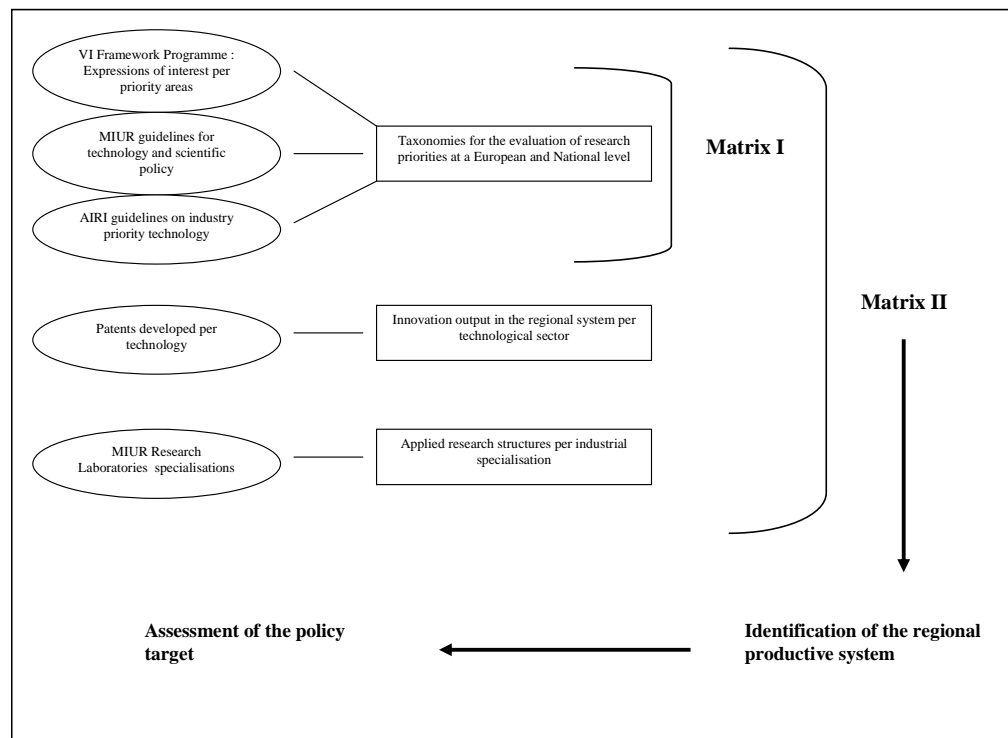
The regional government applied three different criteria for the assessment of this objective, and matching them in a set of matrixes evaluated the characteristics of the regional economy.

The first tool chosen for the evaluation consisted in the collection of the expressions of interest for Sixth framework programme funding activated by regional firms.

This choice had the advantage to provide a classification of the technological initiatives already established in the region according to an international taxonomy, but also the capacity to determine the behavioural attitude of the firms in a European level competitive scenario. This evaluation developed a first matrix with the number of firms which applied for European funding in research and technological development.

This first objective was measuring the regional performance in terms of European indicators: the second passage of the evaluation of the system had hence to establish the performance of the regional economy in terms of national indicators.

Item 6: PRRIIT - Process of selection of the physical technologies



(Personal elaboration on Programma attuativo 525/2003 and 526/2003)

The second tool employed two guidelines: the ones developed in the National programme for technology and scientific policy¹⁵, and the ones developed by the Italian Association for Industrial Research (AIRI)¹⁶. The double choice helped to differentiate between two dimensions related to technological development. The guidelines suggested by the National programme distinguished between Enabling technologies for industrial environment, and Areas of general socio economic relevance. AIRI guidelines implemented the second dimension related to socio economic relevance of the technologies, completing the set of national criteria about technological priorities (Matrix I in Item 6).

After establishing two frameworks (national and international) for the analysis of the regional system, the criteria had to be confronted with the characteristics of the regional context.

The third step was then comparing the regional scenario with the group of parameters to gather the relations between the systems of production according to the double taxonomy developed.

The relevant productive areas of the region were selected in terms of productive threads and local systems of production as follow:

1. Mechanics and industrial automation
2. Design and engineering
3. Ceramics and construction
4. Food industry
5. Informatics and multimedia
6. Biomedical and health care system
7. Chemistry and plastics
8. Textile and clothing

According to this procedure a group of sectors was identified and confronted with other two proxies of technological output: the number of patents and the laboratories of applied research certified by the National Minister of Innovation, Research and University (Matrix II in Item 6).

¹⁵ Programma nazionale delle ricerche, Linee guida per la politica scientifica e tecnologica del Governo, Roma: Ministero dell'Innovazione Università e Ricerca, Aprile 2000.

¹⁶ Repertorio delle tecnologie prioritarie per l'industria, AIRI, 2000.

The table below gives some evidences of three of the dimension of evaluation of the regional economic system, and specifically collects the total number of patents developed per technology between 1989 and 1999; the public and private specialisation of the research laboratories accredited according to the National standards; and finally, the manifestation of interest in terms of projects submitted to the VI Framework Programme by regional organisations.

Table 2: Identification of physical technologies – Patents, Research Laboratories and VI FP manifestation of interest

Patents developed per technology [1989-1999]		
Plastic materials	195	23,96%
Factory automation	111	13,64%
Control and measurement instruments	89	10,93%
Office machinery	75	9,21%
Pharmaceutical	94	11,55%
Electronics	73	8,97%
Chemistry	59	7,25%
Electromedical instruments	65	7,99%
New material	20	2,46%
Optical instruments	17	2,09%
Electronical components	14	1,72%
Aerospace	2	0,25%
Total	814	100%
Research Labs - Specialisation		
Mechanics and engineering	73	31,60%
Informatics, electronic, telecommunication	33	14,29%
Agriculture and environment	32	13,85%
Chemistry	26	11,26%
Medicine	19	8,23%
Medical and precision instruments	16	6,93%
Pharmaceutical	12	5,19%
Veterinary	12	5,19%
Other	8	3,46%
Total	231	100%
VI Framework Programme - Areas of interest		
Information society technologies	19	23,75%
Sustainable development, global change and ecosystems	18	22,50%
Nanotechnologies and nonosciencies, knowledge based multifunctional materials	12	15,00%
Genomics and biotechnology for health	11	13,75%
Food quality and safety	8	10,00%
Citizen and governance in a knowledge based society	5	6,25%
Aeronautics and space	3	3,75%
Other	3	3,75%
Radiation protection	1	1,25%
Total	80	100%

(Personal elaboration on Emilia Romagna, AIRI, and Chamber of Commerce data, 2000)

Table 2 shows as a proxy the areas of specialisation of the regional economic system, as they have been evaluated by the regional government for the development of PRRIITT. The patents developed in Emilia Romagna between 1989 and 1999 are 814 and more than half of them in the sectors of Plastics materials, Automation and Precision instruments. This is in line with both the research laboratories specialisation which are mainly in the sectors of Mechanics and Engineering and Informatics electronic and communication. Finally, as major areas of interest for the Sixth Framework Programme, the areas of Information, society and technology but also Nanotechnologies and Nanosciences, and Genomic and biotechnology for health. Finally, an important correspondence in terms of results between the Agriculture and

environment Laboratories and the amount of VI FP projects in Sustainable development, global change and ecosystems.

In the next item, we review all the criteria adopted by the government for the implementation of the innovation Programme .

Table 3 is the expansion of the final matrix obtained by the matching of the previously explained criteria (Matrix II in Item 6).

It summarises the physical technologies of the regional system according to the properties used for their establishment and aims to show the correspondences and relations among them which were employed to define the new competencies of the system.

Table 3: Identification of Physical technologies – Matrix I and Matrix II matching

		Enabling technologies of industrial interest		Areas of general industrial interest	
		Industrial impact			
		Direct	Indirect	Direct	Indirect
Biomedical and electronical instruments	Rlab	●			
Ceramics and construction	Rlab - Rspe	●			
Chemistry and plastics	Rlab - Rspe	●			
Energy	Rlab				●
Environment	Rlab				●
Food industry	Rlab - Rspe	●			
Food quality and safety	VI FP		●		
Food safety	Rlab - Rspe				●
Genomics and biotechnology for health	VI FP	●			
Health care system	Rlab				●
Improvement of the standards of labour condition	*				●
Informatics and multimedia	Rspe	●			
Information society	Rspe				●
Information society technologies	VI FP	●			
Mechanics and industrial automation	Rlab - Rspe	●			
Mechanics as manufacture of electrical equipment	Rspe	●			
Mechanics as manufacture of electrical machinery and motors	Rlab - Rspe	●			
Nanotechnologies and nonosciencies, knowledge based multifunctional materials	VI FP	●			
Sustainable development, global change and ecosystems	VI FP		●		
Textile and clothing	Rlab - Rspe	●			
Training	*				●
VI FP	Sixth Framework program				
Rlab	Established research laboratories				
Rspe	Established regional productive specialisation				
*	Directly added by the regional authority				

(Personal elaboration on Programma attuativo 525/2003; 526/2003; Law 7/2002)

in the table are grouped the relevant areas of research assumed in the policy as main industrial realities but also as the priorities for the development of the technological framework in the region.

The matching originates by the matching of Sixth Framework project submissions, the established research laboratories for applied research, and the regional productive specialisations in terms of local systems of production and productive threads.

To these elements emerging from the analyses of the productive environment, the regional government added others areas of general interest for an equal development of the regional economy such as the improvement of the labour condition standards and training and further education.

Each element of the table is confronted with the degree of industrial impact (direct or indirect) according to the criteria of the Italian Ministry for Innovation, University and Research (MIUR) and the Italian Association for Industrial Research. Furthermore, the specialisations are grouped into Enabling technologies of industrial interest and Areas of general socio-economic interest.

The final result is a new map of the regional system made in accordance with the development of the main industrial competencies which provides the collection of spontaneous physical technologies finally grouped in the Regional Programme for Industrial Research, Innovation and Technology Transfer, which became effective in 2003.

As result of the matching of these characteristics, the core of physical technologies collected in PRRIITT to enhance applied research and the evolution of the regional system resulted as follow:

1. Agro-food: production and processes
2. Genomics and biotechnologies
3. Sustainable development and ecosystem
4. Energy, environment and transport
5. Organizational systems and labour system improvements
6. Development of advanced materials: processes and applications
7. Advance mechanics and mechatronics:
 - nanotechnologies for automation and precision equipment;
 - microelectronics, sensors, laser optoelectronics;
 - automation processes for industrial chains;
 - motors and oil pressure components
8. Information society: competences and applications:
 - multimedia technologies and applications;

- network and organizational models;
- development of public and private firm services;
- broadband and related technologies

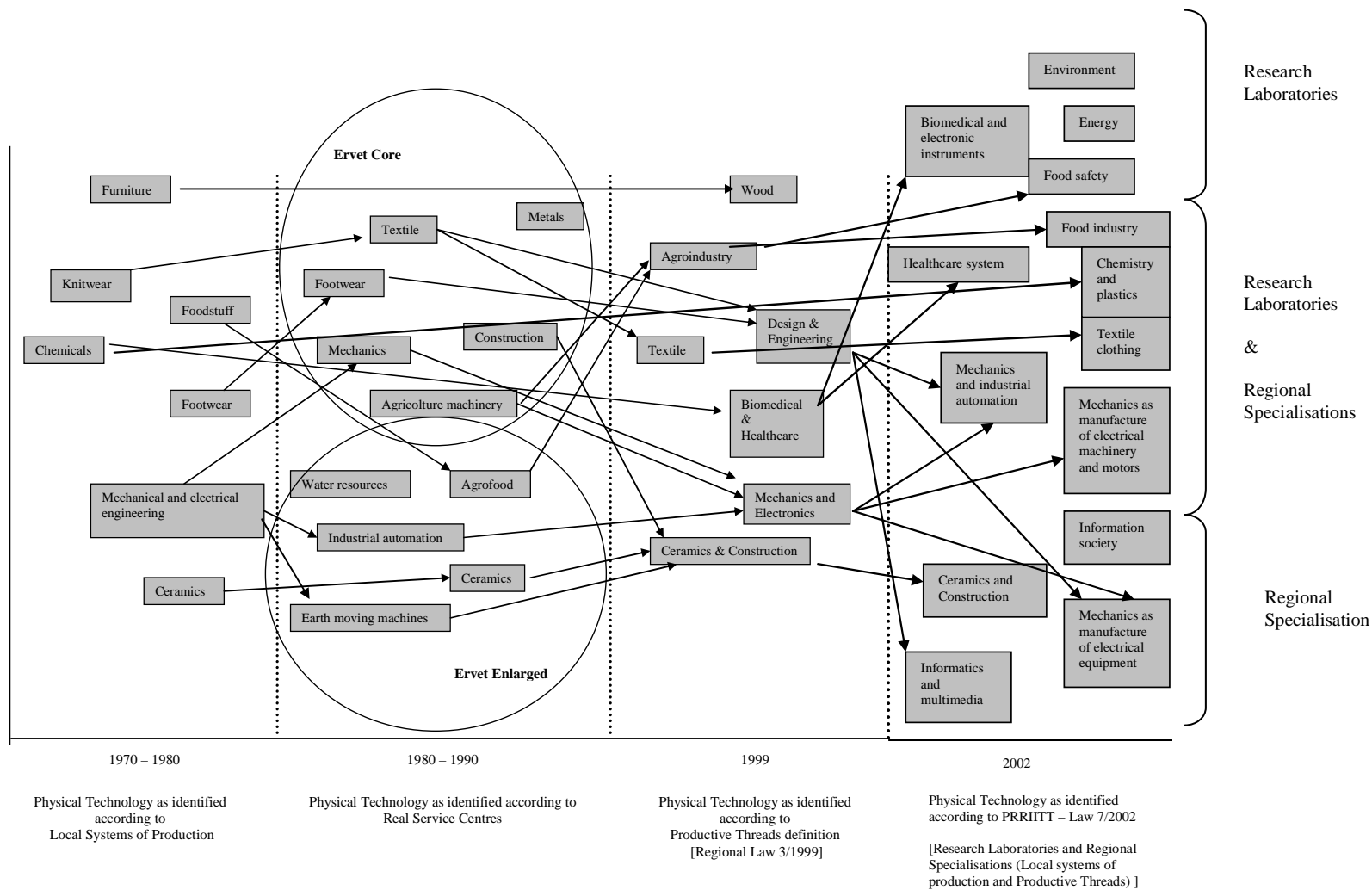
The next figure proposes a complete overview on the evolution of the physical technologies in the region (Figure 3). It extends Figure 2 following the same principles but adding the last piece of narrative: the sector of production as defined according to the Local system of production and Productive thread definition established by the PRRIITT's evaluating criteria.

The figure shows also the two different social technology we described through the narrative developed in this chapter, and specifically the networking operated through the Real Services Centres and the one operated by PRRIITT.

On the far right of the figure are pictured the specialisations of the system in 2002 in terms of research laboratories and regional productive specialisations, this last one category summing the local system and productive thread definition. The arrows, as in the previous figure, aim to highlight the processes of emerging, diffusion and agglomeration of the physical technologies throughout the years whilst the networking action of the Real Services Centres and PRRIITT policy is displayed as well.

As in Figure 2, it is possible to follow the passages of transformation of the physical technologies according to the policy actions (the social technologies) and their mutual development. As we grasp by this figure, the evolution of the regional system is developed through a networking type of policies. In the years the systems has changed its specialisations according to the diffusion and merging of the existing technologies in the system. This process is visible for sectors such as Mechanics, Foodstuff, Chemicals which from local systems of production (the far left in the figure) became part of different Real Service Centres, and then developed being components of more than one productive threads, research laboratories and regional productive specialisations.

Figure 3: Physical technologies of production – PRRITT



3.6 Conclusions

According to the literature on institutional performances, institutions success where socio economic development is advanced, political culture is participant and social stability good: these external circumstances determine system of relations very much favourable for the arising of new institutions [Huntington and Dominguez 1995].

In this chapter we employed a narrative approach to describe the evolution of a system of production identified in terms of physical technologies.

The development of social technologies resulted possible due to some intrinsic characteristics of the system, such as a high level of social capital based on trust, civic engagement and civic empowerment. These attributes of the system are the components which enabled the spontaneous arising of networks of production as not formalised institutional-types.

We then analysed the policy actions developed in this system as processes aimed to the formalisation of these organic institutions, coming to the conclusion that those policy actions can be regarded as social technologies as the instruments employed to transform an organic and spontaneous process into one of a pragmatic nature [Menger 1963].

Fundamental element along this evolution is that the system has always maintained a level of social capital embedded into the behaviour of the firms, allowing the mechanism of emergence and diffusion of the physical technologies to be repeated at a time-one with the Real Services Centres, and at a time-two with the criteria adopted to conceptualise PRRITT. The consistence of the characteristics of the system have therefore enabled this mechanism to become more of a pragmatic type, as an adaptive policy learning in the territorial context [Storper and Scott 1995].

In the following chapters we will try to confront this idea, assessing whether the pragmatic institutional approach developed within the regional environment is still able to capture the emerging of physical technologies as before.

Having in this chapter analysed the criteria employed for the assessment of the physical technologies in the system, in the next one we will discuss some stylised facts about the regional economy. Furthermore we will present more elements of narrative with a technical description of the policy and above all some facts about firms' responses to the policy call.

These elements will conduce to the last chapter, where we will provide a first evaluation of the degree of fitness of PRRITT within the regional system of production in terms of correspondences between the development of the policy action and the agents of the system (firms).

4 PRRIITT and Measure 3.1.A: Technical description and last narrative on policy implementation

4.1 Introduction¹⁷

After the analysis on the process of evolution of the policy, in this chapter we will provide a technical description of the regional economic system and of the Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT), specifically concentrating on one of the measure developed in it.

The purpose of this section is double.

It aims to provide some stylised facts about the regional economic environment and its agents of production to contextualise the framework conditions of the system where the policy is embedded. This first part consists of some reflections about the regional industrial system in terms of performances, size and structure of the firms, plus some considerations about the innovation inputs and outputs., as they were ex ante the policy action.

Furthermore, the second part of the chapter aims to complete the description of implementation of PRRIITT with a last narrative related to the technical aspects. Indeed, by some more narrative is possible to grasp elements to first assess the level of correspondence between the innovation policy and the regional system and therefore of its degree of fitting as social technology over the physical technology of the system.

This work will introduce a quantitative description performed in the last chapter over a sample of firms participating to the innovation Programme. In this chapter we will therefore take into exam the technical structure of the innovation Programme and of one of its specific actions in order to introduce the analysis to the conclusions.

¹⁷ This chapter has greatly benefited of several interviews of the author with Dr. Silvano Bertini, regional responsible for PRRIITT policy development, who helped me in the process of understanding and reconstruction of the events: I sincerely thank him for his time and support. The usual disclaimers apply.

4.2 Structural description of Emilia Romagna economy before PRRIIT¹⁸

With a population of nearly four million residents (7% of the national population), in the late 1990s Emilia Romagna accounted for 8.9 per cent of national GDP (ISTAT, 2000).

However, although higher than the Italian rate, the regional GDP growth rate decreased from 4.1 per cent a year in the 1970s to 1.7 per cent in the 1980s, to increase up to a 1.9 per cent in the 1990s (Table 4).

Table 4: GDP growth rates – Comparison (1971-1999)

GDP growth rates - Comparison (1971-1999)			
	1971-1980	1981-1989	1990-1999
Emilia Romagna	4,1%	1,7%	1,9%
Piemonte	2,8%	2,0%	1,1%
Lombardia	3,2%	2,7%	1,2%
Veneto	3,7%	3,1%	2,2%
Toscana	3,3%	1,9%	1,1%
Italy	3,8%	2,3%	1,4%

Source: Unioncamere Emilia Romagna

At the beginning of this decade, the growth rate of the GPD was assessed on higher values to decrease again at 0.7% in 2002, but maintaining a better performance than the national one .

As overall result of the five years 1997- 2002 the rate of growth of the gross domestic product in Emilia Romagna raised of a 8.5 per cent (Table 5).

Table 5: GDP growth rates – Comparison (1999-2002)

GDP growth rates - Comparison (1999-2002)				
	2000	2001	2002	1997-2002
Emilia Romagna	3,4%	2,1%	0,7%	11,0%
Piemonte	2,9%	2,7%	-1,2%	6,3%
Lombardia	3,1%	1,0%	0,4%	7,6%
Veneto	3,1%	2,2%	-0,4%	7,8%
Toscana	3,4%	0,2%	0,6%	7,8%
Italy	2,9%	1,8%	0,4%	8,5%

Source: Unioncamere 2003

Isolating the growth rate of the Industry the figures slightly change but the regional production system does maintain a better performance than the national one, accounting as GDP growth rate for the industry an increasing value of 6.5 per cent between 1997 and 2002, also the highest among the most industrialised Italian regions (Table 6).

¹⁸ This section is partially based on the work developed by the author for the report 'Regions of Knowledge: Mapping regional R&D investment environment', Coordination Action FP6-2004-KNOW-REG-2 -Project no.: 030092 submitted to the European Commission in March 2007.

Table 6: GDP growth rates – Industry - Comparison (1999-2002)

GDP growth rates - Industry - Comparison (1999-2002)				
	2000	2001	2002	1997-2002
Emilia Romagna	3,9%	1,0%	0,1%	9,8%
Piemonte	3,5%	0,5%	-0,6%	4,0%
Lombardia	2,5%	0,1%	0,0%	4,5%
Veneto	3,3%	0,2%	-0,6%	3,0%
Toscana	4,9%	-1,4%	-1,1%	6,7%
Italy	3,3%	1,0%	0,1%	6,5%

Source: Unioncamere 2003

In terms of employment, during the 1980s, Emilia Romagna accounted for 8.2 per cent of national employment, with the second highest rate of employment and the third lowest rate of unemployment (4.5 per cent, compared to a national average of 11.4%). Conversely with the trend towards service-led growth in the dynamic core regions of the advanced economies, food and agriculture, and the manufacturing industries remained extremely important to the Emilian economy.

In 1999, Agriculture employed the 6.7 per cent of the region's workforce, Manufacturing (excluding constructions) the 36.2 per cent of the region's workforce (as compared with 32 per cent at the national level), and accounted for over 10 per cent of the nation's output in the sector.

The manufacturing industries accounted for an impressive 97 per cent of the region total exports, dominated by electrical and mechanical engineering (55.8% of total exports), ceramics and other non metallic mineral products (12.6%), textile and clothing (9.3%), chemicals (6.5%), food and beverages (6.4%), furniture (1.9%), and print and publishing (1.0%) (Unione Regionale delle Camere di Commercio dell'Emilia-Romagna, 2000: 95).

4.3 The Industrial Structure

During the 1990s, significant transformations took place in the region's industrial structure, as observed from Table 7 to Table 9.

Table 7: Firms and employees in Manufacturing by firm size (1981; 1991; 1996)

Firms and employees in Manufacturing in Emilia Romagna, by firm size (1981)

	Firms		Employees	
	N	%	N	%
1-9 employees	61.473	85,80%	153.173	26,87%
10-49 employees	8.598	12,00%	156.118	27,39%
50-99 employees	838	1,17%	58.104	10,19%
100-499 employees	664	0,93%	123.714	21,71%
> 500 employees	75	0,10%	78.857	13,84%
Total	71.648	100%	569.966	100%

Source: Istat - Census data 1981

Firms and employees in Manufacturing in Emilia Romagna, by firm size (1991)

	Firms		Employees	
	N	%	N	%
1-9 employees	44.924	80,86%	135.819	25,93%
10-49 employees	9.334	16,80%	171.402	32,73%
50-99 employees	693	1,25%	47.635	9,10%
100-499 employees	542	0,98%	104.844	20,03%
> 500 employees	66	0,12%	63.990	12,22%
Total	55.559	100%	523.690	100%

Source: Istat - Census data 1991

Firms and employees in Manufacturing in Emilia Romagna, by firm size (1996)

	Firms		Employees	
	N	%	N	%
1-9 employees	41.998	80,04%	124.185	24,32%
10-49 employees	9.196	17,53%	170.041	33,30%
50-99 employees	651	1,24%	45.553	8,92%
100-499 employees	564	1,07%	108.103	21,17%
> 500 employees	61	0,12%	62.704	12,28%
Total	52.470	100%	510.586	100%

Source: Istat - Census data 1996

Table 8: Firms and employees in Manufacturing by juridical form (1981; 1991; 1996)**Firms and employees in Manufacturing in Emilia Romagna, by juridical form (1981)**

	Firms		Employees	
	N	%	N	%
Owner run	46.812	65,34%	124.282	21,81%
Partnerships	17.534	24,47%	113.515	19,92%
Stock companies	5.502	7,68%	293.525	51,50%
Cooperatives	1.682	2,35%	35.794	6,28%
Others	118	0,16%	2850	0,50%
Total	71.684	100%	596.966	100%

Souce: Istat - Census data 1981

Firms and employees in Manufacturing in Emilia Romagna, by juridical form (1991)

	Firms		Employees	
	N	%	N	%
Owner run	27.889	50,20%	78.788	15,07%
Partnerships	18.710	33,68%	122.464	23,38%
Stock companies	7.829	14,09%	294.740	56,28%
Cooperatives	1.024	1,84%	27.196	5,19%
Others	107	0,19%	502	0,08%
Total	55.559	100%	523.690	100%

Souce: Istat - Census data 1991

Firms and employees in Manufacturing in Emilia Romagna, by juridical form (1996)

	Firms		Employees	
	N	%	N	%
Owner run	22.910	43,66%	60.422	11,83%
Partnerships	18.542	35,34%	115.846	22,69%
Stock companies	10.101	19,25%	314.119	61,52%
Cooperatives	861	1,64%	19.743	3,87%
Others	56	0,11%	456	0,09%
Total	52.470	100%	510.586	100%

Souce: Istat - Census data 1996

Table 9: Firms and employees in Manufacturing by sector (1981; 1991; 1996)**Firms and employees in Manufacturing in Emilia Romagna, by sector (1981)**

	Firms		Employees	
	N	%	N	%
Food, beverage and tobacco	11.535	16,10%	83.293	14,61%
Textile	18.413	25,70%	80.018	14,04%
Leather and footwear	2.167	3,00%	19.554	3,43%
Wood and furniture	8.344	11,66%	37.359	6,55%
Paper and printing	2.136	2,98%	20.468	3,59%
Chemicals, petrol and rubber	2.715	3,79%	28.132	4,94%
Non metals minerals	2.330	3,25%	62.588	10,98%
Engineering	22.705	31,69%	232.039	40,71%
Others	1.303	1,83%	6.515	1,15%
Total	71.648	100%	569.966	100%

Source: Istat - Census data 1981

Firms and employees in Manufacturing in Emilia Romagna, by sector (1991)

	Firms		Employees	
	N	%	N	%
Food, beverage and tobacco	6.520	11,74%	68.637	13,11%
Textile	15.519	22,53%	72.851	13,91%
Leather and footwear	1.560	2,81%	14.292	2,73%
Wood and furniture	3.016	6,39%	15.415	2,94%
Paper and printing	2.584	4,65%	23.962	4,58%
Chemicals, petrol and rubber	1.798	3,24%	27.310	5,21%
Non metals minerals	1.854	3,34%	44.995	8,59%
Engineering	21.521	38,74%	235.502	44,97%
Others	3.652	6,56%	20.726	3,96%
Total	55.559	100%	523.690	100%

Source: Istat - Census data 1991

Firms and employees in Manufacturing in Emilia Romagna, by sector (1996)

	Firms		Employees	
	N	%	N	%
Food, beverage and tobacco	7.167	13,66%	66.224	12,97%
Textile	8.992	17,14%	57.126	11,19%
Leather and footwear	1.275	2,43%	13.099	2,57%
Wood and furniture	3.061	5,83%	14.346	2,81%
Paper and printing	2.637	5,03%	22.214	4,35%
Chemicals, petrol and rubber	1.909	3,64%	28.293	5,54%
Non metals minerals	1.916	3,65%	49.128	9,62%
Engineering	21.565	41,10%	239.244	46,80%
Others	3.948	7,52%	20.912	4,15%
Total	52.470	100%	510.586	100%

Source: Istat - Census data 1996

Manufacturing firms dropped from 71,648 in 1981 to 55,559 units in 1991 and to 52,768 in 1996 (-26.8% overall) while in the same period total employees decreased from 569,966 to 523,690 and to 510,586 (-10.4% overall).

The fall affected particularly firms with less than ten employees (micro-firms), whose number diminished by nearly one third with a correspondent decreasing in the workforce equal to nearly one fifth over the 15 year considered.

In the 1981-91 period, micro-firm reduction benefited the upper class size firms (from 10 to 49 employees), which increased in both absolute terms and as a percentage in the region's industry, while the weight of all classes with 50 employees or more diminished.

Between 1991-96 the changes in firm size were less pronounced. Micro-firms' share kept on contracting, now principally to the advantage of medium-sized firm from 100 to 499 employees.

This selective restructuring suggests that a larger minimum efficient scale was necessary in the region's industry. Such an is underpinned by looking at the increasing in the number of stock companies (more than doubled) as compared with the decrease in owner-run firms (more than halved), while partnerships remained substantially stable.

Sectors related to engineering (such as mechanics and electricians) strengthened their role accounting for 41.1 per cent of the total enterprises and 46.8 per cent of the total workforce in 1996. Also chemicals, petrol and rubber, and paper and printing sectors increased their shares in terms of regional employment, whilst the remaining sectors diminished. The drop was particularly sharp in the cases of textiles (from 18,535 to 8,992 firms and from 80,018 to 57,126 employees) and wood and furniture (from 8,344 to 3,551 firms and from 37,359 to 14,346 employees). The non metal minerals sector underwent a radical restructuring in the 1981-91 period, with a considerable fall in both companies and employees, while in the following five years it returned to expansion and both companies and employees increased.

Finally, the last table shows the total amount of investments in the Emilia Romagna, compared with the other most industrialised Italian regions and the Italian average value (Table 10).

Table 10: Investment per macro sector – Comparison (1997 – 2002)

	Investment growth rate [%]			Investments per capita [1000€]	
	Manufacture	Service	Total	2002	1997-2002
Emilia Romagna	26,9%	32,9%	28,9%	5.041,4	27.385,9
Lombardia	12,0%	23,9%	20,7%	4.489,9	25.215,4
Piemonte	21,7%	29,9%	25,0%	4.564,4	25.624,3
Veneto	11,3%	33,7%	24,3%	4.702,1	25.589,3
Toscana	26,5%	-8,2%	1,7%	3.334,5	20.073,2
Italy	17,9%	22,9%	20,7%	3.738,6	20.779,6

Source: Unioncamere 2003

The table compares the share of investment divided per macro sector over a period of five years just before the beginning of the innovation Programme: on the left side the investment growth rate, and on the right side the investment per capita.

As it is possible to notice, the rate of increasing in investments in Emilia Romagna over the five years is almost 10 per cent higher than the Italian average along all the macro sector observed. The share of investment both in terms of growth rate and of investment per capita is also higher than in the other four regions considered.

According to this figure, is possible to affirm a consistent level of renewal and regeneration in the regional industrial system, pushed by a structural re definition of the firms and changes among the productive sectors. Moreover, in all these cases the change is supported by important investments in both manufacture and service activities.

4.4 R&D investments

In the next tables we will focus on those innovation inputs and outputs which are the specific policy targets of Measure 3.1.A.: R&D investments, R&D employment and patents, to provide an overview of some variable related to the level of innovation capacity of the regional system.

The first table gives some values of the intramural R&D expenditure by sector of performance (Table 11)

Table 11: Intramural R&D expenditures, by sector (2002-2003)

Intramural R&D expenditure by sector of performance (million of euro)						
		All sectors	Business enterprise sector	Government sector	Higher education sector	Private non profit sector
Emilia Romagna	2003	1399	818	113	461	7
	%		58,5%	8,1%	33,0%	0,5%
Italy	2002	14600	7057	2565	4792	186
	%		48,3%	17,6%	32,8%	1,3%
	2003	14769	6979	2582	5000	208
	%		47,3%	17,5%	33,9%	1,4%

[Personal elaboration on Eurostat data]

The intramural R&D expenditures are divided per sector, and the values show the situation of Emilia Romagna compared to Italy in million of euros and as a share of the total investments.

In the observed period there is a contraction of 1% in Italy, due to the decreasing of the investments in the business enterprise sector, representing in 2003 the 47.3% of the total investments in intramural R&D. Both in Italy and in Emilia Romagna the most financed sector for R&D is business enterprises. Remarkably, in Emilia Romagna the percentage is almost 11% higher than the national values.

The next table develop a partition of total amount of gross investments grouped per Pavitt's sectors. Indeed, as specified by the Pavitt's taxonomy, firms belonging to manufacturing can be divided into four groups according to the level and the sources of knowledge incorporated in their production [Pavitt 1984].

Supplier dominated firms are mostly small-medium companies, strongly committed to cost reduction objectives and usually just capable to absorb innovation provided by their suppliers rather than developing of their own. Scale intensive firms are mostly medium-large companies, with the double objective of product innovation and cost reductions, but also able to generate innovation, usually by internalizing R&D in their own laboratories. Specialised suppliers firms are mainly small companies, focused on product innovation, and their major competitive advantage is the high

capacity to acquire and develop knowledge inputs, which enables the production of knowledge intensive goods. Finally, Science based firms are either small or large companies, with a precise core on research and innovation related activities, with internal R&D laboratories but also with established relationships with other innovation providers such as research centres and universities.

Table 12: Gross investments grouped by Pavitt's sectors (2002-2003)

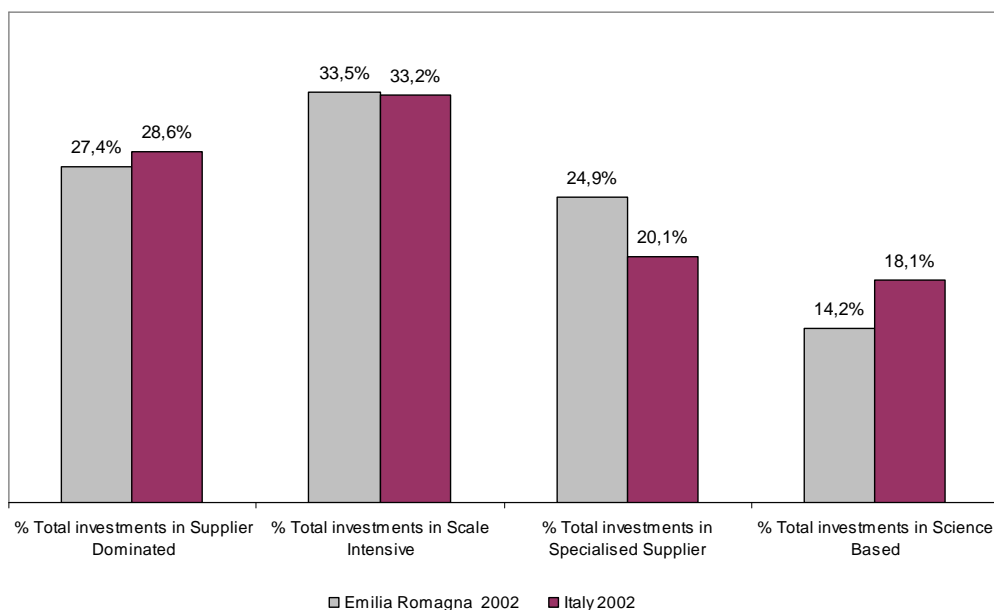
Gross investments in Supplier Dominated						
		Food products; beverages and tobacco	Textiles and textile products	Leather and leather products	Wood and wood products	Pulp, paper and paper products; publishing and printing
Emilia Romagna	2002	636,7	205,9	40,6	84,3	215,7
	2003		112,1		52,7	133,0
Italy	2002	3.847,2	2.311,5	807,8	1.071,9	2.277,4
	2003	3.954,2	2.541,9	534,5	842,8	1.835,8
Gross investments in Scale Intensive						
		Coke, refined petroleum products and nuclear fuel	Other non-metallic mineral products	Basic metals and fabricated metal products	Transport equipment	
Emilia Romagna	2002	8	487,1	704,2	247,5	
	2003	3	2.518,6	453,4	303,8	
Italy	2002	545	2.689,5	6.367,0	2.382,8	
	2003	955	4.416,7	5.897,9	2.389,9	
Gross investments in Specialised Supplier						
		Rubber and plastic products	Machinery and equipment n.e.c.	Office machinery and computers	Radio, television and communication equipment and apparatus	Medical precision and optical instruments, watches and clocks
Emilia Romagna	2002	146,3	753	1	45,1	132,7
	2003	83,2	581	3	32,1	88,1
Italy	2002	1.924,0	3.826	117	539,8	845,3
	2003	1.828,3	3.086	103	989,7	432,4
Gross investments in Science Based						
		Chemicals, chemical products and man-made fibres	Electrical and optical equipment	Electrical machinery and apparatus n.e.c.		
Emilia Romagna	2.002	213,8	290,3	111,0		
	2.003	151,7	186,2	62,8		
Italy	2.002	2.721,8	2.663,2	1.161,5		
	2.003	2.834,8	2.604,8	1.079,5		

[Personal elaboration on Eurostat data]

The figure below provides the share of total investments per Pavitt's sectors in a comparison between Emilia Romagna and Italy.

More than half of Emilia Romagna's investments are concentrated in Supplier dominated and Scale intensive firms, consistently with the national value. The only difference with the national scenario concerns the opposite allocation for Specialised suppliers and Science based firms. Emilia Romagna's share for Supplier dominated is higher than the Italian by 5%. Conversely, investments in Science based are 4% lower in comparison to the national data.'

Figure 4: Total Investments per Pavitt's Sectors



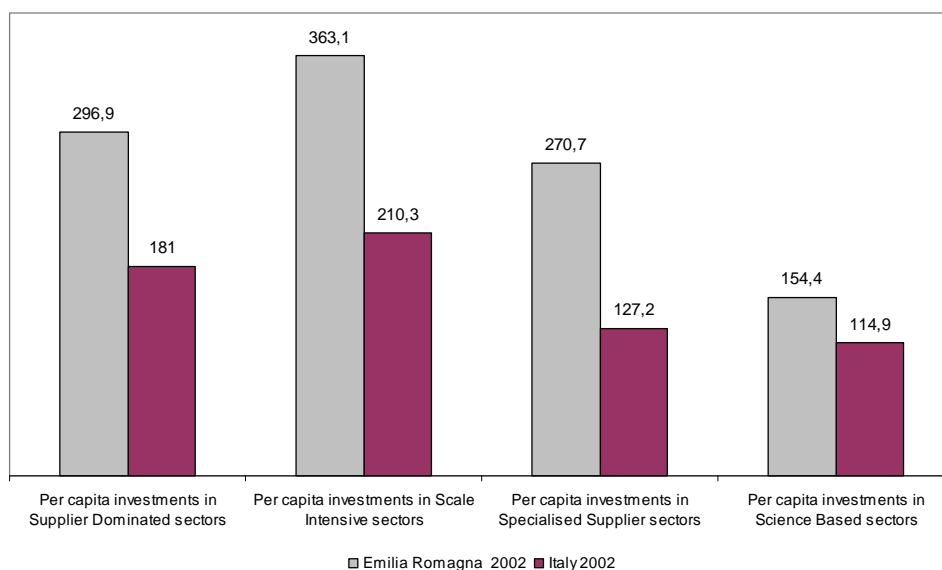
[Personal elaboration on Eurostat data]

The exercise in Table 12 aims to describe the size of the investments in millions of euros for each of these categories, divided per sector. However, a clear interpretation of these values can be grasped by Figure 5.

In Figure 5 the total amount of investments per Pavitt's sectors is presented as per capita over the total population and confronted with the equivalent national values. Weighting the Taxonomy on the population, the relation between regional and national levels of investments appears completely different.

Emilia Romagna per capita investments are higher than the Italian ones in every sector. Concentrating on the sectors more involved in research and development related activities, Science based sectors have a per capita funding of 154 euro against the 115 of national value, and Specialised Supplier sectors an investment of 270 euros per person against the a national investment of 127. It is however in the Scale intensive sectors that the difference is outstanding with 363 euros in Emilia Romagna versus the Italian average of 210.

Figure 5: Per capita gross investments by Pavitt's sectors (2002)



[Personal elaboration on Eurostat data]

4.5 Employment in High Technology Manufacture and Service activities

Regarding the employment levels, we will illustrate the share of workforce committed to high technology manufacturing and knowledge intensive service activities, always as a comparison between the regional and the national value (Table 13).

In manufacturing activities, a first difference is that the most relevant share of work force is placed in Medium high technology sectors (35% of employment,), whilst for Italy the most relevant sectors are the Low technology ones (41%). However, High technology occupation in Emilia Romagna is one per cent less than in Italy counting as 4% of the regional employment. Nevertheless, summing the share of High and Medium high technology the total percentage of employment covers up to the 39% in the region but just for the 34% in Italy. In both the areas, Medium low and Low technology employment is more than half of total the manufacturing employment.

Finally, the rates of High technology manufacturing in 2003 are positive both in Italy and Emilia Romagna but higher in the region with a growth of the 27% against the 8% of Italy.

Employment in High technology service activities absorbs 17% of the total employment in knowledge intensive services employment in Emilia Romagna and 21% in Italy, but interesting is to observe that the knowledge intensive services related to finance and market are higher in the region with respect to the Italian average (62% for market services, and 21% for financial services).

Table 13: Manufacturing and Service activities - High technology employment (2004)

High technology manufacturing employment - (percentage 2004)				
	High technology	Medium high technology	Medium low technology	Low technology
Emilia Romagna	4%	35%	30%	31%
Italy	5%	29%	25%	41%

(Source: Eurostat)

Knowledge intensive service activities - (percentage 2004)			
	High technology service activities	Market service activities	Financial service activities
Emilia Romagna	17%	62%	21%
Italy	21%	60%	19%

(Source: Eurostat)

[Personal elaboration on Eurostat data]

The next tables show the percentage of R&D personnel on total employment per sector (above) and the percentage of researcher as R&D personnel (Table 15).

Table 14: R&D Personnel per sector

Percentage on total employment of R&D personnel by sector of performance						
		All sectors	Business enterprise sector	Government sector	Higher education sector	Private non profit sector
Emilia Romagna	2003	1,31	0,58	0,15	0,57	0,01
Italy	2002	1,16	0,39	0,18	0,56	0,03
	2003	1,13	0,37	0,19	0,55	0,02

Percentage on total employment of Researchers as R&D personnel by sector of performance						
		All sectors	Business enterprise sector	Government sector	Higher education sector	Private non profit sector
Emilia Romagna	2003	0,55	0,18	0,1	0,29	0,00
Italy	2002	0,50	0,15	0,1	0,26	0,01
	2003	0,49	0,14	0,1	0,26	0,01

In 2003, the Emilia Romagna percentage of R&D personnel is higher than the Italian value (1.31% versus of 1.13%). Important to mention, in Italy the highest percentage of R&D personnel is in the higher education sector (e.g., Universities), whilst in Emilia Romagna the highest percentage can be found in the business enterprise sector. However, the level of R&D personnel in the education sector of Emilia Romagna is still higher than Italy (0.57% versus 0.55%). Table 15: : Manufacturing and Service activities- R&D personnel (2002 -2003)

[Personal elaboration on Eurostat data]

Considering just the actual researchers as a percentage of total employment (bottom side of the table), these same insights are confirmed for all the sectors, with the regional values always higher than the national ones.

Thus, it is possible to argue that in Emilia Romagna there is a higher concentration of investments in human capital, above all in the Business enterprise sectors but also in the Higher education sector, suggesting a number of private and public research structures superior than the Italian value.

4.6 Patents

The last element analysed is the patent production always as a comparison between Emilia Romagna and Italy.

The indicator we will use is the number of patent applications to the European Patent Office (EPO). The values are therefore not definitive but a proxy to assess the levels of innovation capability without involving any market related consideration.

The next tables show the number of patent applications to the EPO divided per macro sector (upper item), and the number of high technology patent application as a share of the total (lower item) (Table 16).

Table 16: Patents application sto EU patent office – Total and High technology (2002-2003)

Patent application to the Epo - total number per sector									
		Human Necessities	Performing operations and transporting	Chemistry and metallurgy	Textile and paper	Fixed construction	Mechanical engineering lighting heating	Physics	Electricity
Emilia Romagna	2002	190	344	68	4	45	67	39	30
	2003	97	191	31	6	21	47	25	16
	% variation	-48,9%	-44,5%	-53,9%	60,1%	-52,8%	-30,2%	-35,9%	-48,3%
	% 2003	22,3%	44,0%	7,3%	1,3%	4,9%	10,8%	5,8%	3,6%
Italy	2002	992	1306	517	147	286	510	454	532
	2003	540	781	244	94	138	355	245	291
	% variation	-45,5%	-40,2%	-52,7%	-36,1%	-51,9%	-30,5%	-46,0%	-45,3%
	% 2003	20,1%	29,0%	9,1%	3,5%	5,1%	13,2%	9,1%	10,8%

Patent applications to the Epo - Total and High tech				
		Total	High Tech	% High tech on Total
Emilia Romagna	2002	786	27	3,4%
	2003	434	14	3,2%
	% variation	-44,9%	-47,4%	
Italy	2002	4747	478	10,1%
	2003	2691	244	9,1%
	% variation	-43,3%	-48,9%	

[Personal elaboration on Eurostat data]

In 2003 the total number of patents in Emilia Romagna was 434, equal to the 16.1% of the national production. According to the evidences show by data, the most attractive sectors for patenting both in Italy and in Emilia Romagna were Human necessities (22.3% of Emilia Romagna, and 20.1% of

Italy); Performing operation and transporting (44% of Emilia Romagna, and 29% of Italy); and Mechanical engineering (10.8% of Emilia Romagna and 13.2% of Italy). The less attractive sector for both areas were mature sectors such as Textile and paper.

However, in line with the national attitude, one more evidence is the sharp contraction in the amount of patent applications between 2002 and 2003 in all the sectors both for the region and for Italy.

Breaking up patent applications in High technology and Total, we notice that applications for High technology patents constitute 9.1% of the total amount in Italy and 3.2% of the total amount in Emilia Romagna.

The contraction already mentioned for the Total patent application is highest in Emilia Romagna in the total figure (-44,9%), but strongest for Italy in the high technology sector (-48.9%).

Hence, the regional system linked to high technology production seemed to resist more to the contraction than the national one.

Table 17: High technology patent applications – per sector (2002-2003)

		High tech patent applications to the Epo - total number per sector						
		Total	Computer and automatic business equipment	Micro organism and genetic engineering	Aviation	Communication technology	Semiconductors	Laser
Emilia Romagna	2002	27	12	5	0	5	4	0
	Share on total		45,6%	20,0%		19,6%	14,9%	
	2003	14	6	2	1	4	1	0
	Share on total		39,4%	17,4%	7,1%	26,9%	9,2%	
	% Variation	-47,4%	-54,5%	-54,1%	100,0%	-27,7%	-66,8%	
Italy	2002	478	146	57	8	193	62	13
	Share on total		30,4%	11,9%	1,7%	40,3%	13,0%	2,7%
	2003	244	81	27	4	94	34	5
	Share on total		33,0%	10,9%	1,6%	38,6%	13,9%	2,0%
	% Variation	-48,9%	-44,6%	-53,1%	-50,0%	-51,1%	-45,5%	-61,0%

[Personal elaboration on Eurostat data]

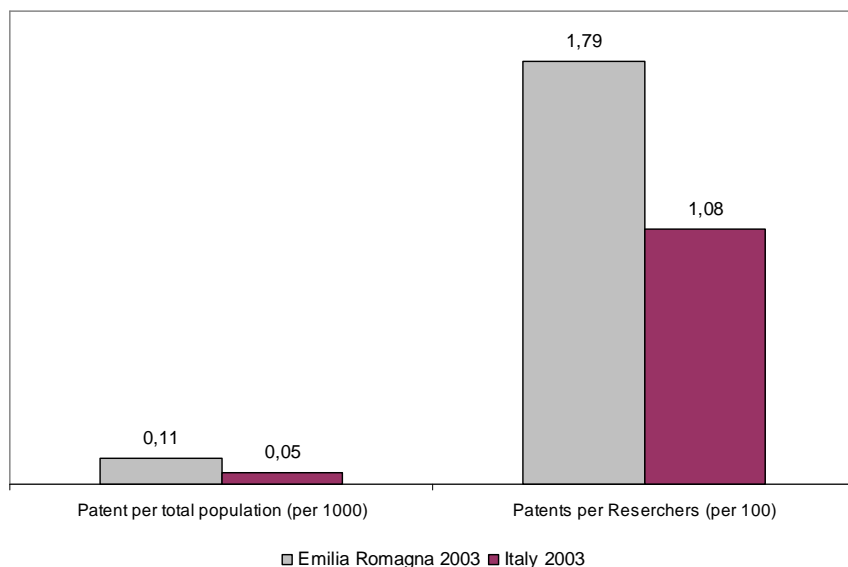
The picture below groups the total amount of patents weighted per person (left side) and per researcher (Figure 6)¹⁹.

The production of patents as per capita values is in Emilia Romagna higher than at the national level.

Considering patents per inhabitants Emilia Romagna has one application every 10.000 inhabitants (0.11), which is double than the Italian value (0.05, equal to one application every 20.000 inhabitants). Also Patents per researchers production is shows the almost the same insights with about two patent applications every 100 researchers in Emilia Romagna, compared to an Italian value of approximately one patent every 100 researchers.

¹⁹ The indicators are pondered on a scale of 100 (patent per researchers) and of 1000 (patents per capita) to allow a confrontation of the two variables.

Figure 6: Patent applications – Per capita and per researcher (2003)



[Personal elaboration on Eurostat data]

4.7 Some conclusions on the regional system of Production at the moment of PRRIITT's implementation

This overview has aimed to describe the regional industrial system as it was at the moment of beginning of the innovation programme. We concentrate on some aspects of the regional economy in terms of its recombination from the 1980s to the present and we considered some of the elements related to the regional innovation performance which is the target of PRRIITT.

The regional system in the period analysed had a considerable re definition in terms of number of firms with a sharp reduction of micro-firms to the benefit of the immediate upper sized firms (10-49 employees). Moreover also the insights about the changes in firms' structure suggest a reduction of owner-run firms to the advantage of more consistent forms such as stock companies. Manufacturing activities however still maintain the highest level of work force employment. This element is in slight disagreement with a consistent literature which would stress a correspondence between the growth of GDP and the increasing of employment in Service activities.

In terms of innovation, Emilia Romagna shows a higher level of investments in human resources both in terms of Business and of Higher education sectors, suggesting a concentration of research and development related activities superior than the Italian average. Such an insight is confirmed by the patents production and the per capita investments levels.

4.8 The Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT): A Technical description of the Policy

The Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT), is the operative branch of the second Triennial Regional Policy Act and addresses the innovation strategies according to it.

Focus of the programme is the improvement of ‘applied research, firms’ pre competitive development, and the increasing of the technological content in production for the development of a regional knowledge economy’²⁰.

PRRIITT explicitly aims to increase the regional productive capabilities considering as starting points the different characteristics of the firms, the networking among these firms and their potential in a regional collaborative environment [Decreto attuativo 525/2003: pp12].

Specifically, the programme focuses on:

1. Stimulating cooperative investments in R&D within firms, firms and research laboratories or every other supplier of technology.
2. Supporting the creation of intra firm industrial R&D laboratories.
3. Promoting the creation of technological spin offs
4. Developing a network of industrial laboratories in applied research

The plan of the legislator is composite and this element of complexity becomes clear analysing the structure of the policy.

The articulation of the entire regional programme is shown in Item 7

²⁰ Regione Emilia Romagna, Law 7/2002.

Item 7: PRRITT – General Structure

		Measure 1.1	Measure 1.2	Measure 1.3	Measure 1.4
Axis 1	Financial aid for firm development and innovation projects	Admittance to credit and investments	Intervention on substainance of the development of firms	Capitalization of Smes	Intervention for the qualification and development of consotium for credit
		Measure 2.1		Measure 2.2	
Axis 2	Regional quality plan	Intervention to substain the development of integrated firms' quality programmes		Intervention aim to the increase the development and the qualification of cooperative firms	
		Measure 3.1	Measure 3.2	Measure 3.3	Measure 3.4
Axis 3	Industrial research projects and firms' pre competitive development	Actions supporting the regional industrial system towards the development of industrial research	Creation of new activities with high technological content	Actions toward knowledge and technological transfer	Network development
		Measure 4.1		Measure 4.2	
Axis 4	Creation of new firms and employment	Support to new professional activities		Support to new entrepreneurial activities	
		Measure 5.1	Measure 5.2	Measure 5.3	
Axis 5	Support toward internazionalization	Programme to promote export and internazionalization	Support to firms' first projects of internazionalization	Actions of international territorial marketing	
		Measure 6.1		Measure 6.2	
Axis 6	Project supporting regional and local development plans	Projects towards the development of innovative infrastructures		Actions promoting innovation processes in the public sector	
		Measure 7.1		Measure 7.2	
Axis 7	Actions supporting the networking of services	Actions towards the implementations of the service networking		Actions monitoring the policy	

(Personal elaboration)

As showed by the item, the innovation policy has not been developed as a single but as a group of different policies, following the idea that within the regional environment the variety of local productive systems and productive threads requires different processes of interaction and hence different modes of organising these networks of production.

The programme is three years long and is composed by seven main axes of activity. Each axes is divided into different measures and each measure into specific objectives²¹.

Over seven axes three explicitly contains the word *firm* but also the other four referring respectively to quality [axis 2]; internationalisation [axis 5]; local development [axis 6]; and networking [axis 7] are indirectly aimed at the implementation of firms' competitiveness.

The first axis targets the implementation of internal investments in firms. Specifically it deals with increasing the level of financial capacity among Smes, which represents one of the major obstacle for Small and Medium enterprises.

The objective of the second axis is to augment the quality level, pushing both single and cooperative firms toward patterns of process and product quality certification.

²¹ The explanatory note about the specificities of the policy can be found in Decreto attuativo 525/2003 and 526/2003, Regione Emilia Romagna.

The third axis involves industrial research and firms' pre competitive development and is aimed directly at the improvement of the competitiveness with actions supporting the industrial system, creating new high tech activities, improving the networking for applied research, and the actions towards technological transfer.

The fourth axis reflects the effort for the creation of new firms and employment, in particular supporting new professional or entrepreneurial activities.

The fifth axis is devoted to develop the level of internationalisation; its goal is to facilitate export activities supporting internationalisation projects or territorial marketing initiatives.

The sixth axis is mainly devoted to public bodies and concerns the support to regional and local development plans such as the development of infrastructures and actions enhancing innovation projects in the public sector.

The seventh axis is the one dedicated to support networking in service activities, in particular focusing on monitoring public policies and the implementation of cooperation among local authorities.

Despite the complexity of its articulation, the structure of PRRIITT is flexible. Its main target is to develop resources of the regional system combining them to exploit their potential. As expresses in several points of the policy action, this process will be implemented stimulating the cooperation and networking among firms or between firms and R&D structures such as university or private laboratories.

4.9 Measure 3.1.A

The specific PRRIITT's policy line further analysed in this work is the measure 3.1 of the innovation Programme and regards firms' pre competitive development through the implementation of R&D and industrial research (Item 8).

In the next table a detailed explanation of the measure in terms of target, objectives and expected results.

The general objectives of the measure are divided into two actions: Action A is towards the development of the regional productive system trough the implementation of the industrial research, Action B towards the development of industrial laboratories. The work will focus on the action A of the measure 3.

Measure 3.1.A specifically aims to improve firms' competitiveness.

The general objective of the policy is the improvement of technology transfer between research structures and industry to incentive the exploitation and diffusion of the existing capabilities of the regional system.

The specific objective is to incentive firms in promoting projects stimulating product or process innovation. These projects should involve the participation of research structures in the R&D stage to intensify industrial research in the regional industrial base.

The expected results intended to increase:

- i. the level of expenditure in R&D in general but especially among SMEs
- ii. the units of R&D personnel
- iii. the number of patents

Compared with the traditional public schemes this measure contains some elements of distinction, mainly related to its internal coherence.

The financing is a co financing process to incentive a more responsible use of the resources allocated to every firm. Furthermore, different rates of funding are fixed according to:

- The nature of the agent requesting the funds
- The level of ratio with the general objectives of the innovation policy.
-

The Measure 3.1.A distinguishes between industrial research and pre competitive development: the former has a rate of financing equal to a maximum of 50% and the latter to a maximum of 25%.

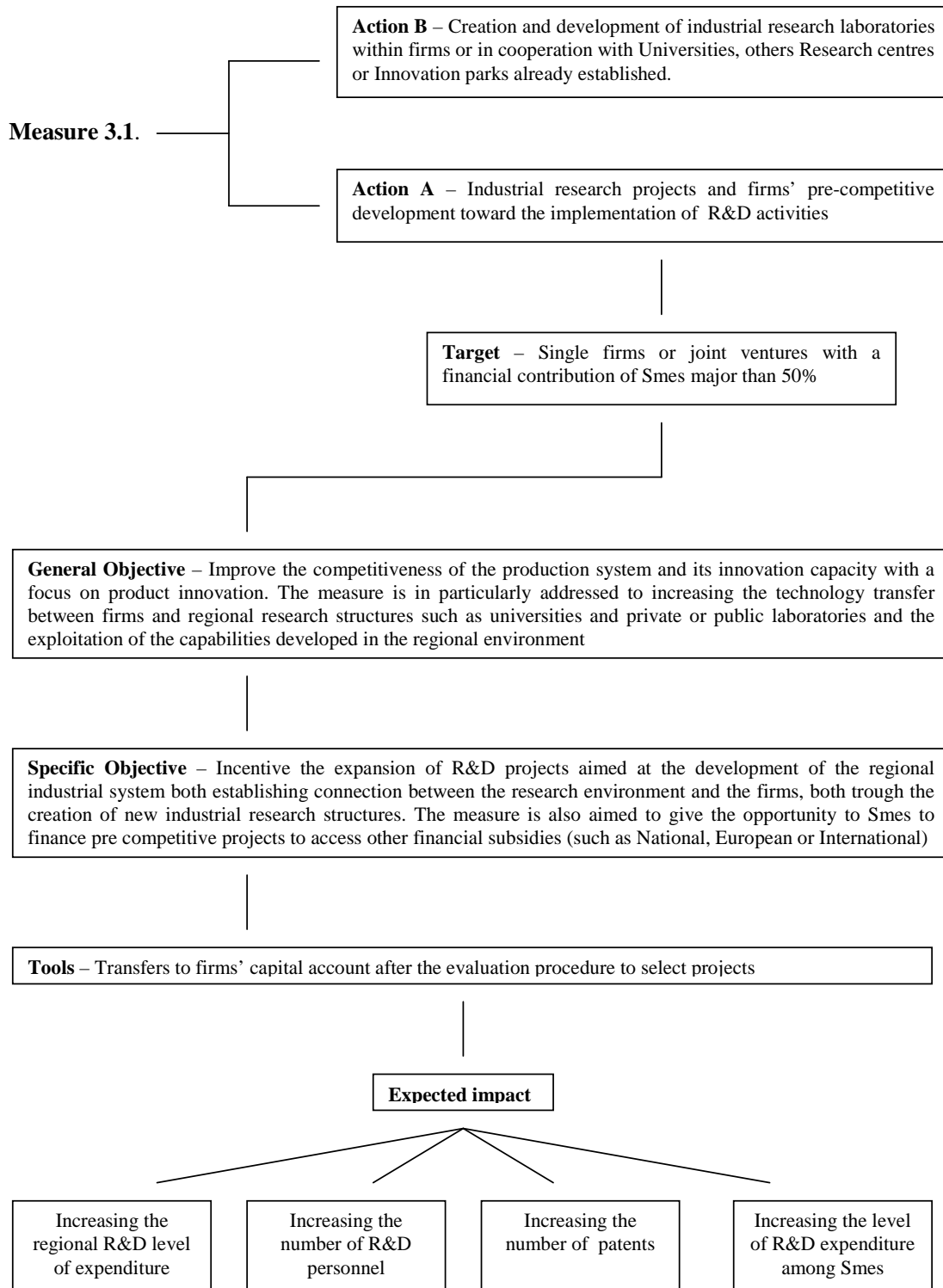
However, according to the general principle of PRRIITT as a multi target policy, two more distinctions were made: a first one specific for SMEs, a second one dealing with the area where the firm was located and its territorial characteristics.

In Table 18, a summary of the funding principle and mechanisms is shown.

In the circumstance of an SME applying for a pre competitive development project with a normal level of funding of the 25%, the actual level of financing could have raised of a 10% than the normal rate.

The second element was related to the location and specifically whether the firm applying was or not in an Objective 2 area, one of the areas with lag of development according to the European Community. In this case, the percentage of financing could be improved of a 5% more.

Item 8: Measure 3.1.A - Structure



(Personal elaboration)

Adding these distinctions, the final co financing highest levels correspond to a maximum of 55% with a combination of SME located in an Objective2 area applying for industrial research funding.

A combination of a SME located in an Objective2 area applying for a pre competitive development funding would give a combination equal to the 40% of funding over the project planned.

One more distinction regarded the discrimination among the costs admitted for the projects, different for the two options of industrial research and pre competitive development (Table 18).

The list of costs is on the left, with the maximum percentages of request whilst the main policy targets in terms of expected objectives as formally expressed in the regional law are highlighted in grey.

As an instrument to improve the technology transfer, according to the policy targets the co financing level of new R&D personnel units is covered to the 80% whilst for internal personnel the rate decrease at the 30%. Furthermore, the costs associated to University collaboration is covered to the 80% while the subcontracting a research laboratory to 50%.

Table 18: Measure 3.1.A. – Structure of co-financing

Structure of the Co financing system - Max percentage admitted		
Categories	Industrial research	Pre competitive development
New R&D personnel	80%	80%
Collaborations with universities	80%	80%
Use of research laboratories	50%	50%
Consultancies	50%	50%
Equipments	30%	30%
Internal personnel	30%	30%
Financial consultancies	75%	50%
Patent registration costs	50%	25%
Patent purchasing costs	not admitted	50%
Costs for prototypes	not admitted	25%
General expenditures	10%	10%
Total	50%	25%
Project realised by Smes		10%
Project realised in a Objective 2 area	5%	5%
Total max	55%	40%

Every firm of every sector with a local productive unit in Emilia Romagna could apply for financing to the measure 3.1.A.

The procedure to be admitted involved three stages of evaluation: one about the satisfaction of the formal pre requisites and two about the contents of the project submitted.

The first stage of evaluation concerned the satisfaction of the formal pre requisites.. For this purpose was specifically developed a software to improve the efficiency and avoid the exclusion for

incompleteness of information or formal errors in the submission. The software was developed by the Consortium of the Italian Universities²² and consisted of an online platform designed to help the users collecting all the documentation necessary for the fulfilment of the project.

Thus, a first screening on the projects was automatically controlled by the software.

Moreover, the online mechanism allowed to monitor the closing time for the call. Indeed the closing time, according to the ratio of the Programme, was related to the total amount of financial requests received with the software controlled procedure.

A threshold was fixed, and the online mechanism would have stopped accepting new projects when the requests for financing already submitted were achieving all the resources available for that period of the call plus 50%.

The second level of evaluation was assigned to an internal committee and the third one to an external commission of experts.

The internal committee function was to carry a first screening on the projects: whether they succeed the first phase, the internal committee assigned them to an external commission representing the last level of evaluation.

The external commission was established in 2003 as a network of evaluating experts covering all the subject areas of the innovation policy.

The external commission reached at its maximum the number of 1411 experts²³. Eligible criteria to be part of it was to have an official certification by either the Italian Minister of University and Research or the Sixth European Framework Program. The other criterion was that every expertise should not be resident in the region and should not have any relation with any private or public company in the region.

The projects were evaluated according to the chronological order of submission of the proposals. Finally, it was established that every project succeeding the evaluation mechanisms and achieving a fixed mark of 75/100 had to be admitted to financing.

²² Cineca

²³ Specifically the areas were: Agriculture, Biology, Chemistry, Physics, Engineering geology, Civil engineering, Architecture, Industrial engineering, Informatics engineering, informatics, Maths, Medicine, Economics and Statistic, plus some other specific fields. Source: Emilia Romagna Region 'Attuazione del primo Programma regionale per la Ricerca Industriale, l'Innovazione ed il Trasferimento Tecnologico 2003- 2005', document developed by Assessorato alle Attività produttive e Sviluppo economico.

Table 19: Measure 3.1.A – Projects submitted and financed

	Submitted projects		Financed projects	
Projects number	1.232*		529**	
Submitted by Smes	969	78,65%	380	71,83%
Submitted by other firms	263	21,35%	149	28,17%
Firms number	1.292*		557**	
Overall projects value	550.154.357 €		235.495.510 €	
Industrial research	279.459.062 €	50,80%	117.539.029 €	49,91%
Pre competitive development	270.694.575 €	49,20%	117.956.482 €	50,09%
Co financing share	209.400.042 €	38,06%	92.246.716 €	39,17%
Average value per project	446.554 €		445.171 €	
Average co financing per project	169.968 €		174.379.43 €	

* 29 projects have been submitted by firms' consortium

** 15 projects have been submitted by firms' consortium

(Personal elaboration on Emilia Romagna data)

4.10 Measure 3.1.A: A last narrative on the reaction of the regional system to the policy measure

Two official calls were planned for the Action 3.1.: the first in February 2004 for the line A of the Measure and the second in September 2004 for the line B. It was also decided to separate the submission phase for each of the two calls in three different periods.

The first submitting period for Measure 3.1.A was on the 9th February 2004. The system opened at 8 am and closed at 10:45 am because the fixed threshold was already reached²⁴.

The first period of the call achieved the number of 363 projects submitted for a co financing requested total amount equal to 68 millions of Euros against the 27 millions allocated by the regional government for all the three periods of the first call.

The process of evaluation took four months and the 21st June 2004 the regional authority officially named the firms receiving the funding and established to close completely the first call without opening the other two periods for the submission. Moreover, the regional government had to assign three more millions of Euros to cover the funding for all the projects positively evaluated, following the criteria declared by the authority itself such as a mark of 75 over 100 in the final evaluation.

The projects funded in this call became officially operative 1st July 2004.

The second period opened the 27th September 2004. Three main changes were adopted with regards of the submission and evaluation criteria.

²⁴ The system closed at 10:45 for those firms which have not already started the process of submission. The system however allowed completing the submission for the other firms which were already working in the system.

First, the projects were sorted in a list according to the mark received after the evaluation of the second committee of experts. Consequently, also the online mechanism for the submission was changed and the threshold level regulating its closing time. Finally, the periods of submission were reduced to two instead of three.

The overall duration of the second call was five days. The total number of submissions 869 for a total amount of 141 millions of Euros of resources requested. According to the new criteria, the projects positively evaluated were 347 for a co financing total amount of almost 62 millions of Euros. The resources allocated by the regional government for the second call were around 35 millions of Euros, thus still inadequate. The decision of the authority was to finance all of them, starting with the firsts 188 projects on the classification lists.

Transfers for the projects judged positively during the second period of the call became effective on 30th December 2005.

4.11 Conclusions

In this chapter we analysed the structural characteristics of the regional system. We investigated the variation of some elements of the regional economy in terms of firms' structure, employment and sectors of production. Afterwards we focused on some characteristics related to innovation inputs and outputs to grasp more considerations about the level of technological productivity of Emilia Romagna.

The work has aimed to integrate the narrative analysis previously developed, and to give the basis for some reflections to develop further. Particularly, in this section we wanted to focus our attention on some of the elements emerged in the narrative as fundamental for the implementation of the policy.

We spotted a system characterised by a strong manufacture core concentrated in the engineering related sectors. During the 1980s, the regional economy went through a phase of re structuring in terms of firms' size and juridical form, loosing own run and micro-type firms to converge towards a more mature phase. Moreover, the regional economy has growth for almost all the years of the analysis to a higher rate than the national average and also of the most industrialised regions.

This element is supported by a general high level of investments but also by a high level of investments in technology driven sectors of Specialised suppliers and Science based firms where the regional investments per capita are superior to the national rates. This factor is paired with an elevate amount of investments in human capital as well, above all in the Business Enterprise sectors but also in Higher education: this element suggests the presence in the regional system of a consistent number of private and public research structures. As a consequence, patents production is improving and in per capita terms already higher than the national value.

In the next chapter we will try to find some correspondence between the characteristics of the firm participating to Measure 3.1.A and the characteristics of the system as emerging by the narrative description and the one developed in this chapter.

We will explore some of the firms whom projects were selected during the first period of the call and we will then compare this group with a Control group of other firms of the regional system which conversely did not apply or receive the funding from the innovation Programme.

5 Some considerations on PRRIITT as social technology

5.1 Introduction

This section of the work carries out an analysis to establish whether the policy action developed with PRRIITT can still be considered a form of social technology of the physical technological characteristics of the regional system.

The chapter will deal with the analysis of a database developed by the author²⁵.

The dataset is composed of primary data, resulting from an internal survey commissioned in 2005 by region Emilia Romagna to Istituto Ricerche Sociali (IRS – Milano). Purpose of the research was to have an intermediate evaluation of the impact of the Measure 3.1.A. to assess some first results in terms of internal efficiency of the measure, despite the fact that during the data collection the projects were not completed yet²⁶.

This circumstance influence the nature of the analysis developed in this work, which will not have the instruments to carry out an overall evaluation of the Measure 3.1.A.

However, the structure of the sample allows some reflections about the success of the targeting of the Measure 3.1.A. with respect of the system upon which the innovation Programme has been created.

We will therefore develop such analysis with particular regard of investigating the correspondences between the firms participating to the Measure 3.1.A. and the predictions made during the development of PRRIITT by the regional government and earlier described with a narrative approach to gauge at which level the innovation policy can be considered as evolving within the system.

²⁵ The database created by the author results as a modification and merging of the data collected by Istituto Ricerche Sociali Milano.

²⁶ The data-gathering procedure started at the beginning of 2005: at the time the first project funded had to finish by September of the same year, whilst the other group of projects funded by the second call was finishing by September 2007.

5.2 The sampling process: characteristics of the Survey

The data we are analysing are secondary data, elaborated by the author on permission of the Emilia Romagna Regional authority.

These data were primarily sampled in 2005, for a study commissioned to Istituto Ricerche Sociali (IRS Milano). Main scope of the study was to evaluate the first results of the Regional Innovation Policy (PRRIITT) and in particular to assess the effectiveness of the implemented policy and its level of coherence within the regional priorities.

To investigate these questions was established to compare two groups of firms following a Quasi-Experimental methodology²⁷. The first group was composed of firms benefiting from the policy action and the second one of firms with the same characteristics of the first group but not benefiting of the policy action.

The first group was selected among the firms which benefited of the policy plan. The total number of participators to the innovation policy was of 557 firms: among these 162 firms were selected to participate to this study according to criteria able to ensure a parametric distribution among the entire universe of 557 firms²⁸.

On the basis of this first, a second group was selected according to a Propensity Score Matching methodology.

This methodology [Rosenbaum and Rubin 1983, Imbens 2000 and 2003] estimate the causal relation of a specific treatment effect pairing the reaction of agents receiving a treatment (treatment group) with agents not receiving it (control group). The comparability between the two sets of agents is the necessary condition for the analysis. The two sets of agents in fact have to match according to several characteristics all of which have to be objective and observable before the experiment. On the basis of these ex ante characteristics, a propensity score to receive the treatment is established in the universe and a second group of not treated firms is first created and then analysed as control group for a counterfactual comparison aimed to assess the significance of the treatment.

For this analysis, the pre treatment similarities to be part of the control group were identified in:

- Industrial sector

²⁷Quasi experimental methods are the ones building the experiment on several observable characteristics such as the comparability of the agents in characteristics other than the feasibility for the experiment. Conversely, experimental methods are based on the random extraction over a population composed according to the unique criteria of feasibility for the experiment.

²⁸ The 162 firms sample has a resulting confidence level of 95% and a confidence interval of +/-6.4%.

- Firm size
- Legal entity
- Firm's age
- Firms proprietary structure
- Export
- Participation to other policy actions

Afterwards, an identical semi structured questionnaire was telephonically submitted to all the firms. The questionnaire was divided in four parts with questions about: firm's structure; production and markets; investments; R&D activities.

One more section was also created just for the firms participating to the innovation policy action, to specifically assess their level of satisfaction for the policy initiative²⁹.

²⁹ The questionnaire with the five sections is available as an Appendix at the end of the work.

5.3 Structural characteristic of the Sample³⁰

In this section we will analyse in details the characteristics of the sample according to structure, performance and R&D characteristics.

In the tables below, the structure of the universe of firms analysed, then divided into the two groups.

Table 20: Sample structure

	Machinery [Nace 29]	Biomedics and precision instruments [Nace 33]	Chemicals and plastics [Nace 24-25]	Software and R&D [Nace 72-73-74]	Other Manufacture	Other Service activities [From Nace 45 to 93]	Total
Employees 2005							
1-5	47	28	14	38	63	15	205
6-15	21	11	6	21	24	8	91
16-50	23	8	6	3	34	5	79
51-150	37	4	8	2	53	6	110
151-250	10	2		2	17	4	35
> 250	7	2	3	1	13	2	28
Not declared	2	1			2		5
Total	147	56	37	67	206	40	553

Table 21: Sample structure - Treatment group

	Machinery [Nace 29]	Biomedics and precision instruments [Nace 33]	Chemicals and plastics [Nace 24-25]	Software and R&D [Nace 72-73-74]	Other Manufacture	Other Service activities [From Nace 45 to 93]	Total
Employees 2005							
1-5	1	1	1	3	4	4	14
6-15	6	5	2	13	6	2	34
16-50	15	7	5	2	19	2	50
51-150	11	3	2	1	17	1	35
151-250	3	2		1	9	1	16
> 250	5	1	3	1			10
Not declared	1				2		3
Total	42	19	13	21	57	10	162

Table 22: Sample structure - Control group

	Machinery [Nace 29]	Biomedics and precision instruments [Nace 33]	Chemicals and plastics [Nace 24-25]	Software and R&D [Nace 72-73-74]	Other Manufacture	Other Service activities [From Nace 45 to 93]	Total
Employees 2005							
1-5	46	27	13	35	59	11	191
6-15	15	6	4	8	18	6	57
16-50	8	1	1	1	15	3	29
51-150	26	1	6	1	36	5	75
151-250	7			1	8	3	19
> 250	2	1			13	2	18
Not declared	1	1					
Total	105	37	24	46	149	30	391

In its entirety, the overall sample analysed is composed of 553 firms: 162 belonging to the Treatment group of firms which benefited of the Measure 3.1.A, and 391 firms belonging to the Control group obtained with the Propensity score matching methodology.

The ratio between the two groups is two and a half control group firms for each firm in the treatment group, which ensures a higher level of reliability for the analyses.

³⁰ In the next tables, when it is not mentioned we refer to the Treatment group. Otherwise, the label Control group (C Group) is shown.

The firms are mainly small and medium enterprises: the 53% of them are micro-firms with less than 15 employees, followed by 34.1% with up to 150 employees and 11.4% with up to 250 or more employees [Table 20].

The 92% of the firms belong to the Manufacturing sector and specifically most of them to the internal sub groups of Machinery (26.58%), Software and R&D (12.12%); Biomedics and precision instruments (10.13%). The most populous group in the sample is however Other Manufacturing with the 37.3% of firms whilst Service activities firms are the 7.2% of the total [Table 25].

In the Treatment group, the most predominant sector is again Machinery (25.9%), followed by Software and R&D (12.9%).

However, conversely from the Control group, the size of the firms participating to the innovation Programme is different.

The most numerous group of firms in the Treatment group is not micro-firms but firms with up to 50 employees which count for the 30.8% of all the sample [**Table 21**]. In the Control group micro firms count for the 63.4% of all the firms in the group [Table 22]. This suggest a first difference between the two groups and in particular that the firms benefiting with of the innovation policy appears to be more structured in terms of size than their equivalent in the Control group.

This evidence can be grasped also by looking at their differences in terms of legal structure [Table 24]. The Control group is composed for the 18.9% of owned-run firms and for the 25.8% of partnerships; conversely the Treatment group is for the 62.9% formed of private limited companies (SRL), and for the 32.1% of public limited companies (SPA).

Crossing these information with the age factor, we obtain the confirmation that in the Treatment group firms appear to be more solid.

In fact, the average Treatment group firm is younger than the in the Control group: just the 25% were founded before 1973, whilst the 75% (equal to 121 firms) were constituted between 1974 and 2005. The Control group is conversely composed of older firms with just the 50% of them founded later than 1984 [Table 23].

Table 23: Firms – Year of constitution

Year of constitution			C GROUP		
N	Valid	162	N	Valid	383
	Missing	0		Missing	8
Mean		2030.24	Mean		1981,73
Median		1984.00	Median		1984,00
Mode		1999	Mode		1980
Minimum		1877	Minimum		1848
Maximum		2005	Maximum		2006
Sum		328899	Sum		763854
Percentiles	25	1973.00	Percentiles	25	1974,00
	50	1984.00		50	1984,00
	75	1996.00		75	1993,00

Table 24: Firms – Legal entity

Firms - Legal entity	Control group		Treatment group		Total	
	N	%	N	%	N	%
Own runned	74	18,9	.	.	74	13,4
Private limited company	54	13,8	102	62,9	156	28,2
Public limited company	95	24,3	52	32,1	147	26,6
Partnership	140	35,8	.	.	140	25,3
Limited partnership	19	4,9	4	2,5	23	4,2
Other	9	2,3	4	2,5	13	2,4
Total	391	100	162	100	553	100

(Personal elaboration)

Table 25: Firms – Nace sectors

Firms - Nace	Control group		Treatment group		Total	
	N	%	N	%	N	%
Machinery	105	26,9	42	25,9	147	26,6
Biomedics and precision instruments	37	9,5	19	11,7	56	10,1
Chemicals and plastics	24	6,1	13	8	37	6,7
Software and R&D	46	11,8	21	13	67	12,1
Other manufactory	149	38,1	57	35,2	206	37,3
Other service activities	30	7,7	10	6,2	40	7,2
Total	391	100	162	100	553	100

(Personal elaboration)

Table 26: Firms – Size per sector of performance [%]

Firms - Size per sector	Machinery	Biomedics and precision instruments	Chemicals and plastics	Software and R&D	Other manufactory	Other service activities
	%	%	%	%	%	%
Control group						
Up to 5 employees	44,2	7,5	54,2	76,1	39,6	36,7
6 to 15	14,4	16,7	16,7	17,4	12,1	20
16 to 50	7,7	2,8	4,2	2,2	10,1	10
51 to 150	25	2,8	25	2,2	24,2	16,7
151 to 250	6,7	.	.	2,2	5,4	10
> 250	1,9	2,8	.	.	8,7	6,7
Not declared	.	.	.	.	.	.
Treatment group						
Up to 5 employees	2,4	5,3	7,7	14,3	7	40
6 to 15	14,3	26,3	15,4	61,9	10,5	20
16 to 50	35,7	36,8	38,5	9,5	33,3	20
51 to 150	26,2	15,8	15,4	4,8	29,8	10
151 to 250	7,1	10,5	.	4,8	15,8	10
> 250	11,9	5,3	23,1	4,8	.	.
Not declared	2,4	.	.	.	3,5	.

(Personal elaboration)

5.4 Production and Investments

The next tables focus on the characteristics associated to production, and in particular on the firms' position on the value chain; the role and the location of the main client and the choices related to the investment activities compared with turnover, export and employment factors.

Table 27 shows the position in the value chain of the two groups. As we can see in the table, both the groups have similar share of productions on behalf of others. However, some dissimilarities about the position on the value chain of the two groups can be evidenced looking at the diversities in the destination and typology of their production.

Firms belonging to the Treatment group have a higher series production both with regards of finite products (38.9%) and of components (3.5%), whilst the Control group has its highest percentages of production respectively on commissions for finite products (36.7%) and commissions for components (4.6%). Consequently, we can affirm that Treatment group firms are mainly devoted to series productions (42.4%) than the Control group (32.1%) and therefore they manifest a better position in terms of independence in the client – supplier relation.

Confirmation to this evidence is also found looking at the markets of the two groups in terms of location of the main client [Table 30]. The table stresses a contrast between the two groups and particularly on the fact that none of the firms in the Treatment group have as main customer a local firm but just national or international (EU) firms. Moreover Treatment group firms are also less dependent on the main client than in the Control group [Table 36]. Conversely, Control group firms have more of a local connotation in terms of markets and are more linked to the strategies of their main customer.

Observing the variations in terms of turnover, export, investments and employees, during 2003 to 2006 the firms showing a positive trend are generally more likely to belong to the Treatment group. In the Control group performances are more steady whilst the Treatment group has a general dynamic attitude, as for example regarding the export values [Table 32].

Furthermore, firms in the Treatment group invest more in general and they particularly focus on Research activities. Such characteristic is positively correlated to the R&D outputs and inputs factors [Table 27 to Table 35].

The Treatment group shows a more dynamic attitude also with regards of the choices of investments: it is indeed more oriented toward research activities such as pre market developments (59%) and introduction of new processes (40.3%) or products (53.5%). In the Control group investment choices privilege replacements related to obsolescence costs (61.2%) whilst rather

distant in terms of importance are the percentages of investments for pre market developments (8.7%); introduction of new processes (27.2%) or products (22.1%) [Table 28].

According to this circumstance, between 2003 to 2006 we can observe higher turnover trend values among the firms participating to Measure 3.1.A. than the others: the 66,7% of the Treatment group had an increasing in its performance [Table 33] and the same results can be grasped looking at the employment and export trend values.

Systematically, between the 60% and the 70% of the Treatment group associates to an increasing in investments [Table 29], turnover [Table 34] and export [Table 35], an increasing in the number of employees. Export values are as well more linked to investments potential in the Treatment group than in the Control group [Table 32].

Table 27: Activity of production: value chain

Main activity of production (2004)	Control group		Treatment group	
	N	%	N	%
Lavorazioni c/terzi	15	13,8	19	16,8
Prodotti finiti in conto proprio (serie)	34	31,2	44	38,9
Prodotti finiti in conto proprio (commessa)	40	36,7	28	24,8
Componenti realizzati in conto proprio (serie)	1	0,9	4	3,5
Componenti realizzati in conto proprio (commessa)	5	4,6	6	5,3
Non ha attività prevalenti	14	12,8	12	10,6
Totale	109	100	113	100

(Personal elaboration)

Table 28: Investments – Partition

Investment objectives (2004-2005)	Control Group		Treatment Group	
	N	%	N	%
Research	18	17,5	121	84
Pre market developments	9	8,7	85	59
Costs associated to the introduction of new processes	28	27,2	58	40,3
Costs associated to the introduction of new products	23	22,3	77	53,5
Costs of obsolescence	63	61,2	77	53,5
Environmental control	11	10,7	24	16,7
Expansion of production capacity	34	33	30	20,8
Organizational innovation	16	15,5	24	16,7
New markets	4	3,9	22	15,3
Energy savings	4	3,9	14	9,7
Other	4	3,9	3	2,1
Total	103		144	

(Personal elaboration)

Table 29: Investments – Investments and Employment trends

Investments Trend and Employment - (2003-2005)	Employment trend											
	Increased			Not modified			Decreased			Total		
	N	% column	% row	N	% column	% row	N	% column	% row	N	% column	% row
Control group												
Increased investments	20	40,8	44,4	16	34,8	35,6	9	42,9	20	45	38,8	100
Decreased investments	13	26,5	40,6	14	30,4	43,8	5	23,8	15,6	32	27,6	100
Not modified	16	32,7	41	16	34,8	41	7	33,3	17,9	39	33,6	100
Total	49	100	42,2	46	100	39,7	21	100	18,1	116	100	100
Treatment group												
Increased investments	58	70,7	61,7	19	59,4	20,2	17	60,7	18,1	94	66,2	100
Decreased investments	2	2,4	28,6	3	9,4	42,9	2	7,1	28,6	7	4,9	100
Not modified	22	26,8	53,7	10	31,3	24,4	9	32,1	22	41	28,9	100
Total	82	100	57,7	32	100	22,5	28	100	19,7	142	100	100

(Personal elaboration)

Table 30: Location of the main client

Main client - Location	Control group		Treatment group	
Lavorazioni c/terzi	Provincia , Regione, Italia		Italia	
Prodotti finiti in conto proprio (serie)	Italia, Unione Europea		Italia	
Prodotti finiti in conto proprio (commessa)	Italia, Unione Europea		Italia, Unione Europea	
Componenti realizzati in conto proprio (serie)	Italia		Unione Europea	
Componenti realizzati in conto proprio (commessa)	Regione		Italia	
Non ha attività prevalenti	Regione, Italia		Italia, Unione Europea	

(Personal elaboration)

Table 31: Investments – Investments and Turnover trends

Investments Trend and Invoices - (2003-2005)	Invoice trend											
	Increased			Not modified			Decreased			Total		
	N	% column	% row	N	% column	% row	N	% column	% row	N	% column	% row
Control group												
Increased investments	29	45,3	64,4	7	28	15,6	9	33,3	20	45	38,8	100
Decreased investments	16	25	50	9	36	28,1	7	25,9	21,9	32	27,6	100
Not modified	19	29,7	48,7	9	36	23,1	11	40,7	28,2	39	33,6	100
Total	64	100	55,2	25	100	21,6	27	100	23,3	116	100	100
Treatment group												
Increased investments	75	71,4	78,1	6	40	6,3	15	62,5	15,6	96	66,7	100
Decreased investments	4	3,8	57,1	2	13,3	28,6	1	4,2	14,3	7	4,9	100
Not modified	26	24,8	63,4	7	46,7	17,1	8	33,3	19,5	41	28,5	100
Total	105	100	72,9	15	100	10,4	24	100	16,7	144	100	100

(Personal elaboration)

Table 32: Investments – Investments and Export trends

Investments Trend and Export - (2003-2005)	Export trend											
	Increased			Not modified			Decreased			Total		
	N	% column	% row	N	% column	% row	N	% column	% row	N	% column	% row
Control group												
Increased investments	4	33,3	13,3	24	35,3	80	2	40	6,7	30	35,3	100
Decreased investments	0	0	0	11	16,2	84,6	2	40	15,4	13	15,3	100
Not modified	8	66,7	19	33	48,5	78,6	1	20	2,4	42	49,4	100
Total	12	100	14,1	68	100	80	5	100	5,9	85	100	100
Treatment group												
Increased investments	23	76,7	35,4	40	66,7	61,5	2	40	3,1	65	68,4	100
Decreased investments	0	0	0	2	3,3	66,7	1	20	33,3	3	3,2	100
Not modified	7	23,3	25,9	18	30	66,7	2	40	7,4	27	28,4	100
Total	30	100	31,6	60	100	63,2	5	100	5,3	95	100	100

(Personal elaboration)

Table 33: Investments – Investments and investment partition trends

Investment objectives and Invoice trends - (2003-2005)	Investments											
	Increased			Not modified			Decreased			Total		
	N	% column	% row	N	% column	% row	N	% column	% row	N	% column	% row
Control group												
Research	10	22,2	55,6	4	10,3	22,2	4	21,1	22,2	18	17,5	100
Pre market developments	6	13,3	66,7	2	5,1	22,2	1	5,3	11,1	9	8,7	100
Costs associated to the introduction of new processes	11	24,4	39,3	12	30,8	42,9	5	26,3	17,9	28	27,2	100
Costs associated to the introduction of new products	12	26,7	52,2	8	20,5	34,8	3	15,8	13	23	22,3	100
Costs of obsolescence	26	57,8	41,3	27	69,2	42,9	10	52,6	15,9	63	61,2	100
Environmental control	5	11,1	45,5	4	10,3	36,4	2	10,5	18,2	11	10,7	100
Expansion of production capacity	15	33,3	44,1	15	38,5	44,1	4	21,1	11,8	34	33	100
Organizational innovation	4	8,9	25	9	23,1	56,3	3	15,8	18,8	16	15,5	100
New markets	1	2,2	25	3	7,7	75	0	0	0	4	3,9	100
Energy savings	2	4,4	50	1	2,6	25	1	5,3	25	4	3,9	100
Other	2	4,4	50	0	0	0	2	10,5	50	4	3,9	100
Total	45	100	43,7	39	100	37,9	19	100	18,4	103	100	100
Treatment group												
Research	84			30	73,2	24,8	7	100	5,8	121	84	100
Pre market developments	62	64,6		17	41,5	20	6	85,7	7,1	85	59	100
Costs associated to the introduction of new processes	41	42,7	70,7	14	34,1	24,1	3	42,9	5,2	58	40,3	100
Costs associated to the introduction of new products	58	60,4	75,3	16	39	20,8	3	42,9	3,9	77	53,5	100
Costs of obsolescence	47	49	61	26	63,4	33,8	4	57,1	5,2	77	53,5	100
Environmental control	18	18,8	75	5	12,2	20,8	1	14,3	4,2	24	16,7	100
Expansion of production capacity	21	21,9	70	6	14,6	20	3	42,9	10	30	20,8	100
Organizational innovation	17	17,7	70,8	7	17,1	29,2	0	0	0	24	16,7	100
New markets	13	13,5	59,1	7	17,1	31,8	2	28,6	9,1	22	15,3	100
Energy savings	12	12,5	85,7	1	2,4	7,1	1	14,3	7,1	14	9,7	100
Other	3	3,1	100	0	0	0	0	0	0	3	2,1	100
Total	96	100	66,7	41	100	28,5	7	100	4,9	144	100	100

(Personal elaboration)

Table 34: Employment – Employment and Turnover trends

Invoice and Employment trends - (2003-2005)

	Invoice trend									Total		
	Increased			Not modified			Decreased					
	N	% column	% row	N	% column	% row	N	% column	% row	N	% column	% row
Control group												
Employees increasing	42	53,8	68,9	14	34,1	23	5	13,2	8,2	61	38,9	100
Employees decreasing	25	32,1	37,9	24	58,5	36,4	17	44,7	25,8	66	42	100
Not modified	11	14,1	36,7	3	7,3	10	16	42,1	53,3	30	19,1	100
Total	78	100	49,7	41	100	26,1	38	100	24,2	157	100	100
Treatment group												
Employees increasing	64	59,8	78	10	71,4	12,2	8	30,8	9,8	82	55,8	100
Employees decreasing	20	18,7	60,6	4	28,6	12,1	9	34,6	27,3	33	22,4	100
Not modified	23	21,5	71,9	.	0	0	9	34,6	28,1	32	21,8	100
Total	107	100	72,8	14	100	9,5	26	100	17,7	147	100	100

(Personal elaboration)

Table 35: Employment – Employment and Export trends

Export and Employment trends - (2003-2005)

	Export trend									Total		
	Increased			Not modified			Decreased					
	N	% column	% row	N	% column	% row	N	% column	% row	N	% column	% row
Control group												
Employees increasing	6	50	15,8	29	42,6	76,3	3	60	7,9	38	44,7	100
Employees decreasing	3	25	125	21	30,9	87,5	.	.	.	24	28,2	100
Not modified	3	25	13	18	26,5	18,3	2	40	8,7	23	27,1	100
Total	12	100	14,1	68	100	80	5	100	5,9	85	100	100
Treatment group												
Employees increasing	20	64,5	35,1	37	61,7	64,9	.	.	.	57	59,4	100
Employees decreasing	6	19,4	33,3	11	18,3	61,1	1	20	5,6	18	18,8	100
Not modified	5	16,1	23,8	12	20	57,1	4	80	19	21	21,9	100
Total	31	100	32,3	60	100	62,5	5	100	5,2	96	100	100

(Personal elaboration)

Table 36: Share of turnover related to the main client

Main client - Share of turnover dependent on the main client

	Lavorazioni c/terzi		Prodotti finiti in conto proprio (serie)		Prodotti finiti in conto proprio (commessa)		Componenti realizzati in conto proprio (serie)		Componenti realizzati in conto proprio (commessa)		Non ha attività prevalenti		Total	
	N	Media	N	Media	N	Media	N	Media	N	Media	N	Media	N	Media
Control group														
Machinery	2	75	14	44,1	23	27,1	1	5	2	52,5	4	29	46	35,3
Biomedics and precision instruments	1	100	1	10	3	76,7	.	.	.	.	.	.	5	68
Chemics and plastics	.	.	4	9	.	.	.	.	2	11,5	2	40	8	14,4
Other manufactory	12	42,9	15	42,1	14	56,3	.	.	1	100	8	47,3	50	48,2
Total	15	51	34	38,1	40	41,4	1	5	5	45,6	14	41,1	109	41,5
Treatment group														
Machinery	3	50	12	21,7	15	25,4	2	.	5	32	5	16,3	42	25,9
Biomedics and precision instruments	1	.	5	40	5	36,3	.	.	.	.	4	23,8	15	33,8
Chemics and plastics	2	55	7	35,9	.	.	.	.	.	.	.	.	9	37,1
Other manufactory	13	49,2	20	22,6	8	10,7	2	26,5	1	23	3	12,7	47	27,9
Total	19	50	44	16,5	28	23,4	4	26,5	6	30,2	12	18	113	28,8

(Personal elaboration)

5.5 R&D

Just 75 firms equal to the 20.7% of the Control group declared a research related activity in the form of general research or specific R&D.

Some of the comparisons which follow in the chapter will therefore have a double value: an internal one related to the sub group of Control group Research firms (CGr) and another one to better ponder the differences between the two groups³¹.

Concerning R&D, Treatment group firms confirm to be more dynamic than the Control Group as all of them have a higher level of investments generally but above all each firm of the Treatment group invests in research related activities against the 47.7% of the CGr [Table 38].

In both groups the research activities are concentrate according to the sector of specialisation and therefore mainly in Advanced mechanics and mechatronics, Information society technologies, and Advanced material. However, in the Treatment group there are signs of higher sensibility towards more recent research themes, such as: Genomics and biotechnologies, Sustainable development, and Energy which are almost absent in the Control group but in line with a younger average age of the former group [Table 39].

As well according to a more recent constitution, most of the firms benefiting of the Measure 3.1.A started their research activity less than 10 years ago (47.9%), whilst in is the opposite for the CGr with the majority of firms starting their activity more than 20 years ago [Table 37]. Notwithstanding this aspect, firms with a dedicated unit among the Treatment group began their R&D activity more than 20 years ago as the majority of the Control group.

As mentioned before in the chapter, all the Treatment group firms invest in research related activities: most of them between the 6 to up the 15 per cent, with an improving rate throughout the years particularly in the highest segment with an increasing in the number of firms equal to the 8% between 2002 and 2005 [Table 40]. This value, per se already relevant, acquire even more significance when compared with the restricted Control group (CGr) whereas the 9.4% of firms invest up to 5% in research activities and just the 5% up to more than 15%.

The same conclusions emerge regarding the investment in R&D personnel with the 28.9% of the Treatment group dedicating more than the 25% of its staff to R&D, with a mean value of R&D staff equal to 22 units versus the 17 of the restricted CGr [Table 41].

³¹ Following in the chapter as CGr. Moreover, we will use the double definition: CGr when referring to precise values for the Control firm's subgroup and Control Group when we are not giving specific values, but general trend observations having the same level of significance for both the subgroup and the total group of Control firms. When it is not mentioned, the tables refer to values for the restricted Control group.

Finally, in terms of competencies of R&D personnel the Treatment group reflects a slightly major heterogeneity of skills than the Control group: although both have as highest groups specialised technicians and engineers, the firms benefiting of the innovation policy shows upper shares of Ph d level competencies which are conversely almost absent in the other group [Table 42]. Moreover, in accordance with an intensive R&D activity, Treatment group firms display more external and formalised networking capacity with the 91.7% of them collaborating with University structures [Table 43].

Concerning the innovation output, the observations seem to be in line with the previous ones. Patent production is generally higher among the Treatment group and more importantly the patents purchased reflect a higher degree of openness toward external markets of knowledge, above all the European one. The purchasing of patents is over all the periods observed more than the 60% on international markets, whilst is the opposite for the Control group which purchased its licenses above all from the national market [

Table 44 and Table 45].

Summarising these last elements, the Treatment group shows:

1. A level of expenditures in R&D increasingly important over the turnover.
2. A networking attitude more international both in terms of export and of patents
3. An increasing of turnover stronger in the situation of an increasing of R&D internal unit or R&D staff.
4. An expectation of more investments in R&D inputs (above all R&D staff) in the future stronger than in the Control group.

Table 37: R&D – Years of activity and Internal units

	Control group*		Treatment group**	
	N	%	N	%
More than 20 years	46	61,3	50	34,7
Between 10-20 years	15	20	25	17,4
Less than 10 years	14	18,7	60	47,9
Total	75	100	144	100

R&D - Dedicated research unit

	Control group*		Treatment group	
	N	%	N	%
More than 20 years	37	49,3	35	61,4
Between 10-20 years	20	26,7	.	.
Less than 10 years	15	20	.	.
No dedicated structure	3	4	22	38,6
Total	75	19,3	57	39,6

* Just 75 firms have R&D activities; ** 18 firms missing

(Personal elaboration)

Table 38: Investments – Investments and Research Investments - Comparison

Investment and Research activity (2004-2006)

	Control group		Treatment group	
	N	%	N	%
Investment				
Yes	103	65,6	162	100
No	54	34,3	.	.
Total	157	100	162	100
Research				
Yes	75	47,7	162	100
No	82	52,3	.	.
Total	157	100	162	100

(Personal elaboration)

Table 39: R&D – Typology of research activity**R&D - Type of activity carried out**

	Control group*		Treatment group**	
	N	%	N	%
Advanced mechanics or mechatronics	38	50,7	83	57,6
R&D and application of Information and Society technologies	12	16	35	24,3
R&D and application of advanced materials	28	37,3	54	37,5
Foodstuff processing	3	4	13	9
Genomics or Biotechnologies	1	1,3	6	4,2
Sustainable development (i.e. climate change and environment)	1	1,3	10	6,9
Energy	1	1,3	17	11,8
Systems of organization quality and work practices	3	4	23	16
Other	12	16	11	7,6
Total	75	100	144	100

* Just 75 firms have R&D activities; ** 18 firms missing

(Personal elaboration)

Table 40: R&D – Total R&D expenditures as a share of total expenditures

	2002-2003		2004-2005		2006-2007*	
	N	%	N	%	N	%
R&D - Expenditures over total						
Control group						
Up to 5%	38	52,1	38	52,1	37	50,7
6% to 15%	17	23,3	15	20,5	16	21,9
More than 15%	18	24,7	20	27,4	20	27,4
Total	73	100	73	100	73	100
Treatment group						
Up to 5%	65	54,2	55	45,8	47	39,2
6% to 15%	36	30	38	31,7	39	32,5
More than 15%	19	15,8	27	22,5	34	28,3
Total	120	100	120	100	120	100

* Expectational value

** Missing: 2 in Control Group; 42 in Treatment group

Table 41: R&D – R&D personnel as a share of total personnel

	2002-2003		2004-2005	
	N	%	N	%
R&D - Personnel shares over total				
Control group				
No R&D personnel	3	4	.	.
Up to 7%	37	49,3	34	45,3
8% to 25%	23	30,7	24	32
More than 25%	12	16	17	22,7
Total	75	100	75	100
Mean value	17,8			
Treatment group*				
No R&D personnel	4	2,9	.	.
Up to 7%	37	26,4	40	28,2
8% to 25%	62	44,3	61	43
More than 25%	37	26,4	41	28,9
Total	140	100	142	100
Mean value	22,1		24	

* 22 missing for the Treatment group

Table 42: R&D – R&D personnel specialisations

	2002-2003		2004-2005	
	N	%	N	%
R&D - Personnel specialisations				
Control group				
Technicians	61	81,3	64	85,3
Engineers	43	57,3	45	60
Chemists or Physicists	15	20	16	21,3
Ph D level	2	2,7	1	1,3
Other	10	13,3	10	13,3
Total	75		75	
Treatment group*				
Technicians	107	78,7	108	76,1
Engineers	106	77,9	111	78
Chemists or Physicists	26	19,1	21	14,8
Ph D level	19	15,1	15	10,6
Other	7	5,1	5	3,5
Total	142		142	

* 21 missing for the Treatment group

Table 43: R&D – R&D external personnel

R&D - External personnel		
	N	%
Control group		
University	20	62,5
Public or private research Labs	12	37,5
Other	7	21,9
Total	32	
Treatment group		
University	122	91,7
Public or private research Labs	40	30,3
Other		
Total	162	

Table 44: Patents – Patent production

	2002-2003		2004-2005		2006-2007*	
	N	%	N	%	N	%
Control group						
Yes	27	36	32	42,7	31	41,3
No	48	64	43	57,3	44	58,7
Total	75	100	75	100	75	
Treatment group						
Yes	55	37,2	51	34,5	74	50,3
No	93	62,8	97	65,5	73	49,7
Total	148	100	148	100	147	100

* Expectational values

Table 45: Patents – Patents purchased

	2002-2003		2004-2005		2006-2007*	
	N	%	N	%	N	%
Control group						
Usa	5	41,7	3	27,3	2	28,6
Europe	3	25	4	36,4	1	14,3
Italy	7	58,3	7	63,6	6	85,7
Other	.	.	.	.	.	.
Total	12		11		7	
Treatment group						
Usa	6	27,3	6	20,7	6	24
Europe	10	45,5	13	44,8	9	36
Italy	8	36,4	11	37,9	11	44
Other	1	4,5	1	3,4	.	.
Total	22		29		25	

* Expectational values

Table 46: R&D expenditures and Performance – trend values

		R&D expenditures as a share of invoice						Total	
		Up to 5%		6% to 15%		More than 15%			
		N	%	N	%	N	%	N	%
Control group									
Increased		22	57,9	8	53,3	6	42,9	36	53,7
Decreased		10	26,3	6	40	2	14,3	18	26,9
Not modified		6	15,8	1	6,7	6	42,9	13	19,4
Total		38	100	15	100	14	100	67	100
Treatment group									
Increased		40	71,4	30	76,9	21	77,8	91	74,6
Decreased		10	17,9	4	10,3	5	18,5	19	15,6
Not modified		6	10,7	5	12,8	1	3,7	12	9,8
Total		56	100	39	100	27	100	122	100

(Personal elaboration)

Table 47: R&D expenditures and Export – trend values

		R&D expenditures as a share of invoice						Total	
		Up to 5%		6% to 15%		More than 15%			
		N	%	N	%	N	%	N	%
Control group									
Increased		4	12,1	3	23,1	2	22,2	9	16,4
Decreased		27	81,8	9	69,2	6	66,7	42	76,4
Not modified		2	6,1	1	7,7	1	11,1	4	7,3
Total		33	100	13	100	9	100	55	100
Treatment group									
Increased		12	28,6	10	41,7	8	50	30	36,6
Decreased		29	69	12	50	8	50	49	59,8
Not modified		1	2,4	2	8,3	.	.	3	3,7
Total		42	100	24	100	16	100	82	100

(Personal elaboration)

Table 48: R&D expenditures and patents registered

		R&D expenditures as a share of invoice						Total	
		Up to 5%		6% to 15%		More than 15%			
		N	%	N	%	N	%	N	%
Control group									
Int patents registered		20	52,6	7	46,7	4	28,6	31	46,3
Int patents not registered		18	47,4	8	53,3	10	71,4	36	53,7
Total		38	100	15	100	14	100	67	100
Treatment group									
Int patents registered		20	36,4	10	25,6	8	28,6	38	31,1
Int patents not registered		35	63,6	29	74,4	20	71,4	84	68,9
Total		55	100	39	100	28	100	122	100

(Personal elaboration)

Table 49: R&D internal unit and turnover performance

	Performance variation and R&D internal unit					
	Yes		Internal R&D unit No		Total	
	N	%	N	%	N	%
Control group						
Performance increased	39	54,2	3	100	42	56
Performance decreased	19	26,4	.	.	19	25,3
Performance not modified	14	19,4	.	.	14	18,7
Total	72	100	3	100	75	100
Treatment group						
Performance increased	87	72,5	15	68,2	102	71,8
Performance decreased	19	15,8	6	27,3	25	17,6
Performance not modified	14	11,7	1	4,5	15	10,6
Total	120	100	22	100	142	100

(Personal elaboration)

Table 50: R&D personnel and turnover performance

	Performance variation and R&D Personnel							
	Increased		R&D Personnel Not modified		Decreased		Total	
	N	%	N	%	N	%	N	%
Control group								
Performance increased	15	78,9	25	47,2	2	66,7	42	56
Performance decreased	2	10,5	16	30,2	1	33,3	19	25,3
Performance not modified	2	10,5	12	22,6	.	.	14	18,7
Total	19	100	53	100	3	100	75	100
Treatment group								
Performance increased	36	72	58	69,9	6	100	100	71,9
Performance decreased	10	20	15	18,1	.	.	25	18
Performance not modified	4	8	10	12	.	.	14	10,1
Total	50	100	83	100	6	100	139	100

(Personal elaboration)

5.6 Conclusions: Some observations about the responses in the Treatment and the Control Groups and the degree of fitness between Measure 3.1.A and the regional productive system

Aim of this chapter was to develop some observations about the degree of fitness between one of the measures of the Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT) and the regional system.

As mentioned before, the scope of the analysis was to investigate whether the innovation Programme has been able to target its action on the specific aspects of the regional system it was built on. Specifically, we wanted to understand to which extension is correct to affirm that the innovation policy developed by PRRIITT can be considered as a social technology, representing a continuum with the previous policy actions and the evolution of the regional system of production.

To this regard, we analysed some characteristics of a sample of firms which benefited of the Measure 3.1.A. In accordance to this objective, we compared these characteristics with the characteristics of a Control group.

It is worthy to remember that the Control group employed in this analysis is a counterfactual sample composed of agents with all the characteristics to be suitable for the experiment. Therefore, comparing the firms participating to the innovation Programme with this sample is per se an instrument able to give insights on the degree of correspondence between the policy and its targeted system of action. Moreover, the ratio chosen for the two groups enhances the level of reliability of the analysis, matching to 2.5 control group-firms each of the firms treated with PRRIITT.

The evolution of the regional system of production has emerged by the policy narrative description as focused on: Small and Medium enterprises; firms belonging to some specific sectors of the Manufacturing productive threads of the regional system; firms characterised by a strong research and development core upon which the production is organised.

Observing the outcomes of the comparison undertaken, the answer seem to be positive.

In terms of size firms belonging to the Treatment group are small and medium enterprises but with a more robust structure and between 16 up to 50 employees.

They are all firms investing and specifically all of them invest in research related activities. They belong to the regional productive threads and the core of their production is based on the development of research activities and supported by a strong number of R&D internal personnel. Moreover, they have developed networks with other research institution in a formal base, above with University, to integrate their competencies.

As a consequence their placement on the chain is higher with a serial production either of final products or of components. They produce not as supply dominated but as specialised suppliers and this circumstance enable them to be less dependent on a single client and to be able to place their activities in a wider market either national or European.

6 Conclusions

Aim of this work has been to investigate the process of evolution of a policy within a local system of production. In our mind, this process can be regarded as a process of institutional change assuming a specific definition of institutions.

According to the literature, there are multiple notion of what institutions are: in our mind institutions are a mechanisms of coordination among different agents sharing a system. We can therefore consider an institution as a standardised social technology organising the actions of the agents. In terms of productive system, institutions become standardised social technologies organising physical technologies of production.

A formulation of institutions built on physical technologies is useful for two reasons.

The first one is that it explicates the relationship between institutions and production. Moreover, a formulation of this kind clarify a concept of institutions as laws and norms not much as constraints but rather as elements coordinating the effective ways production is networked. Secondly, employing a concept of institutions built on social technologies allows to separate the process of institutional change according to the evolution of the physical technologies, focusing on the moments where new forms of coordination are needed as a signal of the evolution of the system.

According to these considerations, with a Narrative approach we isolated in a local system of production three moments describing the transformation of the system with respect to the different industrial policies developed as the physical technologies were evolving.

The moments we consider are: the establishment of the Regional Agency for the Economic Valorisation of the Territory (ERVET) as first policy instrument built on the characteristics of the regional system. The second one is the establishment of the Real Services Centres as policy action specifically implemented to formalise the informal productive networks of the system. The third one is the recent development of the Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT), developed between 2003 and 2007.

We demonstrate as all these policy actions were aimed to the formalisation of pre-existing organic-type institutions and therefore can be regarded as a pragmatic-type of institutions. In such a context a relevant role had one specific characteristic of the system: the high level of social capital embedded in the relationships among the agents.

Social capital is a fundamental component in the process of diffusion and empowerment of the productive technologies, as the element favouring the spontaneous establishment of systems and of

organic-type institutions. The industrial policies we described are in fact emerging from networks of production of a regional system empowered by trust, civic engagement, and reciprocity.

The second part of the work deals with this theoretical conceptualisation and some quantitative elements to gauge the level of fitness of a specific industrial policy and the regional system.

The Regional Programme for Industrial Research, Innovation and Technology Transfer (PRRIITT) is an innovation policy for the improvement of ‘applied research, firms’ pre competitive development, and the increasing of the technological content in production for the development of a regional knowledge economy’. It identifies specific targets such as: increasing the level of expenditure in R&D especially among SMEs; increasing the units of R&D personnel; enhancing the number of patents.

PRRIITT was developed as pragmatic-type answer to the exploitation of a system characterised by a strong manufacture core concentrated in the engineering related sectors, composed of small and medium sized firms with a high interest in research related activities such as pure R&D and human capital investments.

On this scenario, we tried an exercise to establish whether PRRIITT can be considered a form of coordination (social technology) of the productive characteristics (physical technologies) of the regional system. We considered the information at the base of the policy building, isolating the groups of productive characteristics isolated in terms of threads of production, local systems and local specialisations, to identify the emerging networks of production in the regional economy.

We employed a database developed from primary survey data. The sample is composed of firms participating to the policy and firms composing a control group specifically developed to be a counterfactual sample. Therefore, comparing the firms participating to the innovation Programme with this control group is per se instrument able to give insights on the degree of correspondence between the policy and its targeted system of action.

As first result we would like to recall the response of firms to the implantation of the policy.

The first period of the call achieved the number of 363 projects submitted for a co financing requested total amount equal to 68 millions of Euros against the 27 millions planned, whilst the second period of the call a total number of 869 projects for a total amount of 141 millions of Euros of resources requested. Moreover, the first submitting period had to be closed in less than three hours for the high number of requests.

We can consider this evidence a first proxy of the level of fitness of the Programme with the evolution of its environment: the policy plan was actually able to capture the emergence of a system of firms with a physical production already set.

Secondly, we investigate some characteristics of a sample of firms which benefited of the Measure 3.1.A.

The evolution of the regional system of production has emerged in the policy narrative description as a system characterised by engineering related sectors restructured from micro-firm to medium sized enterprises. These elements are supported by a growth of Specialised suppliers and Science based firms in correspondence to the high level of investments in technology driven sectors.

The innovation Programme has captured with its formalisation these dimensions as showed by the comparison between Treatment and Control group.

Firms belonging to the Treatment group are small and medium enterprises with a more robust structure between 16 up to 50 employees. They are all investing, but above all they all invest in research related activities. They belong to the regional productive threads and the core of their production is based on the development of research activities. They are composed of a high number of R&D internal units and they have developed formal networks with other research institutions, above all with University, to integrate their competencies.

As a consequence their placement on the value chain is higher and they don't produce as supply dominated but as specialised suppliers.

Hence, the Innovation programme built with PRRIITT through the comparisons of already existing information about new networks of production was able to generate a policy response comparable to a formalisation of an organic type of institution. We can therefore consider the Regional Programme for Industrial Research, Innovation and Technology Transfer a pragmatic institutions aimed to the formalisation of spontaneously emerging physical technologies of production.

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8 Appendix I: Questionnaire submitted to Treatment and Control Group³²

AIM AND MOTIVATION OF THE QUESTIONNAIRE

The questionnaire has been commissioned in 2006 by the Emilia Romagna regional authority and focuses on a specific innovation the policy action 3.1.A: 'Industrial research projects and firms' pre competitive development'.

This specific line of the policy entails several objectives:

- To enhance the productivity level through the implementation of research activities within firms operating within specific technological (priority) areas
- To increase employment in the industrial research sector
- To stimulate knowledge transfer via collaborations between university laboratories and research centres
- To facilitate the integration of skilled research personnel within firms

A key research question concerns the assessment of the impact of such a regional policy on innovation on the industrial environment. More specifically, the objective has been to understand how much and in which direction the business conduct of firms has been affected by the regional policy.

The time-span under analysis covers the firsts three years of the policy action: 2003-2004-2005 plus expectation values for 2006 and 2007.

³² The questionnaire is translated by the author on the basis of the official one submitted by Istituto Ricerche Sociali (Milano) on behalf of Regione Emilia Romagna.

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1. BASIC INFORMATION

- 1.1. Legal name, address of the main unit
- 1.2. Address of the local unit which benefits from the investment
- 1.3. Typologies of legal entity
 - ① Sole proprietorship
 - ② Partnership
 - ③ Private limited company
 - ④ Public limited company
 - ⑤ Limited partnership
 - ⑥ Partnership limited by shares
 - ⑦ Other (specify)
- 1.4. Total number employees
 - 1.4.1. at the end of 2003
 - 1.4.2. at the end of 2005
 - 1.4.3. at the end of 2006 (estimated value)
- 1.5. Does the firm operate within in a partnership?
 - 1.5.1. If so, overall employment of the partnership
 - 1.5.2. If so, is it a subsidiary or a parent company?
 - 1.5.3. If subsidiary is the parent company a financial or manufacturing company?
- 1.6. Nace code
- 1.7. Main activity (open question)
- 1.8. Year of foundation
- 1.9. Is the firm sistematically engaged in export activities ?
 - 1.9.1. If so, how long for?
 - 1.9.2. Month/year of the most recent export operation
- 1.10. Turnover (millions of euro)
 - 1.10.1. 2003 |_|_|_|_|
 - 1.10.2. 2005 |_|_|_|_|
 - 1.10.2.1. *If the information is not available, has the turnover between 2003-2005 increased/decreased/not changed*
 - 1.10.2.2. *If the turnover has increased or decreased se è aumentato / diminuito, quanto è aumentato/diminuito in % del valore 2003?*
 - 1.10.2.3. Expected value at the end of 2006 |_|_|_|_|
 - 1.10.2.4. *If the information is not available, which has been the percentage variation in 2005/2006? |_|_|_|%*
- 1.11. Percentage of turnover from export?

1.11.1. in 2004

1.11.2. in 2005

1.12. Expected turnover value from exportation in 2006 (percentage)

1.13. Please rate turnover growth between 2003-2005

① Very good

② Good

③ Not very good

④ Unsatisfactory

1.14. Please state expected turnover growth in 2006-2007

① Very good

② Good

③ Not very good

④ Unsatisfactory

2. GOOD SERVICES AND MARKETS

(MANUFACTURING ONLY until ATECO 366 included)

2.1. Percentage of 2005 turnover derived from:

2.1.1. Intermediary products

2.1.2. Final products/ serial production

2.1.3. Final products/demand production

2.1.4. Intermediate products/serial production

2.1.5. Intermediate products/ demand production

[The sum of the previous questions must be equal to 100]

2.2. For each of the questions above with a positive answer:

2.2.1. Who is the main client? (i.e.: other firm, retailer, intermediary firm, other/ specify)

2.2.2. Location of the client. i.e. province, region, Italy, EU, NorthAmerica, Asia, Latin America or Central America, other)

2.2.3. Please rate the contribution of each product/service to the turnover in 2004-2005
[high, medium, low, nil]

2.2.4. Please rate the expected contribution of this product on the turnover in 2006-2007
[high, medium, low, nil]

2.2.5. Please rate the contribution of this product/service will have on the turnover of 2006-2007 [high, medium, low, nil]

3. INVESTMENTS

3.1. Investments

3.1.1. Total investments in 2004-2005

3.1.1.1. value

3.1.1.2. scope

- ① Research
- ② Pre market developments
- ③ Costs associated to the introduction of new processes
- ④ Costs associated to the introduction of new products
- ⑤ Costs of obsolescence
- ⑥ Environmental control
- ⑦ Expansion of production capacity
- ⑧ Organizational innovation
- ⑨ New markets (national/supranational)
- ⑩ Energy savings
- Other [specify]

3.1.1.3. Which investments did you carry out in 2004-2005 (more than one response is admitted)

- ① machinery/plans/tools
- ② Training
- ③ Research personnel
- ④ Patents/licences/ trades
- ⑤ Consultancy
- ⑥ Other, specify:

3.1.1.4. Compared to 2002-2003 has the level of investments in 2004-2005 increased/decreased/ not changed?

3.1.1.5. Please rate if increased or decreased, of which estimated percentage?

3.2. Expected investments for 2006-2007

3.2.1.1. Compared to 2004-2005 did the level of investments in 2004-2005: increased/decreased/ not changed?

3.2.1.2. Please rate if increased or decreased, of which estimated percentage?

3.3. Which kind of investments were subsidized?

3.3.1. in 2002-2003

- ① Research
- ② Pre market developments
- ③ Costs associated to the introduction of new processes
- ④ Costs associated to the introduction of new products

- ⑤ Costs of obsolescence
- ⑥ Environmental control
- ⑦ Expansion of production capacity
- ⑧ Organizational innovation
- ⑨ New markets (national/supranational)
- ⑩ Energy savings
- Other [specify]
-

3.3.1.1. Which was the subsidy for? (open question)

3.3.2. In 2004-2005

- ① Research
- ② Pre market developments
- ③ Costs associated to the introduction of new processes
- ④ Costs associated to the introduction of new products
- ⑤ Costs of obsolescence
- ⑥ Environmental control
- ⑦ Expansion of production capacity
- ⑧ Organizational innovation
- ⑨ New markets (national/supranational)
- ⑩ Energy savings
- Other [specify]
-

3.3.2.1. Which was the subsidy? (open question)

3.3.3. Please explain why you did never use any subsidy:

3.3.3.1. Never asked for it (yes/no)

3.3.3.2. If you never applied for any subsidies, please explain why [already used 3.1.A fund, not interested in any subsidy, it is too costly, it is too difficult to obtain, other (specify)]

3.3.3.3. You submitted an application which was not successful?

3.3.3.4. About this last option, which subsidy did you apply for? [open answer]

3.3.3.5. Please indicate if you will be interested in applying for new subsidies in 2006-2007 [yes/no]

4. R&D

- 4.1. How long have you been carrying out R&D activities?
- 4.2. How long have you had an internal R&D unit? [if there is no R&D unit, mark zero]
- 4.3. Does your R&D activity concern any of these areas?
 - Advanced mechanics or mechatronics Meccanica avanzata e mecatronica
 - Research and Development and application of Information and Society technologies
 - Research and development and application of advanced materials
 - Food processing
 - Genomics or Biotechnologies
 - Sustainable development (i.e. climate change and environment)
 - Energy
 - Systems of organization quality and work practices
- 4.4. As a percentage of turnover, how much did you invest in R&D in 2002-2003; 2004-2005; and please rate the expectations for 2006-2007
- 4.5. How many members of staff did contribute to R&D related activities in 2002-2003, 2004-2005, and will you be hiring to this hand in 2006-2007?
 - 4.5.1. What is the expertises? [technicians, engineers, chemists or physicians, Phd students, other (specify)] More then one answer is allowed
 - 4.5.2. Please indicate if you have temporarily employed external research personnel or technicians in 2002-2003,2004-2005, or if you are planning to do so in 2006-2007
 - 4.5.3. Did you hire as a response to policy action 3.1.A [yes/no]
- 4.6. Do you have any external R&D partner? If so, could you please indicate if university, private or public research centres, other, [specify] [more than one answer is allowed]
- 4.7. Do you engage in partnership to carry out R&D?
 - 4.7.1. If so, could you please state
 - 4.7.1.1. Where are they localized? [*nearby your city /in your region / in Italy / abroad*]
 - 4.7.1.2. Do these firms engage in similar activities as yours or are they placed lower or higher in the value chain? Under what kind of agreements?
- 4.8. Did you register any patent abroad in 2002-2003? And in 2004-2005? Please indicate if you will register any in 2006-2007? Please indicate also where the patent has been registered [EPO, USPO]
 - 4.8.1. Has the patent been originated from the a EU project under action 3.1.A?
- 4.9. In 2002-2003 did you purchase any license or patent? If so, please indicate from where [Usa, Eu, Italy, other specify], and in 2004-2005? If so, please indicate from where [Usa, Eu, Italy, other specify].Will you purchase any licence or patents in 2006-2007? If so, please indicate from where [Usa, Eu, Italy, other specify]

4.10. Did you participate to R&D project co financed by the European Union?

5. ON THE EVALUATION OF ACTION 3.1.A

- 5.1. What was the source of information concerning this subsidy opportunity? [trade union, bank, personal *accountant*, *Sportello Unico Attività Productive*, University, Research centre, Other Consultant, other (specify)]
- 5.2. How did you learn about it? [newspaper, specific journals, newsletter, internet, meeting, informal conversations, other (specify)]
- 5.3. Where did you retrieve information concerning the application procedure and the functioning of the subsidy? [trade union, bank, university, research centre, consultant, other (specify)]
- 5.4. How much do you know about the Action 3.1.A? Please rate your opinion from 0 to 6
- 5.5. Please indicate if you have received assistance in your application [trade union, bank, university, research centre, consultant, other (specify)]
- 5.6. How many days were necessary to obtain the subsidy? Don't remember / number of days
- 5.7. Could you estimate the total cost incurred in to access the subsidy? Yes/no
- 5.7.1. If so, could you please indicate which costs are included?
- ① Men/hour to assemble the proposal
 - ② administration costs
 - ③ financing costs from banks
 - ④ other specify
- 5.8. Are you satisfied from the subsidy? [0=nil, 6= very much]
- 5.8.1. For its amount
 - 5.8.2. Because it was responding to the projectual idea
 - 5.8.3. Because it has been quickly obtained
 - 5.8.4. Because has been administratively easy to obtain
 - 5.8.5. Because of the administrative costs
 - 5.8.6. Because it has afforded a new business activity
- 5.9. Please rate the relevance of the contribution of the various people involved in accessing the funds [0 = nil, 6= very much]
- 5.10. Does the financed project involve a collaboration with University, research centres, or laboratories associated to the Ministry of University and Research?
- 5.10.1. If so, are you satisfied of this collaboration?

