

# From regional innovation to multi-local valuation milieus

## The case of the Western Switzerland photovoltaic industry

*Christian Livi, Hugues Jeannerat and Olivier Crevoisier*

### Introduction

The issue of the agglomeration and the location of economic activities has been the subject of numerous regional studies. Various conceptual models have been developed to show how certain socio-economic processes shape particular spaces and how they, in turn, are shaped by them. These models principally reflect a process of economic globalization characterized by the increased mobility of goods and services but limited by those production factors that underpin innovation, such as knowledge and innovation capital. Of these various models, the concept of *innovative milieu* provides an explanation as to how certain local players end up developing formal and informal production and innovation networks, autonomous in an increasingly integrated global economy (Camagni and Maillat 2006). To what extent should this approach be updated to take into account current thinking and include new territorial, economic and social dynamics?

In this chapter, we argue that, although it still allows us to understand certain important local innovation processes, the definition of the ‘innovative milieu’ – and along with it traditional territorial innovation models more generally – should be opened up to renewed questioning. On the one hand, classical regional entities have to be reconsidered with the purpose to understand the relational dimension of the social dynamics of innovation networks (SDIN) in order to define regional milieus within proximity and distant relations (Rutten and Boekema 2012). Such an approach does not only give prominence for instance to the local accumulation of knowledge and financial resources, but also to their mobility and multi-local anchoring (Crevoisier and Jeannerat 2009; Theurillat 2011). On the other hand, restricting innovation to an understanding of knowledge use and generation across space provides a too partial comprehension of territorial development. Not merely should innovation be depicted as a competitive economic change. It should also fundamentally be analysed as a socio-economic process of value creation taking place in time and space.

Building upon these particular arguments, we examine the social and territorial forces that characterize the photovoltaic industry in Western Switzerland and identify the relations forged within the region. We point to the various territories in which different innovations are developing in conjunction with

photovoltaic technology and show the new territorial forms that these innovations in turn then create. In this case, territorial innovation is not merely understood as the result of multi-local knowledge dynamics but also as a socio-economic market valuation of ‘responsible’ innovations. This valuation process develops through local and multi-local investment, manufacturing, consumption and mediation processes.

Throughout this particular case study, we advocate the need to revisit the traditional notion of *innovative milieu* and open new avenues for future research in regional studies. In a globalized knowledge economy examined more and more through complex social interactions among proximate and distant socio-economic agents (Rutten and Boekema 2012), it is not sufficient to examine innovation *per se* as the driver of territorial development. Understanding innovation’s socio-economic market valuation (Beckert and Aspers 2011) across various places and at different geographical scales clearly appears as a critical and decisive issue for regional studies. To instigate such a broader socio-economic approach to territorial innovation, the concept of ‘multi-local valuation milieu’ is proposed as a possible exploratory framework for a future research agenda.

### **Territorial Innovation Models: the emergence of new thinking**

Since the 1980s, there has been an increasingly territorial approach to economic development in relation to the issue of innovation and competitiveness. Various different conceptual models such as *Innovative Milieus* (Camagni and Maillat 2006), *Regional Innovation Systems* (Lundvall 1992), *Learning Regions* (Florida 1995; Morgan 1997) or *Clusters* (Porter 1998) have shown how geographical proximity can enhance innovation and competition in certain regions. In particular, these models show how regional innovation is based on market and non-market relations between local players, relying on prior socialization (confidence, shared competition/cooperation rules, social capital, common language, etc.) (Grossetti and Godart 2007).

In recent years, critical reviews of these ‘territorial innovation models’ (TIMs) have been published (Doloreux 2002; Moulaert and Sekia 2003; Simmie 2005; Lagendijk 2006; Benko 2007; Cooke 2008) and are currently the subject of renewed examination. This chapter is not intended to provide a new assessment of these models but to use certain aspects of TIMs, and in particular the ‘innovative milieu’, as a means of understanding territorial development and innovation.

#### ***Territorial Innovation Models and Innovative Milieus***

Although TIMs are based on different research traditions and different schools of thought (Moulaert and Sekia 2003; Lagendijk 2006), we can see that they share certain common conceptual approaches to the phenomena of economic development and innovation.

First, *technological evolution* is seen as the basis of competitive innovation. Regional innovation is largely characterized by the ability of local manufacturing systems to either flexibly adapt to constant changes in demand (*flexible specialization*) (Simmie 2005) or to develop and incorporate new technology into goods or manufacturing tools that outperform those of their market competitors. Based on a strong intra-regional focus, TIMs theory considers innovation as the main factor in competitive differentiation and represents a company's evolution in its technical, social, natural or market environment (Crevoisier 2010; Rutten and Boekema 2013).

Innovation is also seen as the main driving force behind economic change and as a process that reflects the ability of local players to respond autonomously to challenges presented by the wider socio-economic environment (Doloreux 2002; Moulaert and Sekia 2003). However, regions are not completely independent production entities but specific systems capable of developing *endogenously* in response to the global environment, which itself remains relatively poorly defined (Crevoisier 2010). This endogenous growth does not only occur in response to changes in the global environment but is also determined by the territorial context in which the innovation is rooted (institutions, culture, traditional skills, investment channels, networks of players, etc.) (Lorentzen 2008).

Regional innovation is therefore seen as a process of generating and using knowledge and financial resources, representing local cumulative and distributive practices specific to a place. It is typified by relatively long life cycles or by spatial and historical *path dependencies* (technological, industrial, institutional, social etc.) (Boschma and Frenken 2009; Martin 2010). Innovative capacity (i.e. entrepreneurship) is thought of as regional and economic development perceived as the capacity of competing territories to innovate (Crevoisier 2010).

Ultimately, TIMs are based on a production-based vision of economic development (Grabher *et al.* 2008). Indeed, the region is principally seen as a specific production system that competes with other production systems. The existence of sophisticated local demand is seen as an opportunity for innovative technological developments (Porter 1998). However, a region's competitiveness is based principally on its capacity to export to an extra-regional market, rarely differentiated, often *footloose* (Malmberg and Power 2005). From this point of view, the response to the socio-economic challenges presented by globalization has been the mobility of goods and services: produce locally; export globally (Jeannerat 2013).

The *innovative milieu* model that was widely taken up, developed and consolidated following the pioneering work of Philippe Aydalot (1986) in many ways reflects this territorial innovation approach of competitiveness. Set against a backdrop of regional industrial decline, this theory took into account a process of economic development increasingly influenced by the need for flexible manufacturing and networked innovation in the face of varied and changing market demand (Crevoisier 2001). Emphasizing territorial and social issues, the innovative milieu approach posits territory as a constitutive element of

innovation and economic change. It encompasses the idea that technological, organizational and territorial factors all go to determine the regional milieus that generate innovation for new products, technologies and organizations (Camagni and Maillat 2006).

This being the case, the innovative milieu represents the territorial setup in which the processes of innovation emerge. It posits the entrepreneurial activity of economic players and their privileged local relations as the endogenous force behind the creation of specific resources (Coppin 2002). Thus, territory is seen as part of the processes of innovation and a fundamental framework for understanding economic change. It reflects the spatial nature of the socio-economic transformations studied and vice versa (Crevoisier 2001). The innovative milieu model commonly emphasizes the importance of what local players do and their ability to generate the resources required for innovation. Based above all on an industrial and technological approach to economic development, it emphasizes how local training and collective learning can foster the economic competitiveness of specific production systems (Lundvall and Johnson 1994).

There are two lines of thought that allow us to expand and examine TIMs in greater depth: on the one hand, demonstrating the mobility of resources and, on the other hand, the emergence of theories about market construction and the socio-economic value of goods and services.

### ***Contemporary reflections: the mobility of production factors and the socio-economic market valuation***

From the early 2000s onward, the TIM approach to economic change and innovation, particularly innovative milieus, has become subject to theoretical and empirical re-evaluation. There are increasing calls to take into account new socio-economic issues in order to gain a wider understanding of territorial and economic development. In our view, two major critical avenues are particularly noteworthy in this regard.

The first deals with the *mobility of production factors*. Whilst the TIMs' approach focused primarily on the mobility of goods and services, these days we also have to consider the increased mobility of production factors (Sheller and Urry 2006; Urry 2008; Cresswell and Merriman 2008), particularly knowledge and capital, based notably on diffused networks of individuals (Rutten and Boekema 2013).

In fact, various works demonstrate the trans-regional (Henderson *et al.* 2002; Coe *et al.* 2004; Saxenian 2005), multi-local (Crevoisier and Jeannerat 2009) and meta-national networks (Doz *et al.* 2001; Cooke 2005) shaping the generation, usage and (re)combining of knowledge that characterizes innovation today. Innovation is therefore no longer considered simply as an endogenous development process within a region or a company but as a process of integration and participation in global knowledge and innovation networks (Chen 2007; Shearmur 2011). Learning is less connected to firms, inter-firm networks and societies, but much more understood as a process of social and global interaction between individu-

networks are now based on informal local and global buzz and have burst into wider spatial – and often global – scales (Lorentzen 2008; Malecki 2010).

Moreover, various studies indicate an increased mobility of capital within the global financial channels, enabling investments to be made anytime, anywhere (Sassen 1991; Dow 1999; Corpataux *et al.* 2009). This mobility challenges traditional regional investment channels and makes it possible to invest or withdraw capital instantly in a business sector or in a business from one region to another (Corpataux and Crevoisier 2005; Theurillat *et al.* 2008; Crevoisier *et al.* 2011). Financing local innovation is no longer linked to the regional environment's ability just to raise local investment (e.g. bank credits, business angels, etc.), but also to capture the interest and secure the involvement of financial investors organized at global level.

A second avenue of research concerns the way in which the economic value of economic change is constructed. The Knowledge Economy approach considers economic value creation as the result of creative learning (Malecki 2010). Such an approach mostly leaves aside the comprehension of the socio-economic market valuation of innovation and provides a partial understanding of the actual economic value of knowledge. Working mainly on the basis of an industrial and technical/scientific view of innovation, TIMs connect economic value to the idea of competitiveness. The value of innovation resides in the ability of a company or production system to compete in a market. This competitiveness is observed but rarely deconstructed within the market. Various authors take the view that it is not enough to simply understand how innovation works as a production process but that we also need to understand how innovation receives socio-economic value in the market (Peck 2005; Lagendijk 2006; Grabher *et al.* 2008). This involves seeing the market not as an exogenous mechanism for selection or information but as a social construct involving various different parties coordinating their activities around the qualification (Callon 2007) and valuation (Beckert and Aspers 2011) of different goods and services.

From this point of view, the construction of value in the market becomes an essential issue. This involves not only analyzing how value is constructed between the production and consumption of goods and services, but also considering the role that territory plays in this construction. According to Stark (2011), the market value of a good or service is determined by the social performance of players to give not only its monetary exchange value (price), but also the social conditions of its evaluation (prize) and its experimentation (praise). Therefore, the study of territorial development consists of understanding where and how competitive innovations are produced and also where and how these innovations are given socio-economic value, i.e. collectively mobilized, co-produced, diffused, negotiated and legitimized (Jeannerat 2013).

### ***The case of the Western Switzerland photovoltaic industry***

The case of the Swiss photovoltaic industry, largely concentrated in Western Switzerland, emphasizes many aspects of the issues highlighted earlier.

On the one hand, the relations among photovoltaic actors are characterized by wider territorialities influencing the production of new applications and technologies. Even if the global photovoltaic market is not yet stabilized and often linked to political subsidies, researches and developments of new technologies, the number of applications and products constantly increases at a global level. In this particular context, Western Switzerland plays an important role in research and development of new photovoltaic technologies and applications built upon social dynamics of innovation involving new regions and actors besides traditional local techno-industrial networks (Rutten and Boekema 2013).

On the other hand, photovoltaic producers develop ethical products and discourses to promote themselves as 'responsible' innovators and value consumers' commitment in sustainable development. Although technological resources remain important for the development of new photovoltaic products, innovations are intensively built upon symbolic and cultural resources provided by intermediary actors such as media and experts. These players co-construct the market by qualifying such innovations as 'responsible' through activities of cultural creation, diffusion and legitimization.

### ***Methodology***

The Western Switzerland photovoltaic industry is used as a case study to demonstrate how certain local and extra-local innovations develop. These innovations are linked to social and economic concerns about so-called 'sustainable' development. Taken as a social construction, our analytical and methodological approach focused on the idea of 'actually existing sustainabilities' (Krueger and Agyeman 2005; Evans and Jones 2008; Krueger and Gibbs 2008). This empirical approach did not involve defining *a priori* what sustainable development is (e.g. using an analytical model or predetermined sustainability criteria), but rather observing the actions and discourses of those studied. The operationalization of sustainable development thus takes different forms according to the institutions and territories in which the networks of players and systems of socio-economic valuation operate.

These issues have been examined in an empirical survey based on the Western Switzerland photovoltaic industry conducted between May and September 2011. Included in a 'GREMI-T ASSLIIn' research project<sup>1</sup> (Kebir *et al.* 2012), this survey involved a qualitative study based on an indepth document analysis of regional press articles, expert reports and professional journals. In addition, 18 semi-directive interviews were undertaken with business people, photovoltaic research institutes, public figures and representatives of associations. The aim of these interviews was to understand various individual business projects in greater depth so as to discern the social and economic values that players in this milieu attribute to these activities. Several participant observations have also been carried out at public events, such as trade fairs, specialist exhibitions and forums.

Seven business projects were studied to identify the different paths that innovation may take and the way it is integrated – or not – into local and/or extra local

processes. These projects were not only investigated as particular innovation networks but also the financial and market valuation mechanisms at play in the area of photovoltaic innovation.

A first project type aims to raise public awareness on an international scale by demonstrating the efficiency of photovoltaic energy: the solar-powered boat *PlanetSolar*, the solar-powered aeroplane *SolarImpulse* and the solar and wind-powered vehicle *ICARE*. A second project type contributes to the value of public and tourist destinations: the solar-powered tricycle *Magic Turtle* as an alternative form of sustainable transport and the *Grove Boats* company manufacturing solar-powered boats for touristic and environmental use. A third, more traditional type of project involves developing and exploiting on the private market a final product or specific application using photovoltaic technology: the start-up *Iland Green Technologies*, which created a portable solar-powered generator using flexible cells produced by a neighbour company called *Flexcell*.

### ***The evolution of the international photovoltaic industry***

The first solar cell was created at the end of the nineteenth century by American researcher and inventor Charles Fritts. However, serious study into photovoltaic technology and its market application in the aerospace industry did not begin until the 1950s. Considerable development of photovoltaic technology only began in the 1970s and 1980s when, in the wake of various oil crises, solar power was seen as an alternative to fossil fuels. Research into first-generation silicon cells then began to receive more funding. Although the cost of photovoltaic cells remained prohibitive in comparison to other energy sources, the first photovoltaic companies began to see a reduction in some of their production costs and developed an initial niche market.

From the 1980s onwards, technological innovation in photovoltaic industry diversified along two broad lines. On the one hand, basic research led to significant improvements in the capacity of first-generation photovoltaic cells. Monocrystalline and multicrystalline silicon cells still remained the most profitable on the market, representing almost 80 per cent of the global market. On the other hand, new research led to the development of second-generation photovoltaic cells, which do not necessarily have greater capacity but have the potential for new applications (e.g. flexible manufacturing cells) (Ballif 2011).

The 2000s were a critical period in the global photovoltaic industry's development with the arrival of the third generation of very high-powered photovoltaic cells (Ballif 2011). Moreover, frequent energy crises (e.g. rising oil prices, the anti-nuclear debate) and a considerable reduction in the production cost of first-generation cells enabled the photovoltaic industry to develop independently of the oil market and to make inroads into the consumer market (Ballif 2011). This phase of industrial and technological maturity led to the standardization and territorial specialization of production and to the globalization of the international market. Today, China and Germany are the main international producers of solar panels (Dunford *et al.* 2012).

### *Productive processes in Western Switzerland's photovoltaic industry*

Over the last thirty years, Western Switzerland has played a key role in the development and evolution of the international photovoltaic industry in three ways. Since the 1980s, research by the photovoltaic laboratory (PVLab) at the Neuchâtel's Institute for Microtechnology (IMT), now affiliated with the *Ecole polytechnique fédérale de Lausanne* (EPFL), has notably contributed to improving the profitability of photovoltaic cells and to developing new generations of photovoltaic technologies (Ballif 2011). In line with local research, new start-ups and companies emerged. Former researchers pioneered the development of specific applications and products using photovoltaic technology. Equally, sophisticated suppliers grew up locally and became the equipment providers of major international photovoltaic companies.

This territorial dynamic of innovation and knowledge can be regarded as two interacting, articulated and interdependent subsystems: the *R&D subsystem* and the *entrepreneurial subsystem* (Figure 2.1). The R&D subsystem brings together players behind the development of new technologies whilst local associations look to connect them. Generally speaking, public laboratories are involved in third generation photovoltaic technology research, improvement and development. Local associations look to create networks for these players, enabling them to generate mutually beneficial industrial synergies.

The local entrepreneurial subsystem represents the sphere in which innovative entrepreneurial projects are developed. Three main types of projects and enterprises can be distinguished. First, certain 'mature enterprises' develop innovative and specialized photovoltaic products dedicated to the domestic and international markets, for instance the case of *Flexcell* producing and selling flexible photovoltaic panels (the company unhappily disappeared in 2011 because of fierce competition). Second, various 'pre-competitive enterprises', or start-ups, develop, in the form of prototypes, market applications of photovoltaic technologies developed in the region (second and third generation technologies). The portable solar generator created by *Iland Green Technologies* developed upon both local research laboratories and components produced by local firms. Finally, several 'demonstration enterprises' make use of photovoltaic technologies, not with the aim to commercialize a particular market product but to promote the social and technical potentials of photovoltaic energy. For instance, the solar aeroplane *SolarImpulse* was designed primarily to contribute to photovoltaic technologies whilst also demonstrating their credibility and potential for other market applications.

By analogy with the *innovative milieu* model (Camagni and Maillat 2006), these two subsystems represent the heart of the innovative milieu and constantly cooperate within innovative local networks. Local technological relations between the players in this environment often take the form of local learning and training relations (Lundvall and Johnson 1994; Rutten and Boekema 2012), i.e. the collective organization and use of resources by players in the environment. Therefore, these collective training and learning initiatives enable the local production system to adapt and respond to its changing environment (Uzunidis

2010: 96). In our cases, local innovation networks encourage the creation, use and (re)combining of the knowledge necessary to this evolution. This productive organization usually takes the form of a technological transfer: regional research laboratories very often supply local businesses with technological knowledge.

However, Western Switzerland photovoltaic industry shows that production and innovation networks are characterized also by a wider spatiality. Beyond the traditional innovative milieu organized principally on a regional basis, important multi-local relations can also be observed. For instance, a number of German and Asian companies have set up laboratories in the region in order to get involved in and have access to local technological innovations that enables them to develop increasingly profitable photovoltaic cells. A leading German business on the international industrial photovoltaic technology and equipment market has set up a private laboratory next to a public regional research centre in order to be able to exploit the new technologies developed in Western Switzerland. Consequently, major international companies are players in the local innovative milieu but also integrate this environment into *global production networks*, thereby considerably surpassing the boundaries of the region (Henderson *et al.* 2002; Coe *et al.* 2008).

Innovation and learning processes have to be seen as an assemblage of local and multi-local learning and training relations. Beyond local production of technologies, countries such as the United States or Germany and the regions of Southeast Asia have an important impact on Western Switzerland's photovoltaic industry. While Western countries focus on production lines, Southeast Asia regions move towards the production of low-cost solar panels (Dunford *et al.* 2012); however, the creation of a global photovoltaic market raises several questions about the production and consumption of products presented as 'sustainable'.

### **'Sustainable' values as 'responsible' innovations in multi-local photovoltaic industry**

In recent decades, the notion of 'sustainable development' has become central to social and economic projects and to key policies (Strange and Bayley 2008; OCDE 2011). Considering territorial and economic development from this point of view raises various questions as to the development of territorial innovation models, the socio-economic value of goods and services, as well as the business models to which they relate. This involves a shift in perspective from an isolated view of the economy to seeing it in relation to its ecological and social environments (Laperche *et al.* 2009: 11), but also to re-examining how we view territorial innovation and the role of innovative milieu (Kebir *et al.* 2012). Similarly, innovation and learning are mainly conceptualized as upstream processes oriented to or from the market, the socio-economic construction of which often remains unexplored (Berndt and Boeckler 2009). But innovations are not only dependent on pure technology; they are increasingly subject to socio-cultural dynamics characterized by the incorporation of cultural, aesthetic (Grabher *et al.* 2008;

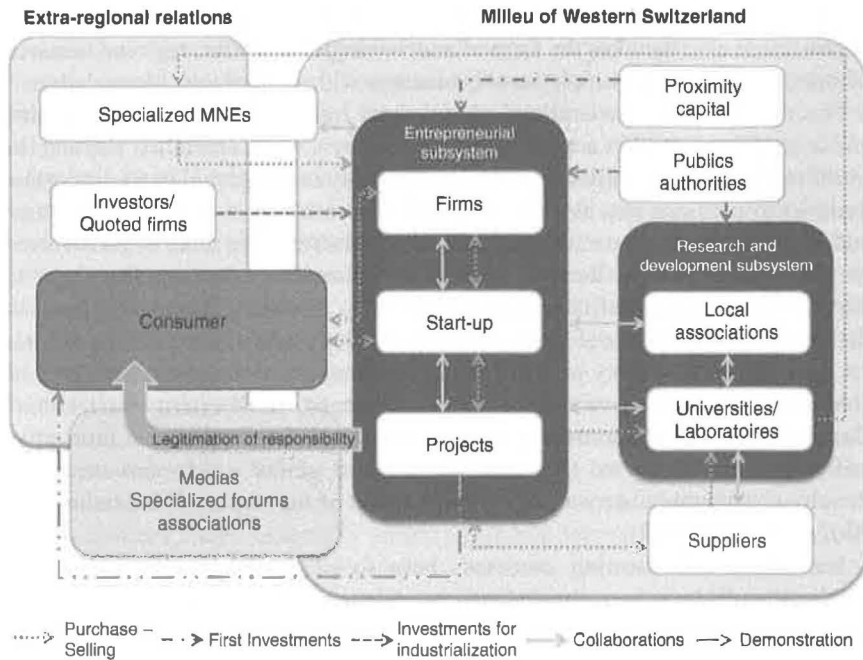


Figure 2.1 Multi-local relations and valuation in the photovoltaic milieu of Western Switzerland.

Source: Authors' own compilation.

Crevoisier and Jeannerat 2009) and sustainable aspects (Gabriel and Gabriel 2004/2005) within products or innovations.

Based on our case study of the Western Switzerland's photovoltaic industry, we now examine the issue of sustainable development from the point of view of current innovations in this industry, by going through the socio-economic valuation of photovoltaic products for upstream investors in sustainable projects and for downstream customers of sustainable products or technologies (Figure 2.1). We highlight two kinds of interdependent valuation systems: the financial valuation system and the market valuation system.

### ***Financial valuation in the photovoltaic milieu: building a reputation within multi-local relations***

Western Switzerland's photovoltaic milieu develops within regional and extra-regional investment channels. The financial resources of entrepreneurial projects vary considerably depending on the project type and development phase. In the earliest stages of a start-up's life, it is often necessary to have entrepreneurs and investors in close geographic proximity because there must be a relation of trust

between these parties (Crevoisier 1997). The initial investment in entrepreneurial projects generally comes from public funding or from the entrepreneur's interpersonal relations. Public funds give businesses the opportunity to initiate and incubate so-called 'precompetitive' projects, i.e. projects that are not yet at the manufacturing and marketing stage. Other investors in a project may include family, colleagues or friends. *Iland Green Technologies* is such a case in point, with company start-up capital coming mostly from the owner's social network.

However, these initial investments are insufficient to cover the large-scale manufacturing and marketing of newly developed products. The cost of this second phase is generally too high to be met by the entrepreneur's personal network or too risky to be of interest for regional lenders. The local milieu is therefore often unable to support the industrial development of innovative entrepreneurial projects through the instigation and use of local financial resources. In this stage, generally speaking, multinational, listed companies with the ability to quickly invest large sums of money provide the necessary support. Such was the case for *Flexcell*, a company producing flexible solar panels: once it reached the industrialization phase, it was bought by *Q.Cells*, a German manufacturer of photovoltaic cells and production lines.

Very often, innovative companies that have benefited from the investment capital of major listed groups are bought once they reach the industrialization phase (Garel and Jumel 2005). These big companies have considerable liquid assets to invest and are generally more interested in making profitable investments (Crevoisier 1997). These investments are part of the major groups' innovation strategy, based more on corporate venture capital, i.e. high-risk buying and selling of innovative entrepreneurial projects (Chesbrough 2002; Ben Hadj Youssef 2006). Big companies investing in photovoltaic projects in Western Switzerland may be motivated by either the prospect of a return on the future sale of a business or the international exploitation of a company's product.

Moreover, the socio-economic value of these investments may be more than just monetary. They may also be of symbolic and public-relations value. This is particularly evident in the case of demonstration projects. Investors in projects such as *PlanetSolar* or *SolarImpulse* – seeking to achieve a world tour relying on solar energy – want to be associated with the sustainable and eco-friendly values that they embody. Investment in the enterprise is therefore done as a form of sponsorship rather than as a straightforward industrial investment. These sponsorship-style investments are not just about money but also reputation. Financing such projects is complicated and involves public and private as well as regional and international investment.

Therefore, the financial value of innovative local projects may lie in improved visibility, credibility and legitimacy with multi-local investors. In this situation, market initiatives play a crucial role. Trade shows and platforms are ideal environments for the creation of markets and industries (Lampel and Meyer 2008; Gawer 2009; Aspers and Darr 2011) – they not only bring together entrepreneurs and investors but also enable worthwhile projects to be presented and selected.

### ***Market valuation of photovoltaic innovations: the socio-economic construction of responsibility***

The economic value of innovations developed in Western Switzerland's photovoltaic milieu cannot be seen merely in terms of a competitive technology in the market, e.g. in terms of price or energy efficiency. It is built through a complex process of socio-economic valuation. In common with other studies on sustainable development (Gabriel and Gabriel 2004/2005; Ingham 2011), our case study shows that the market value of the innovations studied is largely built around the notion of 'responsibility'. Ingham (2011: 32) defines responsibility as being open to environmental and social concerns when developing and deploying innovations shared by various players in society. The market valuation of photovoltaic innovations is therefore made through production and consumption activities, which are qualified socially (Boltanski and Thévenot 1991) as 'responsible', 'not responsible' or 'irresponsible'. Gabriel and Gabriel (2004/2005: 206) see this qualification as bestowing a legitimacy that gives value to the product and its message.

In this case, the relationship between production and consumption relates to two pivotal groups: *responsible entrepreneurs* and *committed consumers*. On the one hand, the entrepreneur is often seen in a prophetic role, embodying the planet's salvation through their projects. They are seen as 'responsible' when they follow a 'defensive and curative purpose' with regard to reducing the environmental pollution created by industrial civilization (Djellal and Gallouj 2009: 61). On the other hand, consumers are not only encouraged to buy 'useful' products but also to adopt environmentally friendly behaviour to help save the planet. By buying photovoltaic products, consumers become 'committed' to the valued common responsibility. They thus assess technical quality as well as producers' behaviour and identify themselves with the discourse and ideology attached to the product itself. The product's value is not just down to strictly technical factors, but also the discourse that the product symbolizes and communicates. This process of market valuation involves various technical players and devices enabling the evaluation and stigmatization of the players' social behaviour and the quality of the innovations.

Demonstration projects, such as a solar boat or a solar plane, are good examples of this issue. They aim to promote the performance of photovoltaic technologies, but also to raise political and civic awareness and understanding of renewable energy. The social dimension of these projects is diffused, legitimized and co-created by media-driven and symbolic forces for the general public and potential consumers. Once the media get hold of this, it is then easier to involve investors wishing to promote a responsible image.

In the specific case of the photovoltaic industry, *legitimizing third parties* (particularly the media and public bodies) automatically give visibility and perhaps even support to innovations that respond to genuine social desirability and put entrepreneurs' responsible practice in the spotlight (Pratt 2000; Tremblay 2011; Jeannerat 2012). These players also transmit image, social control and credibility to a national and international audience (Rekers 2010). The

dissemination and legitimization of responsible innovations therefore occur in specific locations such as the promotional market, e.g. trade fairs, specialist shows or events.

Consequently, the process of social evaluation is based on media debate and confers symbolic value on photovoltaic innovations. This symbolic value is a key element of the economic value of photovoltaic innovations, beyond the efficiency of the products or technologies involved. It helps justify both investment processes upstream and consumption behaviours downstream of the innovation. From this perspective, local innovation within complex business and revenue models can be seen as based not only on the buying and selling of goods and services but also on the reciprocal action of market players (Chesbrough and Rosenbloom 2002; Ng 2010).

In contrast to the traditional industrial business model, photovoltaic innovations developed in Western Switzerland are not necessarily economically valued simply as final goods and services for sale on the market. To varying degrees and levels, each entrepreneurial project has a value in terms of demonstration, social desirability and its contribution to a better world. Their economic value involves various public and private, local and global, manufacturing, media and consumer bodies within the market. Certain services receive value through direct monetary exchange (e.g. a purchase); others receive it indirectly through an enhanced image (e.g. deferred purchase). Yet others ultimately receive value through the development of products and technologies derived from an original project (e.g. the transfer of knowledge from a demonstration project).

### **From ‘local innovative milieu’ to ‘multi-local valuation milieu’**

In line with other TIMs, the concept of ‘innovative milieu’ has enabled to comprehend the regional dimension of innovations. In different aspects, territory was highlighted as a constitutive element of economic change. While pursuing a similar line of research, investigating SDIN opens up new promising research avenues at the roots of territorial development. In a world characterized by increasingly interconnected and mobile resources of innovation, such an approach avoids starting from the predefined arenas of firms, sectors and regions to explain economic and territorial development. In this view, a local industrial district, cluster or innovative milieu is perceived not as an autonomous production system specialized within a global market but as a territorial anchoring context of resources used, generated and combined across various locations.

However, exploring SDIN should not end with merely a renewed understanding of the geographies of economic change. In TIMs, innovations receive value in market competition and this value is revealed in the competitiveness of particular production spaces. Such an approach leaves intact ‘both the market and the associated apparatus of neo-classical theory’ (Peck 2005: 145) still used mostly to explain the economic value of goods and services. As highlighted by Potts *et al.* (2008), the economic value of knowledge, innovation and creativity builds upon complex market-based social networks and cannot be restrained to an

industrial and production perspective. Accordingly, exploring the ‘social dynamics of innovation networks’ should also be about exploring the *social dynamics of valuation networks* at the core of innovation.

It seems crucial to us to elaborate on current territorial innovation models to grasp the related territorial valuation models within which they endow. In line with ongoing debates in economic geography, we believe that the concept of ‘multi-local valuation milieu’ could provide a renewed perspective and a pertinent explorative framework to revisit and broaden established approaches to regional innovation (Table 2.1). Drawing upon the case of the photovoltaic industry in Western Switzerland, specific building blocks of such a framework can be emphasized.

First, a multi-local valuation milieu is characterized by actor relations extending beyond a manufacturing view of innovation. In the examined photovoltaic projects, regional producers are not only connected to local researchers and suppliers. They also build new and substantial relations with different kinds of local and more distant actors. These relations contribute to constructing and legitimizing the socio-economic value of innovation beyond the production systems that operate within the regional innovative milieu. Whilst production firms and R&D laboratories continue to play a crucial role in innovation processes, the economic value of their activities must be understood within the framework of wider public constructions. Beyond the essential role of producers granted by classical approaches, the market construction implies production and consumption processes with a view to ‘co-development’, involving hybrid relations (Grabher *et al.* 2008). In particular, ‘committed’ consumers, local and global interest groups, media and investors play an active role in the creation and development of

Table 2.1 Local innovative milieu and multi-local valuation milieu

	<i>Local innovative milieu</i>	<i>Multi-local valuation milieu</i>
Players	Players involved in the production system (research organisms and firms, etc.)	Players involved in the market (manufacturers, investors, consumers, media and civil society organizations)
Innovation	Result of endogenous technological and production processes	Result of socio-economic processes based on production, exemplarity and demonstration
Socio-economic legitimization and valuation of innovation	Technical device	Link between discourse and technical device subject to critical attention
Strategic relations	Networking in production milieu	Networking, co-creation of media-led discourse and social control in market
Type of territorial innovation	Productive local combination	Multi-local and media involvement

Source: Authors’ own compilation.

the milieu, not just at production level but also in communicating and financing entrepreneurial projects.

Second, a multi-local valuation milieu reveals social dynamics of production-consumption increasingly based on communication, social interaction and social control. For instance, whilst ‘sustainable innovations’ remain mainly focused on production, their value is constructed through their exhibition to political and civic audience. On the one hand, they are embodied in products and actions legitimized through the discourse of ‘responsibility’ (Gabriel and Gabriel 2004/2005). On the other hand, these innovations are the purpose of social initiation and demonstration that contributes to construct legitimate discourses and values in market. The value of responsibility (Ingham 2011) is subject to commonly agreed notions of quality that are technically and symbolically justified. Justification does not primarily rely on physical or functional performances, but rather on a socially promoted and commonly projected desirable future. Accordingly, the market valuation of innovation builds on complex processes of production, consumption and media performances; therefore, the ability to manage this symbolic dimension appears as the central component of sustainable innovation.

Finally, the SDIN embedded within a multi-local valuation milieu partake in wider production and consumption networks, at medium and long distances. In the photovoltaic case, the increasing power of China’s industry has led, for instance, to a division of labour at intercontinental level over the last few years (Dunford *et al.* 2012). Stakeholders in Western Switzerland must therefore get involved in global production and consumption networks enabling the socio-economic valuation of their specific projects. These new relations fall under regional and extra-regional processes. Moreover, innovations do not merely result from local competences and investment capital (Shearmur 2011). They are also built on multi-locally anchored resources and on socio-economic value co-constructed by media and shared by consumers. ‘Responsible innovations’, which are developed and valued within Western Switzerland’s photovoltaic milieu, clearly extend beyond regional and national boundaries and involve different production, consumption and mediation locations.

A project such as *PlanetSolar* – born in Western Switzerland, financed and produced in Germany, demonstrated and advertised at strategic places around the world – illustrates this multi-local combination of knowledge and financial resources very well. It reveals innovations that far exceed the bounds of regional technological development and industrial production. It is an innovative vector of socially co-constructed values, reflecting a quality that economic and non-economic players seek to attain in future. These values include social responsibility represented globally and initiated locally, between different places of action.

## Note

- 1 Research entitled ‘*Ancrage, durabilité, localisation de l’innovation: vers des nouvelles formes de territorialisation des activités?*’, which is supported by the French Ministry of Work’s urban development, construction and architecture plan.

## References

- Aspers, P. and Darr, A. (2011) Trade shows and the creation of market and industry. *The Sociological Review*, 59 (4): 758–778.
- Aydalot, P. (1986) *Milieux innovateurs en Europe*. Paris: GREMI.
- Ballif, C. (2011) Cellules solaires en silicium à haut rendement. *Electrosuisse*, 3: 12–14.
- Beckert, J. and Aspers, P. eds. (2011) *The worth of goods. Valuation and pricing in the economy*. New York, NY: Oxford University Press.
- Ben Hadj Youssef, A. (2006) Le capital risque: que vont faire les grands groupes dans les start-ups?. *Gérer et Comprendre*, 84: 34–43.
- Benko, G. (2007) Économie urbaine et régionale au tournant du siècle. *Métropoles*, 1: 141–181.
- Berndt, C. and Boeckler, M. (2009) Geographies of circulation and exchange: constructions of markets. *Progress in Human Geography*, 33 (4): 535–551.
- Boltanski, L. and Thévenot, L. (1991) *De la justification, les économies de la grandeur*. Paris: Gallimard.
- Boschma, R. and Frenken, K. (2009) Some notes on institutions in evolutionary economic geography. *Economic Geography*, 85 (2): 151–158.
- Callon, M. (2007) What does it mean to say that economics is performative?. In: D. Mackenzie, F. Muniesa and L. Siu, eds. *Do economics make markets? On the performativity of economics*. Princeton, NJ: Princeton University Press, 331–357.
- Camagni, R. and Maillat, D. (eds). (2006) *Milieux innovateurs: théorie et politiques*, Paris: Economica.
- Chen, Y.-C. (2007) The upgrading of multinational regional innovation networks in China. *Asia Pacific Business Review*, 13 (3): 373–403.
- Chesbrough, H. (2002) Making sense of corporate venture capital. *Harvard Business Review*, 80 (3): 90–99.
- Chesbrough, H. and Rosenbloom, R.S. (2002) The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, 11 (3): 529–555.
- Coe, N.M., Dicken, P., Hess, M. and Yeung, H.W.C. (2004) Making connections: global production networks and world city networks. *Global Networks*, 10 (1): 138–149.
- Coe, N.M., Dicken, P. and Hess, M. (2008) Global production networks: realizing the potential. *Journal of Economic Geography*, 8 (3): 271–295.
- Cooke, P. (2005) Regionally asymmetric knowledge capabilities and open innovation: Exploring Globalisation 2 – a new model of industry organisation. *Research Policy*, 34 (8): 1128–1149.
- Cooke, P. (2008) Regional innovation systems: origin of the species. *International Journal of Technological Learning, Innovation and Development*, 1 (3): 393–409.
- Coppin, O. (2002) Le milieu innovateur: une approche par le système. *Innovations*, 2 (16): 29–50.
- Corpataux, J. and Crevoisier, O. (2005) Increased capital mobility/liquidity and its repercussions at the regional level: some lessons from the experiences of Switzerland and Great Britain (1975–2000). *European Urban and Regional Studies*, 12 (4): 315–334.
- Corpataux, J., Crevoisier, O. and Theurillat, T. (2009) The expansion of the finance industry and its impact on the economy: a territorial approach based on Swiss pension funds. *Economic Geography*, 85 (3): 313–334.
- Cresswell, T. and Merriman, P. (2008) *Geographies of mobilities: practices, spaces, subjects*. London: Ashgate.

- Crevoisier, O. (1997) Financing regional endogenous development: the role of proximity capital at the age of globalization. *European Planning Studies*, 5 (3): 407–415.
- Crevoisier, O. (2001) L'approche par les milieux innovateurs: états des lieux et perspectives. *Revue d'Économie Régionale et Urbaine*, 1: 153–166.
- Crevoisier, O. (2010) La pertinence de l'approche territoriale. *Revue d'Économie Régionale et Urbaine*, 5: 969–985.
- Crevoisier, O. and Jeannerat, H. (2009) Les dynamiques territoriales de connaissance: relations multilocales et ancrage régional. *Revue d'Économie Industrielle*, 128: 1–23.
- Crevoisier, O., Theurillat, T. and Araujo, P. (2011) Les territoires de l'industrie financière: quelles suites à la crise de 2008–2009?. *Revue d'Économie Industrielle*, 134 (2): 133–158.
- Djellal, F. and Gallouj, F. (2009) Innovation dans les services et entrepreneuriat: au-delà des conceptions industrialistes et technologistes du développement durable. *Innovations*, 1 (29): 59–86.
- Doloreux, D. (2002) What we should know about regional systems of innovation. *Technology in Society*, 24 (3): 243–263.
- Dow, S.C. (1999) The stages of banking development and the spatial evolution of financial systems. In: R.E Martin ed. *Money and the space economy*. New York, NY: John Wiley & Sons, 31–48.
- Doz, Y.L., Santos, J. and Williamson, P. (2001) *From global to metanational: how companies win in the knowledge economy*. Boston, MA: Harvard Business Press.
- Dunford, M., Lee, K.H., Liu, W. and Yeung, G. (2012) Geographical interdependence, international trade and economic dynamics: the Chinese and German solar energy industries. *European and Urban Regional Studies*, 20 (1): 14–36.
- Evans, J. and Jones, P. (2008) Rethinking sustainable urban regeneration: ambiguity, creativity and the shared territory. *Environment and Planning A*, 40: 1416–1434.
- Florida, R. (1995) Towards the learning region. *Futures*, 27 (5): 527–536.
- Gabriel, P. and Gabriel, P. (2004/2005) Diffusion du développement durable dans le monde des affaires: un schéma conventionnel. *Revue Française de Gestion*, 152: 199–213.
- Garel, G. and Jumel, S. (2005) Les grands groupes et l'innovation: définitions et enjeux du corporate venture. *Finance, Contrôle, Stratégie*, 8 (4): 33–61.
- Gawer, A. ed. (2009) *Platforms, markets and innovation*. Cheltenham, UK: Edward Elgar.
- Grabher, G., Ibert, O. and Flohr, S. (2008) The neglected king: the customer in the new knowledge ecology of innovation. *Economic Geography*, 84 (3): 253–280.
- Grossetti, M. and Godart, F. (2007) Harrison White: des réseaux sociaux à une structure de l'action. Available from: <http://sociologies.revues.org/index233.html> [accessed 6 January 2010].
- Henderson, J., Dicken, P., Hess, M., Coe, N.M. and Yeung, H.W.C. (2002) Global production networks and the analysis of economic development. *Review of International Political Economy*, 9 (3): 436–464.
- Ingham, M. (2011) *Vers l'innovation responsable: pour une vraie responsabilité sociale*. Brussels: De Boeck.
- Jeannerat, H. (2012) Production, consommation et valeur économique: vers une approche territoriale du marché. Thèse de doctorat en sciences humaines, Université de Neuchâtel.
- Jeannerat, H. (2013) Staging experience, valuing authenticity: towards a market perspective on territorial development. *European Urban and Regional Studies*, 20 (4): 370–384.
- Kebir, L., Costa, P., Crevoisier, O. and Peyrache-Gadeau, V. (2012) *Ancrage, durabilité, localisation de l'innovation: vers des nouvelles formes de territorialisation des activités?* Paris: PUCA.

- Krueger, R. and Agyeman, J. (2005) Sustainability schizophrenia or actually existing sustainabilities? Toward a broader understanding of the politics and promise of local sustainability in the US. *Geoforum*, 36 (4): 410–417.
- Krueger, R. and Gibbs, D. (2008) Third wave sustainability? Smart growth and regional development in the USA. *Regional Studies*, 42 (9): 1263–1274.
- Legendijk, A. (2006) Learning from conceptual flow in regional studies: framing present debates, unbracketing past debates. *Regional Studies*, 40 (4): 385–399.
- Lampel, J. and Meyer, A.-D. (2008) Field-configuring events as structuring mechanisms: how conferences, ceremonies and trade shows constitute new technologies, industries, and markets. *Journal of Management Studies*, 45 (6): 1025–1035.
- Laperche, B., Crétiéneau, A.-M. and Uzunidis, D. eds. (2009) *Développement durable: pour une nouvelle économie*. Brussels: Peter Lang.
- Lorentzen, A. (2008) Knowledge networks in local and global space. *Entrepreneurship and Regional Development*, 20: 533–546.
- Lundvall, B.A. ed. (1992) *National systems of innovation: towards a theory of innovation and interactive learning*. London: Frances Pinter.
- Lundvall, B.A. and Johnson, B. (1994) The learning economy. *Journal of Industry Studies*, 1 (2): 23–42.
- Malecki, E.J. (2010). Everywhere? The geography of knowledge. *Journal of Regional Science*, 50 (1): 493–513.
- Malmberg, A. and Power, D. (2005) On the role of global demand in local innovation processes. In: G. Fuchs and P. Shapira, eds. *Rethinking regional innovation and change: path dependency or regional breakthrough?* Vol. 30. New York, NY: Springer, 273–290.
- Martin, R. (2010) Roepke Lecture in economic geography – rethinking regional path dependence: beyond lock-in to evolution. *Economic Geography*, 86 (1): 1–27.
- Morgan, K. (1997) The learning region: institutions, innovation and regional renewal. *Regional Studies*, 31 (5): 491–503.
- Moulaert, F. and Sekia, F. (2003) Territorial innovation models: a critical survey. *Regional Studies*, 37 (3): 289–302.
- Ng, I.C.L. (2010) The future of pricing and revenue models. *Journal of Revenue and Pricing Management*, 9 (3): 276–281.
- OCDE (2011) *Travaux de l'OCDE sur le développement durable*. June.
- Peck, J. (2005) Economic sociologies in space. *Economic Geography*, 81 (2): 129–175.
- Potts, J., Cunningham, S., Hartley, J. and Ormerod, P. (2008) Social network markets: a new definition of the creative industries. *Journal of Cultural Economics*, 32, 167–185.
- Porter, M.E. (1998) Clusters and the new economics of competition. *Harvard Business Review*, 76 (6): 77–90.
- Pratt, A.-C. (2000) New media, the new economy and new spaces. *Geoforum*, 31: 425–436.
- Rekers, J.-V. (2010) *Introducing innovations: the role of market intermediaries and institutions in culture and science-based industries*. Paper presented at the DRUID Summer Conference, London, June 2010.
- Rutten, R. and Boekema, F. (2012) From learning region to learning in a socio-spatial context. *Regional Studies*, 46 (8): 981–992.
- Rutten, R. and Boekema, F. (2013) Beyond the learning region: a new direction for conceptualizing the relation between space and learning. *European Planning Studies*, 21 (5): 722–734.
- Sassen, S. (1991) *The Global City: New York, London, Tokyo*. Princeton, NJ: Princeton University Press.

- Saxenian, A. (2005) From brain drain to brain circulation: transnational communities and regional upgrading in India and China. *Studies in Comparative International Development*, 40 (2): 35–61.
- Shearmur, R. (2011) Innovation, regions and proximity: from neo-regionalism to spatial analysis. *Regional Studies*, 45 (9): 1225–1243.
- Sheller, M. and Urry, J. (2006) The new mobilities paradigm. *Environment and Planning A*, 38: 207–226.
- Simmie, J. (2005) Innovation and space: a critical review of the literature. *Regional Studies*, 39 (6): 789–804.
- Stark, D. (2011) What's Valuable?. In: J. Beckert and P. Aspers, eds. *The worth of goods: valuation and pricing in the economy*. Oxford, UK: Oxford University Press, 319–338.
- Strange, T. and Bayley, A. (2008) Le développement durable à la croisée de l'économie, de la société et de l'environnement. OCDE, Les essentiels de l'OCDE.
- Theurillat, T., Corpataux, J. and Crevoisier, O. (2008) The impact of institutional investors on corporate governance: a view of Swiss pension funds in a changing financial environment. *Competition and Change*, 12 (4): 307–327.
- Theurillat, T. (2011) *Une approche territoriale de la financiarisation des régions, des villes et de la durabilité urbaine*. Thèse de doctorat en sciences humaines, Université de Neuchâtel.
- Tremblay, S. (2011) Développement durable et communication: vers un espace ouvert fondé sur la participation citoyenne, l'éthique du dialogue et l'influence. *Télescope*, 17 (2): 239–255.
- Urry, J. (2008) Governance, flows, and the end of the car system?. *Global Environmental Change*, 18: 343–349.
- Uzunidis, D. (2010) Milieu innovateur, relations de proximité et entrepreneuriat. Analyse d'une alchimie féconde. *Revue Canadienne de Science Regionale*, 33: 91–106.