



MOBILITY OF KNOWLEDGE  
KNOWLEDGE RESOURCES  
AND MARKETS: WHAT TERRITORIAL  
ECONOMIC SYSTEMS?

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## ABSTRACT

In their attempt to explain in ever more in-depth manner learning processes at the roots of economic change, territorial innovation models (TIMs) have remained centred on production. Consumption is mainly regarded as the expression of an abstract demand relayed by exogenous market mechanisms. Building on a socio-institutional approach of market, the article conceptualises an 'economic system' in which knowledge is analysed as a resource constructed and valued through the market co-evolution of a production and a consumption system. Drawing upon various case studies, four particular economic systems are depicted and contrasted with regard to different territorial knowledge dynamics (TKDs).

## KEYWORDS

Territorial knowledge dynamics, resources, production, consumption, market, EURODITE.

## ACKNOWLEDGEMENTS

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## INTRODUCTION

In 1982, Nathan Rosenberg published his work under the title 'Inside the black box: technology and economics'. From various researched cases, he demonstrated, against dominant economic theories, that scientific and technological learning is not exogenous but endogenous to economic change. Beyond this innovative thesis, Rosenberg's suggestive title reflects a more general scientific project that has widely been retrieved, developed and consolidated in regional studies and economic geography since then. This project has been to investigate and explain how knowledge is a constitutive resource of economic processes taking place in time and space.

Over the last thirty years, various territorial innovation models (TIMs) (MOULAERT and SEKIA, 2003) have emphasized how geographical proximity can shape localized learning trajectories and enhance the endogenous development of particular regions. They have pointed to the local and sectoral cumulative learning processes that underlie the reproduction, the renewal and the mobilisation of knowledge resources within particular production systems competing in a global market.

While exploring further Rosenberg's black box, TIMs have primarily focused on production processes to explain economic and territorial development. Consumption has mainly been approached as the expression of an abstract demand relayed by the market. Most often, the market is regarded as a selection or information mechanism exogenous to the examined knowledge processes. Its place in economic valuation largely remains an unexplored 'black box' in regional studies and economic geography (BERNDT and BOECKLER, 2011).

This article proposes broadening the conception of TIMs by introducing a more systematic reflexion on consumption and market construction in the organization and the evolution of the economic system of knowledge. It is argued that territorial knowledge dynamics (TKDs) are not only shaped by the cumulative reproduction and renewal of knowledge resources within specific sectoral and regional production systems. They develop across regions and sectors according to interdependent production-consumption processes organized and institutionalized at various scales (CREVOISIER and JEANNERAT, 2009).

Adopting a relational and institutional approach, the first part of the article conceptualises the general framework of an 'economic system' in which knowledge is approached as a resource

socio-economically constructed and valued in market through the co-evolution of a production and a consumption system. This conceptual framework is discussed with regard to established theories and to emerging debates in regional studies. Drawing upon various case studies realized in the framework of the European project EURODITE, the second part of the article emphasizes different economic systems. Through the ideal-types of knowledge 'viabilisation', knowledge 'improvement', knowledge 'adaptation' and knowledge 'co-development' various TKDs are examined.

## WHAT ECONOMIC SYSTEM OF KNOWLEDGE?

### KNOWLEDGE AND PRODUCTION IN TERRITORIAL INNOVATION MODELS

Knowledge, in its various forms, contents and dynamics, has gradually received specific scientific and policy attention *as a fundamental driver of innovation* in the 'knowledge economy'. But not merely as a factor of change, knowledge has increasingly been considered *as the key resource* valued in a 'knowledge-based economy' (LUNDVALL and JOHNSON, 1994; COOKE and LEYDESDORFF, 2006). How to consider such a resource?

Two different and fundamental approaches may be adopted to look at a resource (BATHELT and GLÜCKLER, 2005; KEBIR and CREVOISIER, 2008). On the one hand, knowledge can be regarded as a 'substantive' resource, or as a 'given' factor, with inherent and predetermined consequences in production and market competition. On the other hand, knowledge can be seen as a constructed resource developed, maintained and valued within particular relational and institutional configurations embedding and evolving in time and space.

In this latter approach, knowledge is not by nature an economic resource. Knowledge is an object with an own material and immaterial 'raison d'être', embodied for instance in objects (e.g. a machine, a book or a technology), embrained in people (e.g. a personal experience or competence) or embedded in social relations and practices (e.g. a language, a culture or a tradition). It is shared and transformed within social communities and contributes, in turn, to build the existence, the meanings and the identity of these communities (WENGER, 1998; AMIN and COHENDET, 2004; AMIN and ROBERTS, 2008). Knowledge is not a 'finished' good but develops in an on-going dynamic. It is generated, used and combined along life cycles marked by a dialectical process of creation (learning) and of destruction (forgetting) (GREGERSEN and JOHNSON, 1997). The logic prevailing here is the one of reproduction and renewal over time.

Knowledge becomes an economic resource when exploited within a production system (KEBIR and CREVOISIER, 2007). In general terms, a production system is the locus where an object is identified as a resource through its implementation into a particular market offering. It builds on collaboration and competition relations among actors (e.g. firms, research and training centres or public bodies) who coordinate their activities to produce economic goods and services. Knowledge and knowledge resources are not established once and for all. They co-evolve along with the production system (NORGAARD, 1994) and transforms according to the context in which they develop (e.g. market changes, cultural evolution, new social or economic practices). Such changes can reinforce or weaken the relation between knowledge and production processes and can lead for instance to dynamics of 'renewable growth, erosion/depletion, setting off or shortage' (KEBIR and CREVOISIER, 2007).

Regional studies have widely investigated how territorial development draws on the social construction of particular knowledge resources (Figure 1). Numerous researches have highlighted the fact that innovation is not the by-product of an exogenous knowledge change but emerges from endogenous learning processes taking place within particular production systems organized in time and space. The territorial innovation models (TIMs) (MOULAERT and SEKIA, 2003) developed in the past decades have highlighted the particular learning processes driving regional competitiveness.

Originally attached to the analysis of industrial change and technological innovation, the early models of 'innovative milieu' (AYDALOT, 1986) and 'industrial district' (BECATTINI, 1990) have pointed to the cumulative and diffusion learning processes that underlie the flexible specialization of particular milieus able to innovate in a post-Fordist economy characterized by the evolution of a more specific and changing demand (SIMMIE, 2005). Learning processes have subsequently become a purpose of more specific investigations and systematic conceptualizations. Innovative regions have increasingly been regarded as 'learning regions' able to adapt local production through a continuous renewal of knowledge resources (MORGAN, 1997). Conceptual models such as 'regional innovation systems' (BRACZYK et al., 1998) or 'clusters' (PORTER, 1998) have proposed operational understanding of these learning processes and have actively contributed to perform regional policies (DOLOREUX, 2002; MARTIN and SUNLEY, 2003; COOKE, 2008).

From various perspectives, TIMs have emphasized how geographical proximity can foster the reproduction and renewal of knowledge resources in particular local production systems. They have also given prominence to technological change as fundamental factor of innovation. Regional

innovation has been illustrated through the capacity of a local production system to reproduce and renew knowledge resources through cumulative learning processes along sectoral and technological trajectories, or by the implementation of local scientific research into a (new) production system. This perspective on regional development has inspired various technological and innovation policies that have mostly been translated into public support to local R&D activities (ASHEIM et al., 2011).

In the past decade, TIMs have been an object of further investigations and of conceptual reconsiderations in a context of more open and more permanent learning processes. Various literature have pointed to the rise of an immaterial economy where knowledge intensive business services (KIBS) as well as cultural industries leads new specific forms of spatial agglomerations and of a regional/urban competitiveness (see for instance, POWER and SCOTT, 2004; SIMMIE and STRAMBACH, 2006; LAZZERETTI and COOKE, 2008; DOLOREUX and SHEARMUR, 2012). Primary to techno-scientific innovation, 'creativity' is regarded as the driver of a constant reproduction and renewal of knowledge resources in a local production system (Florida 2002). In contrast to the cumulative knowledge trajectories described in early TIMs, local creativity and innovation is increasingly perceived through new mode of knowledge production based on more reactive and *ad hoc* processes of combination and exploitation (GIBBONS et al., 1994). Local production systems have increasingly been regarded as 'project arenas' (GRABHER, 2002; QVORTRUP, 2006) or as multi-sectoral 'platforms' (ASHEIM et al., 2011) combining different types of knowledge bases (e.g. analytic, synthetic and symbolic) in a creative and reactive manner, according to shorter cycles of development.

Besides renewed considerations on the reproduction and renewal of knowledge resources in particular local production system, an increasing literature has also emphasized the importance to understanding territorial development beyond the boundary and the scale of a region. Various works have pointed to the fact that regional innovation is not only driven by endogenous dynamics of knowledge use, generation and combination but is also fuelled by external knowledge flows (OINAS and MALECKI, 2002; BATHELT et al., 2004; LAGENDICK and OINAS, 2005). Particular studies have for instance, highlighted how innovation occurs through 'global production networks' (GPN) of multinational companies (COE et al., 2004) or through the circulation of skilled workers (SAXENIAN, 2006). A local production system is thus no longer perceived as an autonomous innovative milieu but as an interacting milieu producing and renewing knowledge resources in relations with other distant milieus within 'global innovation networks' (CHEN, 2007).

## TERRITORIAL KNOWLEDGE DYNAMICS IN A BROADER ECONOMIC SYSTEM

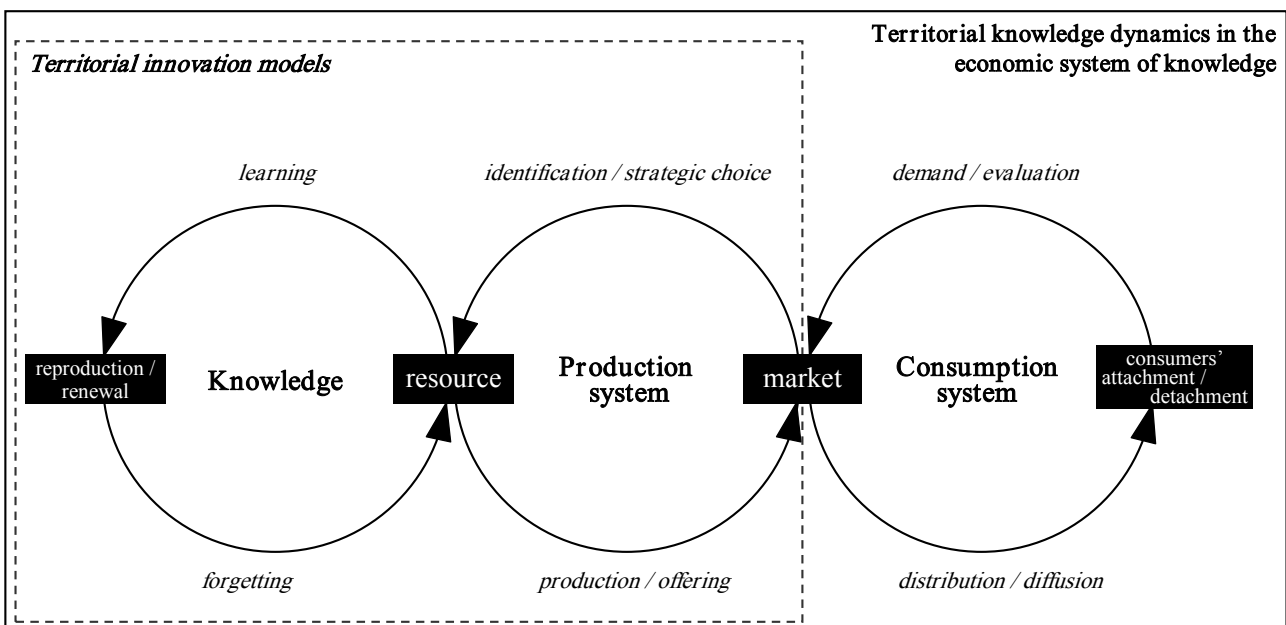
In their attempt to explain in ever more in-depth manner the complex learning processes that are at the roots of economic change, older and newer TIMs are mainly focused on production (MALMBERG and POWER, 2005; GRABHER et al., 2008). In line with an industrial approach of innovation, the economic value of knowledge is explained by the (global) competitiveness of particular (regional) production systems. While deconstructing, for instance, the relational, institutional and evolutionary processes that underlie knowledge and innovative production, this approach tend to consider as given the functioning of a market-based economy (PECK, 2005). Market acts as selection or information mechanism often taken for granted (BERNDT and BOECKLER, 2011). Competitiveness is 'observed' as the result of a market choice exogenous to the analysed dynamic of production. In other words, if regional studies and economic geography have depicted in a systematic and complex manner the knowledge processes that are endogenous to economic change, the socio-economic valuation of this change has largely remained unexplored.

Considering knowledge economy from a socio-economic and territorial point of view implies not just analysing and conceptualizing how knowledge is socially and technically turned into a resource of production across time and space. It consists in understanding how such a resource is turned into economic value in market. Not as an economic end to or from which learning, technologies and production processes are oriented, market is to be regarded *as endogenously constructed within a particular economic system of knowledge*. Market is not established once for all but is the condition of *uncertainty* under which various economic and non-economic actors coordinate their activities to assign value to different goods and services (BECKERT, 2009). In such a perspective, economic competitiveness is not given. It reflects a social and technical quality that actors assign to market objects through mutual relations of influence and by comparing and classifying them with each other (CALLON et al., 2002). Market can be regarded as a relational construction involving various actors and objects engaged in a consumption system as well as in a production system (Figure 1).

Competing and cooperating actors in the *production system* coordinate their action with regard to the market signals provided by a demand as well as by the strategic positioning of other producers (WHITE, 2002). (Knowledge) resources are turned into singular offerings in comparison with each other. Actors in the *consumption system* coordinate their activity to distribute and diffuse these objects up to end-consumers. In turn, consumers express a market evaluation and demand. This

encompasses not only the activity of end consumers but also of various intermediaries (e.g. distributors, retailers, medias, opinion leaders, groups of interest) contributing to create, enable, motivate, mediate or legitimize a consumptive attachment and detachment to particular market objects (CALLON et al., 2002). On the one hand, distribution and diffusion activities give access to certain goods and services as well as make them identifiable, comparable and valuable by end-consumer (COCHOY, 2008). On the other hand, demand and evaluation is relayed, aggregated, enhanced and given voice through social and technical intermediation. Market actors can be involved in a production and a consumption system at the same time. For instance, a media company is part of a production system when selling a magazine; it engages in the consumption system when diffusing opinions or advertisements.

FIGURE 1: CONCEPTUALIZING AN ECONOMIC SYSTEM OF KNOWLEDGE



Source: own elaboration

Market also builds upon instrumentalized, consolidated and transforming institutions that pre-exist and survive to individual actor relations (HODGSON, 2007). Institutions are mobilized and arranged by market actors to coordinate their activities and to deal with the uncertainty of 'unsatisfactory innovation' (LUNDVALL, 1988). On the one hand, market builds on particular institutionalized quality conventions (FAVEREAU et al., 2002) against which different market offerings are compared and differentiated (e.g. technical and security standards, norms of authenticity). They establish

equivalency principles against which actors justify, legitimate, adjust and direct their activity of production, consumption and intermediation. On the other hand, institutions frame market cooperation and competition (e.g. regulations or property rights) and are at the same time constraints and opportunities for action (LOASBY, 2000). They are rules according to which actors have to play and are the purpose political power and potential conflicts in their establishment, control and transformations (FLIGSTEIN, 1996). They are also rules that are instrumentalized according to strategic choices. For instance, intellectual property rights (IPR) can be utilized to protect a market offering or, at the contrary, to give access to new resources in production.

In a relational and institutional approach, market does not appear a disruptive mechanism of selection or information between production and consumption. Productive strategies occurring within the production system implies the establishment or the control of particular distribution/diffusion channels within the consumption system. In turn, the evaluation constructed within the consumption system provides particular feedback participate to institutionalize particular strategic choices within the production system (ARTHUR, 1990). The production and consumption systems co-evolve interdependently in time and space according to various relational configurations and institutional arrangements. In such a view, the mobilisation of knowledge resources in production are for instance not 'pulled' by market or 'pushed' by science. It is constitutive of market construction. It shapes, and is shaped by, the continuous (re)qualification of market goods (CALLON et al., 2002) and is part of the socio-institutional coordination of market actors. In such an economic system economic and non-economic actors face important uncertainty to establish, maintain and organise a relational and institutional continuum between the reproduction/renewal of particular knowledge resources and the final consumers' attachment/detachment to particular market goods and services. How such a continuum is socially and institutionally organised in time and space?

Dealing with a similar questioning, LUNDVALL (1988) early laid the conceptual foundations of an economic system of knowledge within which 'organised markets' and 'user-producer interactions' are endogenous to technological change and are institutionalised in particular 'national systems of innovation'. Beyond technology and nations, this questioning needs more than ever to be pursued in regional studies.

Studying *territorial knowledge dynamics* (TKDs) in their economic system today goes beyond analysing particular technological, sectoral and regional cumulative trajectories of innovation. Not

only does it imply considering how knowledge resources are increasingly used and generated through combinatorial knowledge dynamics taking place within and across various sectors and places (CREVOISIER and JEANNERAT, 2009). It also leads to consider how TKDs shape and are shaped by their socio-institutional valuation in market. How do TKDs develop and evolve in particular economic systems?

## CONTRASTING KNOWLEDGE ECONOMIC SYSTEMS

Drawing upon various illustrative cases studies, the next sections highlight the particular relational and institutional configurations and the prevailing TKDs that characterize various forms of economic systems. Four ideal-types of economic systems are distinguished: the economic systems of knowledge *viabilisation*, of knowledge *improvement*, of knowledge *adaptation* and of knowledge *co-development* (Table 1).

This typology is derived from a *qualitative metasynthesis* (SANDELOWSKI et al., 1997) of 23 case studies realized and reported in framework of the EC FP6-funded project EURODITE led between 2005 and 2010 (Contract No. 006187). These case studies gave accounts on the knowledge dynamics shaping particular economic developments in Europe (MACNEILL and COLLINGE, 2010). A particular attention was paid to the way knowledge is generated, used and combined not only within but also between different firms, sectors and regions. The empirical illustrations used in the conceptual discussion bellow provide a selective account of these various cases.

Conversely to other forms of meta-analysis or comparative studies, the objective of the metasynthesis was not to aggregate, resume and compare different reported cases. Primary case studies were deconstructed and used as idiographic material to reconstruct a new theoretical interpretation (SANDELOWSKI et al., 1997). Building on the conceptual reflexion provided in the first part of the paper, the elements of specific economic systems of knowledge were reconstructed around four majors issues: (1) the form of uncertainty characterizing the system; (2) the type of actors and relations involved in the system; (3) the institutional arrangements governing the system (in particular IPR, standards and public regulations); (4) the territorial organisation of the system (in various locations and at various spatial scales); (5) the influential policies at stake in the system.

These particular qualitative elements were progressively depicted and 'translated' from a case to another (THORNE et al., 2004). This translation enabled to build and to contrast different ideal-types

of economic systems of knowledge and to discuss them with regard to established socio-economic theories of markets, of technical change and of territorial innovation.

TABLE 1: CONTRASTING KNOWLEDGE ECONOMIC SYSTEMS

	<b>KNOWLEDGE VIABILISATION</b>	<b>KNOWLEDGE IMPROVEMENT</b>	<b>KNOWLEDGE ADAPTATION</b>	<b>KNOWLEDGE CO-DEVELOPMENT</b>
<b>Purpose of uncertainty in actors' coordination</b>	Market failure, sunk costs	Remaining updated with an evolution of the demand, conserving market position, path dependence	Mastering the production of a new supply or reaching a new demand	Loyalty and adequate evaluation of consumers of the product particularities
<b>Relational organisation (configuration of actors and important technical devices)</b>	Scientific communities, pioneer entrepreneurs, hybrid consortiums, universities as knowledge incubators Research programs, military funding	Competing lead producers, specialised pools of suppliers, dedicated KIBS and universities. Targeted research, positioned goods in market, devices of comparison and certification	Multinational service and trend providers, Universities as translators of new practices. Basis (technological, organisational) infrastructures, established best practices	Original creators, initiators, knowledgeable audience, influential connoisseurs Goods and services as technical/cultural toolkit, acknowledgement awards, labels of origin
<b>Institutional arrangements (more specifically, standards and IPR)</b>	Imposing new standards; IPR instrumentalized as pre-market knowledge monetisation	Standards as positioning tool; IPR to protect market position and to control market entry	Standards as transition opportunity and reducer of uncertainty; IPR to control knowledge in specific applications	Standards and IPR to acknowledge/authenticate shared knowledge between producers and consumers
<b>Territorial knowledge dynamics (TKDs)</b>	Global scientific/firm consortiums Local anchoring through new product devising Upper scale institutionalised consumption	Knowledge combination within global production networks Local anchoring in dedicated and specialised production systems Global distribution networks	Globalised market trends and, multi-local exchange of best practices Local anchoring through the (re)generation of the production system Localised consumption systems as opportunity to exploit knowledge application	Organised producer-consumer co-presence (physical and virtual) through multi-local stages of experience, initiation or legitimation. Local anchoring by staging common knowledge in production and consumption
<b>Influential policy</b>	Funding of fundamental research programs at supra-regional level Regional policy of science transfer (e.g. triple helix) Institutionalisation of supra-regional standards of consumption	Important dependency to large multi-national companies, dedicated and specialised intervention, policy path dependences	First impulse to regional transition, financial support to pre-market transition, Platform policy of sectoral (re)combination Supra-regional exchange of best practices, negotiated access and exploitation of standards	Legitimizing voice, participation to local stage setting, public authentication and certification localised specificity

Source: own elaboration

## THE ECONOMIC SYSTEM OF KNOWLEDGE 'VIABILISATION'

The term 'viabilisation' is adopted from French to designate the idea of 'making something viable'. Knowledge viabilisation is at stake when knowledge is developed as a new potential out of a pre-established market (e.g. fundamental research or technological development). In such a context, the economic system organises around the necessity to 'make viable' (AMENDOLA and GAFFARD, 1994) the exploration of radically new knowledge resources (MARCH 1991). In the EURODITE case studies, knowledge viabilisation mostly relates to techno-scientific projects and developments.

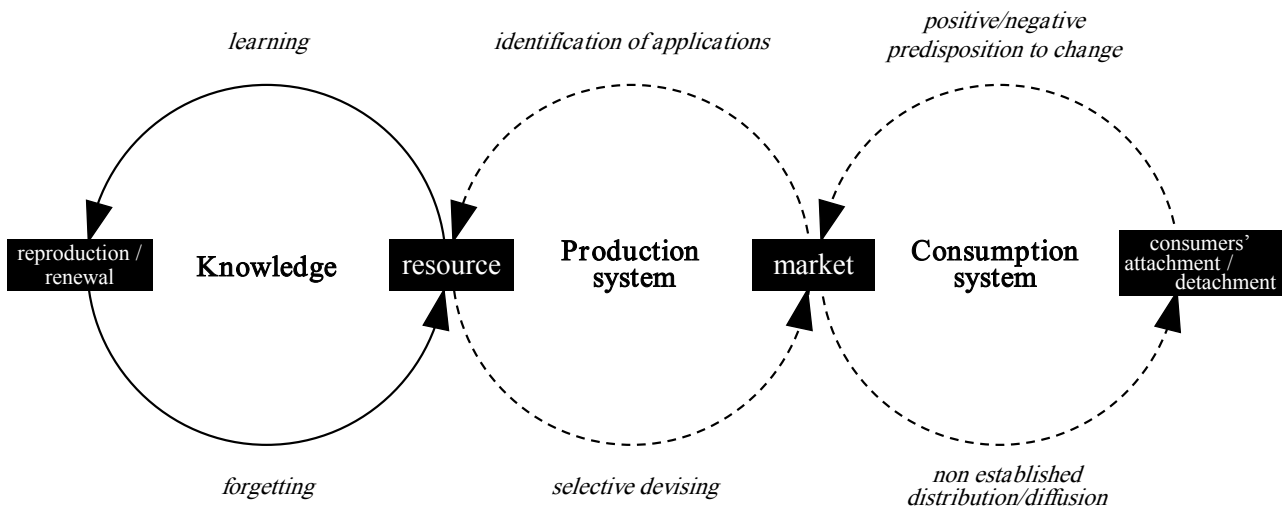
Knowledge viabilisation implies the socio-institutional construction of a new production system as well as a new consumption system (Figure 2). The construction of the production system implies a *selective devising* that consists in identifying a new market application out of new 'productive options' implied by a fundamental knowledge development (AMENDOLA and GAFFARD, 1994). It is for instance the devising of new in-car or wireless services based on the Global Navigation Satellite Systems (GNSS) technology developed in Midi-Pyrénées (BALLAND and VICENTE, 2009; VICENTE et al., 2011), or the devising of new medical or imagery applications based on the fundamental laser technology developed in Aquitaine (CARRINCAZEUX et al., 2009). The construction of the consumption system consists in the implementation of new diffusion and distribution activities inciting consumers to attach to the new offering. Consumers and civil society expresses, in turn, their *positive or negative predispositions to change*. For instance, the civil reluctance and unfavourable press coverage in Europe about genetically modified organism (GMO) restrains potential applications of genetic science in the food production system (VISSERS and DANKBAAR, 2009).

Uncertainty within such an economic system not only relies on the potential market of a potential radical innovation or a new technological trajectory (DOSI, 1982; NELSON and WINTER, 1982). It also concerns the fundamental *temporal lag* existing between the exploration of new knowledge resources and their market exploitation (sunk costs) (AMENDOLA and GAFFARD, 1994). Relational configurations and institutional arrangements reflect particular forms of coordination not only driving market change, but also making this change viable in time and space.

Led by universities, *scientific communities* are essential actors in knowledge creation and *pioneer entrepreneurs* are the ones capable to understand the potential of new knowledge creation and to turn it into market offering. Pioneer entrepreneurs often stem from scientific communities and develop particular applications based on earlier research. Consortiums bringing different strategic

actors together under a common research project are also typical organisations of knowledge viabilisation. They provide coordinated solutions to cover sunk costs and to share complementary knowledge. Consortiums promote a multilateral configuration of public and private actors that enable companies to share research and investments and to overcome their mutual competition (VISSERS and DANKBAAR, 2009).

FIGURE 2 : THE ECONOMIC SYSTEM OF KNOWLEDGE VIABILISATION



Source: own elaboration

In such an economic system, institutions are instrumentalised to construct market or to monetise fundamental knowledge creation before being applied in a particular market offering. It is for instance the case of IPR that enable small and medium size biotech companies in the Bavarian regions to develop fundamental knowledge by ‘in-licensing’, which consists in buying existing licences in order to develop and re-sell them further to other companies (KAISER et al., 2008; KAISER and LIECKE, 2009). The institutionalisation of global technical standards and their application by providers of applications will determine the success of the GNSS (BALLAND and VICENTE, 2009). In turn, particular regulations expressing a particular reluctance to consumption change also impact on the viabilisation of fundamental knowledge. For instance the European moratorium on GMOs leads biotech companies to develop hybrid research based on traditional seed breeding practices as well as on genetic manipulations (VISSERS and DANKBAAR, 2009).

Knowledge viabilisation reflects particular TKDs organising within and between particular regions and milieus. In early processes, knowledge is mainly created and made mobile within global

scientific communities. National and international research and education programs are major drivers and supports of such communities. Equally, research consortiums bringing large multinational companies, research organisations and national agencies develop across various regions and nations. Knowledge creation occurs within multi-local and global research networks.

Whereas reproduction and renewal of fundamental knowledge occurs within spread scientific communities and 'pipelines' of multinational consortiums (BALLAND and VICENTE, 2009), the construction of production systems usually occurs through *local devising*. Universities are important players participating at the same time to the creation of mobile knowledge and to the anchoring of knowledge resources in a local production system (CARRINCAZEUX et al., 2009). Localised public intervention supports the emergence of the production system by providing strategic and financial backup to pre-competitive knowledge development (provision of venture capital, military spending, strategic research funding, creation of strategic science parks and incubators).

In a regional and production perspective, knowledge viabilisation occurs through close interaction between firms, universities and public intervention, which recalls a 'triple helix' organisation. However, it appears too restrictive to consider such an economic system as a localized productive devising of new knowledge resources. Not only are multi-local relations and upper scale research institutions crucial in upstream knowledge creation, they are also determinant in the construction of the extra local consumption system. Constraining regulations (ex. moratorium on GMOs in Europe) and standards (e.g. technical, health, or security) institutionalized at national, European, international levels are for instance decisive in the economic success of productive applications. The value of a regional innovative product cannot be dissociated from the upper scale institutions that facilitate, enable or restrain changes in consumers' market evaluation.

### THE ECONOMIC SYSTEM OF KNOWLEDGE 'IMPROVEMENT'

In contrast to knowledge viabilisation, knowledge improvement occurs in an established market context. Production and consumption processes are stabilised around identified goods or services. Production resources are well-identified and well-mastered. Different lead producers compete on a common fundamental knowledge basis (e.g. a similar technology applied to a similar product). Within the consumption system, distribution and diffusion channels are efficient and influential (e.g. professional retailers, specialized press coverage) (Figure 3).

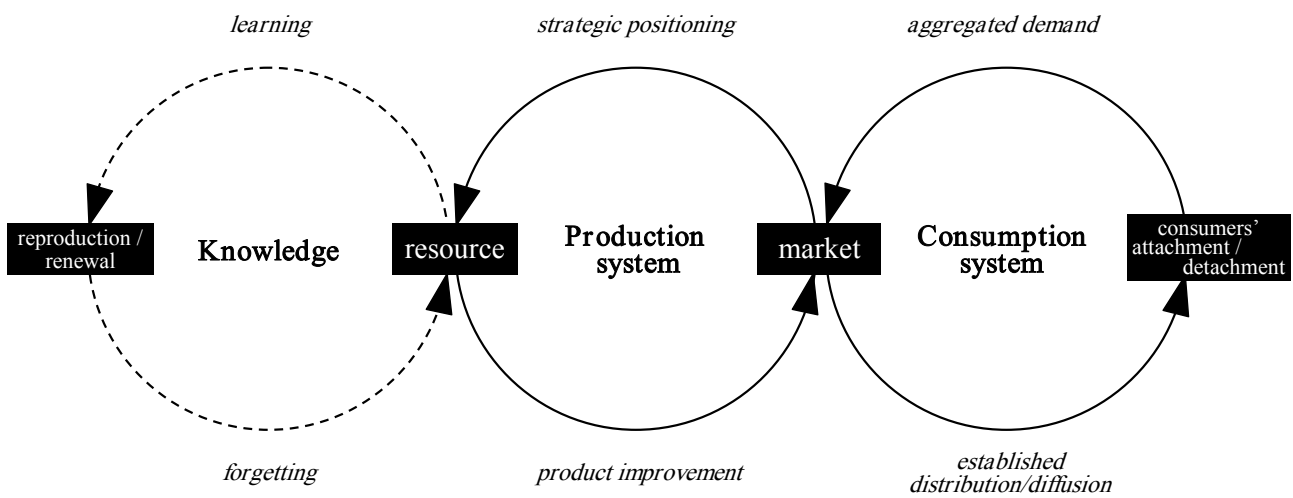
EURODITE case studies related to the automotive industry are particularly illustrative of such an economic system of knowledge. In such an industry, market builds upon car manufacturers exploiting similar fundamental technology (airbag, fuel injection system, anti-lock braking system, electronic stability system, etc.). Also, the production chain is organised around large and specialised subcontractors (e.g. 'original equipment manufacturers'). Influential distribution/diffusion channels are well-established up to end-consumers (e.g. media coverage, specialised retailers) and various intermediaries relay and express the opinion and the evolution of an *aggregated demand* (e.g. consumers' lobbies, critical groups of interest). The institutionalisation of particular quality standards establish this aggregated demand and impacts on the production changes (e.g. new security or environmental standards).

In the economic system of knowledge improvement, uncertainty relates to the capacity of producers to follow the evolution of basic technologies, of the general demand and to defend their strategic market niche (WHITE, 2002). In such a context, knowledge developments occur in two ways. On the one hand, it relies on cumulative knowledge processes along a particular sectoral trajectory (MALERBA, 2002). For instance, the generalisation of electronics in automotive engineering or the adoption of new environmental regulations leads car manufacturers to develop new knowledge to remain competitive (BLÖCKER and JÜRGENS, 2009; MACNEILL et al., 2009). On the other hand, knowledge improvement relies on a *strategic market positioning* among competing end producers. For instance, the Volvo company developed new pioneer crash-safety technology to maintain its market position of highly reliable and safe car manufacturer (LARSSON, 2009).

With such an economic system, socio-institutional relations are mostly hierarchical and dominated by large leading companies with an important investment capacity. For this reason upstream knowledge suppliers (e.g. research institutions, sub-contractors or KIBS) develop specialised, dedicated and very dependant activities (STRAMBACH et al., 2009). Already in early stages, lead producers seek to accompany, orient and control new fundamental knowledge development (BLÖCKER and JÜRGENS, 2009). Public players develop dedicated technological policies, education programs or structural intervention to reinforce the competitive capacity of lead producers and affiliated suppliers. Quality standards and IPR participate to stabilising producers' market positioning. For instance, in the mature pharmaceutical industry, large leading companies purchase strategic patents to maintain, reinforce or protect their market position against other competitors (VISSERS and DANKBAAR, 2009).

Stable and standardised quality conventions established at upper scales support the creation of distant distribution channels and the global aggregation of the demand. TKDs are therefore primarily organised around production issues. Production is strongly standardised and organised by multinational companies in *global production networks* (HESS and YEUNG, 2006). Knowledge circulates across space in such networks. At local scale, public and private initiative seeks to provide specialised solutions within such production processes.

FIGURE 3 : THE ECONOMIC SYSTEM OF KNOWLEDGE IMPROVEMENT



Source: own elaboration

In the *home regions* of lead producers, particular public supports, specialised subcontractors or dedicated research organisations seek to provide strategic knowledge resources (e.g. new electronic research in collaboration with the Volkswagen company in Southeast-Lower Saxony or development a safety solutions with the Volvo company in Västtra Götaland (BLÖCKER and JÜRGENS, 2009; LARSSON, 2009). Such applied developments often imply mobilising cross-sectoral knowledge resources from different regions. KIBS are particularly important intermediaries that make knowledge accessible and exploitable the dedicated production system (STRAMBACH et al., 2009). *Affiliated regions* organised around major international suppliers also develop specialised and complementary knowledge resources. For instance, various public and private initiatives take place in the Veneto region to develop particular specialised solutions for international mature industries (e.g. nanotech or design for large international production companies)(STOCHETTI et al., 2009).

## THE ECONOMIC SYSTEM OF KNOWLEDGE ADAPTATION

Knowledge adaptation occurs when the production system undertakes a *reactive transition* to adapt with regard to an *expressed demand* and identified knowledge resources. It differs from knowledge viabilisation, as adaptation occurs within an existing production system, as well as from knowledge improvement, as new knowledge resources in production are oriented toward a new demand (Figure 4).

Knowledge adaptation can be induced by an 'external shock' (quick changing demand, new regulations, industrial or financial crisis, etc.) that challenges the resilience capacity of the production system (PENDALL et al., 2010; SIMMIE and MARTIN, 2010). Very diverse EURODITE cases illustrate such a situation. For instance, the increased global competition leads the industrial production system of the Ruhr area to mobilise new knowledge resources in tourism or event organisation (BUTZIN and WIDMAIER, 2009). The sudden increase of Russian tourists in the Antalya region leads the local production system to adapt its practices (e.g. language, skills, services) to the new demand (DULUPÇU et al., 2009). Similarly, the opening of borders and the rapid increase of a domestic demand for new information and communication technologies in Slovakia or Slovenia implied an important adaptation of the local IT service providers (REHAK et al., 2009; STANOVNIK and MUROVEC, 2009).

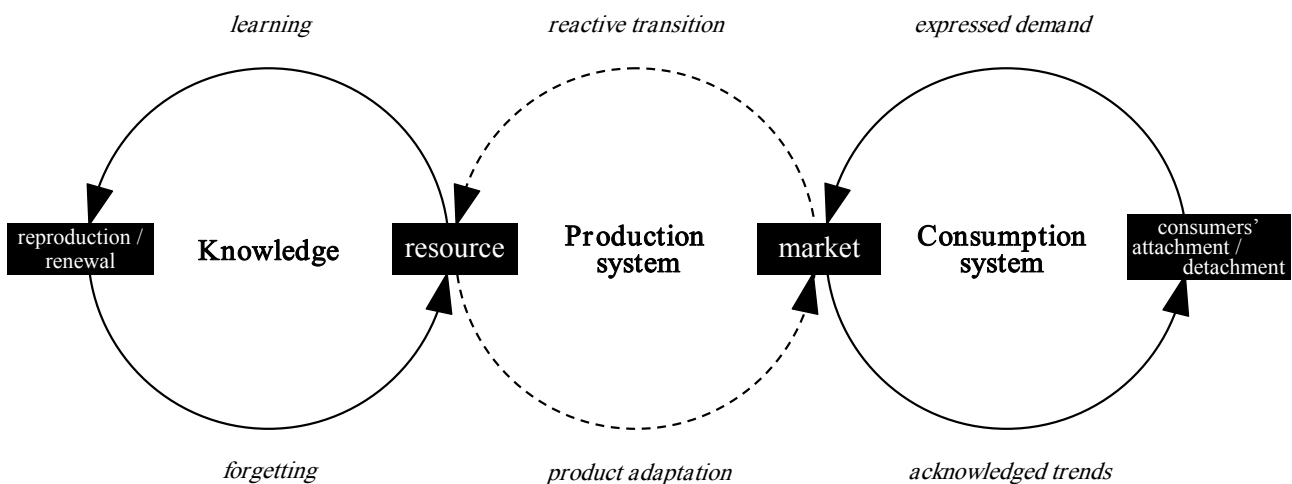
Knowledge adaptation can also be motivated by a new identified market opportunity. It is for instance the case in Aquitaine or Wales where new knowledge combinations are occurring between biotech and agro-food activities to respond to the increasing demand for green or healthy food (CARRINCAZEAUX et al., 2009; DE LAURENTIS and COOKE, 2009). In such cases, the emergence of a new consumption trend leads to the development of new knowledge platforms (HARMAAKORPI, 2006; ASHEIM et al., 2011).

Within such an economic system, uncertainty is characterized by the ability of actors involved in the construction of the new production system to implement productive continuity between new identified knowledge resources and a new identified demand. Such a knowledge economic system primarily implies a change process in the production system (e.g. regeneration of industrial activities through tourism activities or adoption of new technological solutions to provide dedicated products). As knowledge adaptation often implies a preliminary phase of transition before the new resources become competitive in market, public incentives are particularly influential. Particular

programs supporting cross-sectoral collaborations or exchange of best practices are key technical backups.

Actors involved in knowledge adaptation are of different kinds. Large international companies are often providers of new generic knowledge. For instance, international consultancy companies are major players in the importation of IT knowledge in the Bratislava region (REHAK et al., 2009). Also, large European tour operators play a strategic role in the adoption of new tourism business models in the Antalya region (DULUPÇU et al., 2009). More particular firms (e.g. SMEs) attempt to appropriate generic knowledge to implement particular solutions. Universities or KIBS tap existing knowledge and participate to a tailor made applications in the production system.

FIGURE 4 : ECONOMIC SYSTEM OF KNOWLEDGE ADAPTATION



Source: own elaboration

Institutionalized standards (technological or cultural), best practices and IPR provide access to new knowledge. For instance, standardised or branded events such as international conferences, exhibitions, fairs, sports tournaments or cultural happenings are often used to boost the adaptation of traditional economic activities (BUTZIN and WIDMAIER, 2009).

At a territorial level, knowledge adaptation European or international institutionalised standards, best practices or new consumption trends facilitate the identification of new potential knowledge resources or market opportunities. The establishment and control on institutions significantly influence how knowledge circulates and anchors in different places. Multi-national companies seek to control standards and their derived applications in various consumption contexts.

At a regional level, the production system can adapt in various ways according to the changing socio-economic context, to new potential knowledge resources or to new market opportunities. It can adapt in a generic way by mobilising standardised resources and by implementing generic activities addressed by the demand. For instance, a region can adopt a standardised tourism strategy to promote new economic activities (e.g. organisation of main stream events). Such a generic adaptation is quite fragile as it relies on common undifferentiated knowledge (e.g. cost differentiation). For this reason, the adaptation of the regional production system most often relates to specific adaptation too. Regional specification can take various forms.

In some cases, specification consists in mobilising generic knowledge through best practices and in combining it with the particular local production system (e.g. tourism initiative related to the manufacturing heritage of the Ruhr area). In other cases, it bases on a specific demand (specification to Russian tourists in the Antalya region or specification to the domestic ICT demand in Slovenia or in the Bratislava region). Finally, it can also be organised through the combination of two (or more) existing local production systems in the context of an identified generic demand (bio-food production in Aquitaine or in Wales). In all these different cases, local public support plays an important role of initiator and local research structures provide the access to mobile knowledge and anchor it in a specific way.

### THE ECONOMIC SYSTEM OF KNOWLEDGE CO-DEVELOPMENT

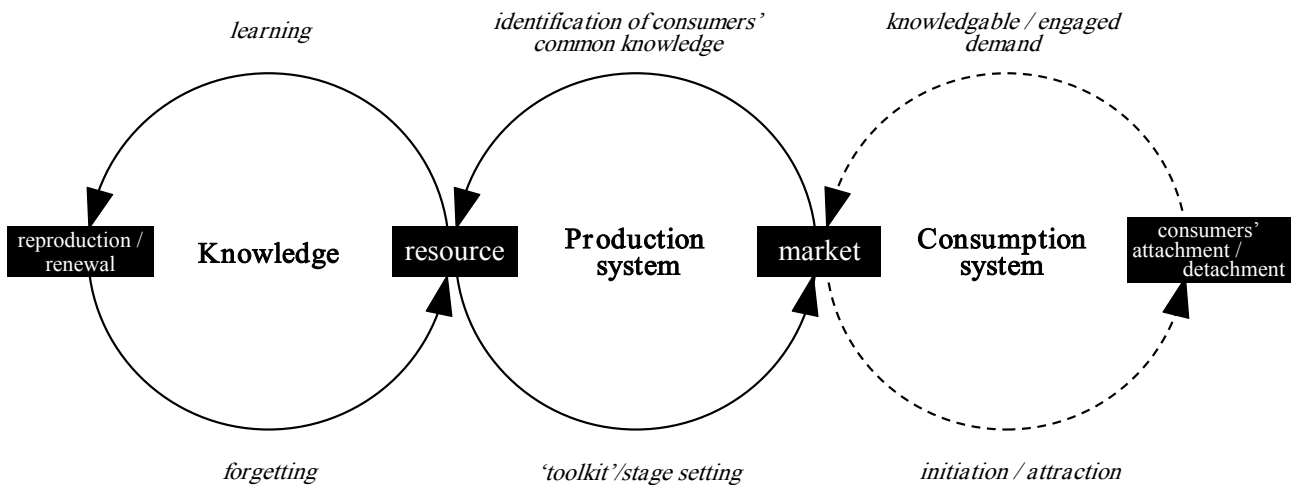
In knowledge viabilisation, improvement or adaptation, the consumption system expresses positive or negative feedbacks of a general demand: producers know *about consumers*. In particular cases however, it is not merely knowledge about consumers but rather knowledge *of* consumers that becomes a resource for producers. In such cases products are not finished goods or services but rather regarded as 'toolkits' *co-developed* in market by the consumption system (VON HIPPEL, 2005, GRABHER et al., 2008). The case of open-source software development is often mentioned as an iconic example. However, the notion co-development should not only be restrained to sophisticated technical use. With the rise of cultural and leisure industries, consumer knowledge is also increasingly engaged in the symbolic valuation of goods and services.

It is the socio-cultural dimension of knowledge co-development that is emphasised by various EURODITE case studies. It is for instance the case of specific tourism activities in Skåne that capitalize on the knowledgeable readers of detective Wallander novels taking place in this region

(DAHLSTRÖM et al., 2009). On the island of Bornholm, local food producers promote branded products based on particular imaginaries and songs learnt at school by Danish pupils (MANNICHE et al., 2009). Also, car companies in the West-Midlands or Swiss watch manufacturers seek to escape from mass competitors through authentic products relying on advanced consumers' knowledge about their specific cultural and technical value (e.g. historical technology or historical design, traditional manufacturing skills or sport heritage).

In such cases, producers use consumer's knowledge as a resource to build a specific authenticity or to sell a 'memorable experience' (PINE and GILMORE, 1999). Innovation in production is oriented by the identification of *consumer's common knowledge*, which is turned into resource. For instance, consumers' knowledge about mechanical watches enable Swiss watch manufacturers to establish their legitimacy through the development of new mechanical complications (JEANNERAT et al., 2009; JEANNERAT and CREVOISIER, 2011). In a similar view, the new cars developed by Morgan Motors conserve some historical particularities recognised by consumers as authentic such as flowing wings, a flat windscreen or an ash frame (MACNEILL et al., 2009).

FIGURE 5 : ECONOMIC SYSTEM OF KNOWLEDGE CO-APPROPRIATION



Source: own elaboration

In the case of knowledge co-appropriation, uncertainty relates to consumer's knowledgeability about the technical and cultural value of the product. Technical devices support processes of consumer's initiation such as training activities, visits of production sites, or particular pedagogical exhibitions. Also experiential stages are set to merge consumers in producer's environment and to

create a particular learning context about the particularities of the product (visit of production sites or of places of historical imaginaries).

The socio-institutional organisation of the system supports the initiation of intermediaries and end-consumers who become '*connoisseurs*'. Particular *hybrid communities* develop and evolve around shared knowledge (GRABHER et al., 2008). They are funded by producers (e.g. exclusive 'clubs' of Aston Martin or Morgan cars owners)(MACNEILL et al., 2009) or by consumers (e.g. online community of watch aficionados)(JEANNERAT et al., 2009). Particular collaborations between complementary producers sharing same imaginaries are established to reinforce common knowledge (e.g. joint events between luxury car and luxury watch brands). Particular intermediary such as journalists, ambassadors (e.g. of Bornholm product or Swiss watches) or event organisers ensure the initiation to and legitimation of common knowledge within market evaluation (JEANNERAT et al., 2009; MACNEILL et al., 2009; MANNICHE et al., 2009).

Public intervention legitimizes common knowledge by providing formally independent voices (e.g. public patronage of awards or public labelling). Institutions such as copyrights or quality labels (e.g. Bornholm food or Swiss Made) are not merely mobilised to protect production processes. They are also utilized to recognize the common knowledge shared by producers, consumers and intermediaries on valuation criteria (e.g. certification of authenticity).

At territorial level, knowledge resources are mainly mobilised within global production networks (standardised solutions) while cultivating specified relations with consumers are organised through various forms of co-presence between producers and consumers. Such co-presence can be virtual (e.g. virtual forums) or geographical (proximity of producers with consumers). In the different analysed cases, geographical co-presence remain crucial and is ritualised stages of production (e.g. the promotion of food products through tourism activities or visit of factories by strategic consumers or ambassadors), of consumption (e.g. experiential retailing, initiation programs or travelling exhibitions) and of intermediation (for instance, the Le Man racing cup for Aston Martin). Such multi-local knowledge dynamics support knowledge exchange about specific products, about specific production contexts, and through consumer's engagement.

## CONCLUSION

The analytical focus progressively placed on knowledge by regional studies has enabled to understand the complex dynamics of territorial development. Nevertheless, the shift from innovation to knowledge in the conceptualization of economic change has still left unachieved the question of market valuation. Schematically, knowledge is perceived as the main resource of innovation and economic value of innovation is explained as a productive competitiveness. In line with emerging critical literature, we have advocated in this paper the need to conceptualize TKDs in a broad economic system. In particular, we have argued that the economic value of knowledge resource must be understood through the market co-construction of a production and a consumption system. This approach echoes the fundamental theories, largely retrieved in regional studies, advocating the need to go beyond a linear model of innovation, (see for instance, KLINE and ROSENBERG 1986; LUNDVALL 1988). Introducing a systematic approach on production and consumption processes to understand TKDs provides the opportunity to extend and complement established TIMs.

On the one hand, the increasing focus on knowledge as object of analysis and comprehension has progressively taken some distance from the meso-level interpretation of territorial development in favour of evermore micro processes taking place at the level of firms and actors (LAGENDIJK, 2006). The 'cognitive' emphasis placed on innovation processes has blurred the broader context within which knowledge use and generation make an economic sense (MARTIN and SUNLEY, 2001). Considering market not as an external device but as a constitutive element of a learning system (Potts 2001) leads to interpret the notions of knowledge, innovation or creativity in their broader economic context.

Through the construction of the archetypal economic system of knowledge viabilisation, improvement, adaptation and co-development (Table 1), this paper advocates the need not to go beyond innovation policies exclusively oriented by local techno-science transfers and to consider knowledge exploration and exploitation (MARCH 1999). It implies considering territorial innovation in an economic system institutionalized at various spatial scales (GERTLER, 2010) and organised across interdependent milieus of production, of control, of intermediation and of consumption. Not mutually exclusive, these analytical point to regional policies no longer based on technological and sectoral trajectories but on the organisation of different economic system whereby market appears not as 'invisible hand' but as a matter of complex relational and institutional construction.

On the other hand, the industrial paradigm upon which TIMs have been built primarily highlights the technological and sectorial trajectories driving firm and their up-stream relations of supply and R&D activities. Down-stream process of innovation related to consumption processes have largely been 'neglected' (GRABHER et al., 2008). (Re)introducing consumption into the conception of innovation does not necessarily means that end-consumers are always primary players in economic change and territorial development. It more generally leads to consider on the actors configuration and institutional arrangements influencing and intermediating their voice and participation in the market valuation of knowledge resources. In some cases, the influence of consumption relates to general feedbacks regarding a radical change in production. In other cases, it participates to incremental changes in production through the expression of an aggregated voice. Sometimes, it also provides an impulsion to new production processes by creating new identifiable demand. Or, in some other contexts, consumption participates more directly to the co-creation of economic value by engaging with common knowledge with production. However, the increasing prominence of cultural activities and symbolic knowledge-bases in innovation as well as the new centrality of interactive communication platforms (e.g. online media, communities or networks) enhances the role of consumers' engagement in economic valuation today. In this perspective, not only is knowledge co-development called to become central in future economic systems. Knowledge viabilisation, improvement and adaptation develop an 'economy of qualities' (CALLON et al. 2002) built on complex and influential consumption systems.

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