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# Creating change through pilot and demonstration projects: Towards a valuation policy approach

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ABSTRACT

Beyond R&D and competitiveness theories of innovation, various conceptual broadenings have recently been proposed to tackle the complex, multidimensional and multi-level dynamics of innovation at stake in the transformation of the economy and society towards new sustainable development regimes. This paper proposes a reading of these conceptual broadenings as a matter of 'valuation'. In line with pragmatic theories of socio-economic value and market construction, it is argued that value creation is not the result or byproduct of innovation. In contrast to traditional regulation and R&D policies, which confine themselves to framing innovation, valuation policies are endogenous triggers of the transformation of a value regime. Value creation is about inquiring into new values in society, translating them into social and technological solutions and making them valuable in markets. In this perspective, pilot and demonstration (P&D) projects in current transition policies can be interpreted as fundamental inceptions of new values that are not predetermined by innovation but actuated through complex processes of value co-creation in society and markets, and which engage policies as agents of change. By focusing on the purpose behind the sustainability transition rather than the factors that contribute to it, a valuation policy approach offers new insights for future research and policy.



## 1. Introduction

Clean energy is the new 'space race'. In his 2011 State of the Union address, Barack Obama recalled the American economic and technological competitiveness of the post-war era to justify an ambitious recovery plan in response to the threatening recession caused by the 2008–2009 economic crisis. In alluding to the strategic public funding that had been provided for space-based research and development – when the 'science wasn't even there yet' – and which had lain the seeds for 'new industries and millions of new jobs', President Obama added credibility to a foreseen yet abstract future.

This historical metaphor actualizes a policy interpretation of the new challenges that today's regions and nations face in regard to their future economic development. Not only does it motivate a 'Green New Deal' meant to stimulate employment and economic growth through public spending on eco-energy, it also views the competitive renewal of industrialized countries within the frame of a new global race for scientific discovery and cutting-edge technologies. More generally, this narrative is emblematic of current science, technology and innovation (STI) policies, which usually support research and development (R&D) through strategic public procurement, fundamental research funding and technology transfer at the nexus of science and industry.

In the past few years, conventional STI policies have been subjected to various critiques. It has been argued, for instance, that the 'Grand Challenges' posed by a transition to new sustainable ways of producing, consuming and living reach far beyond a 'space race' approach to innovation (Kuhlmann and Rip, 2014; Kallerud et al., 2013). At the crossroads of innovation and transition studies, various conceptual broadenings have been proposed to tackle the complex, multi-dimensional and multi-level dynamics of innovation at stake in the transformation of the economy and society towards new socio-technical regimes of sustainable development.

This paper argues that the question of innovation generally structures the question of sustainability transition policies today. New conceptual broadenings have proposed alternatives to con-

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ventional R&D policies, but, while it is widely recognized that the concept of innovation must be redefined, the concept itself is nonetheless accepted as an appropriate frame of interpretation.

The first part of this paper proposes a reading of current debates and research avenues at the crossroads of innovation and transition studies through the conceptual frame of valuation instead of innovation. While the question of innovation primarily involves the governance of socio-technical change in the economy and society, the question of valuation involves the governance of value creation and change.

In line with pragmatic theories of socio-economic value and market constructions, the second part of this paper argues that value creation is not the result or byproduct of innovation. Value creation is about inquiring into new values in society, translating them into social and technological solutions and making them valuable in markets. The sustainability transition is thus about valuation in society, in socio-technical change, in markets and in policy. In contrast to traditional regulation and R&D policies, which confine themselves to framing innovation, valuation policies are endogenous triggers of the transformation of a value regime.

In this perspective, pilot and demonstration (P&D) projects in current transition policy cannot be reduced to innovation tools meant to incubate new niche solutions and diffuse exemplary practices. They are fundamental inceptions of new values that are not predetermined by innovation, but actuated through complex processes of value co-creation in society and markets, and which engage policies as agents of change. The third part of the paper examines how recent P&D projects funded by the Swiss federal policy for clean technologies can contribute to a transition to clean energy. Originally conceived and justified as proto-market instruments, their actual role in transition is more to promote a general valuation policy than a conventional STI policy. Finally, the concept of valuation policy is discussed in line with this case study, and further research avenues for transition and innovation studies are proposed.

## 2. Sustainability transition policies as a matter of innovation

How does a transition towards a new economy and society in tune with the values of sustainable development occur? While this question is not new, it has become especially salient as a result of the recent rise of a post-crisis grammar pushed by new ecological priorities (Van den Bergh et al., 2011; Markard et al., 2012). Viewed as a contemporary 'Grand Challenge' for policymakers (Kuhlmann and Rip, 2014; Kallerud et al., 2013), this transition does not involve a shift from one established regime of production and consumption to another already established regime, as was the case with the transition from a planned to a market economy in the former communist countries. Instead, it involves the uncertain transformation of the dominant system of social and economic development into a new, aspirational, and therefore still abstract and open-ended, system (Meadowcroft, 2007; Geels, 2010).

In recent decades, this uncertain transformation has mainly been addressed as a matter of science, technology and innovation in both public discourse and academic debates. In various ways, the emphasis has been placed on innovation in order to justify and operationalize various policy measures meant to stimulate, enhance and frame a 'sustainably transition' shaped by new technological trajectories and market arrangements (Kemp, 1994; Smith et al., 2010). More recent scholarly literature has expanded this restrictive conception of innovation in order to emphasize that transition policies must also deal with the ways in which innovations shape a new regime of development (Schot and Geels, 2008; Voß et al., 2009).

This section first emphasizes the dominant policy 'referential'[1] (Muller, 2014), based on STI and competitiveness, currently employed to justify public intervention in the transition to sustainability. It then highlights the conceptual broadening of this referential in recent academic debates. We argue that this broadening continues to focus on innovation as the key to the transition. The issue of value creation and value change as the actual purpose of a sustainability transition is most often eluded or implicitly addressed as a byproduct of innovation. Finally, we propose a valuation perspective that can integrate current policy challenges and academic debates into a broader conceptual framework.

### 2.1. STI policies and competiveness as a dominant referential of transition policies

Since the 1990s, a crucial challenge in sustainability transition policy has been how to deal with the uncertainty resulting from the creative destruction of the existing system of production and consumption and the radical technological and market changes this transition entails. On the one hand, new production and market regulations are conceived and set up as particular 'stick and carrot' measures that spur firms to innovate in new green technologies and products (Flanagan et al., 2011; Hamdouch and Depret, 2010; Van den Bergh et al., 2011; OECD, 2011a). On the other hand, proactive support for up-front R&D and disruptive entrepreneurship are provided through green-oriented STI policies (Suurs, 2009).

Through strategic research funding, R&D missions, innovation parks, startup incubators and science-industry networks, STI policies have usually had two aims – to trigger transition through the development of new sustainable technologies and products, and to stimulate the growth of export-based industries.

This operationalization of a socio-economic justification for STI policies is emblematic of policy rationales based on a techno-productive and competitiveness understanding of innovation. Innovation is assumed to be the primary driver of competitive growth (Porter, 1998). Economic value created from innovation is then implicitly conceived as a generator of social value as a result of (material) improvements in the quality of life and well-being (Fig. 1).

In this view, analytical and conceptual focuses mainly investigate how innovation can arise and create economic value by opening new technological trajectories and producing new commodities. The policy focus is mainly on measures that will facilitate knowledge spillovers between science and industry and that will overcome the sunk costs and market-failure barriers to radical technological innovation.

This policy rationale has become even more important in the current post-crisis context. With the aim of re-stimulating their economies, many countries have launched ambitious recovery plans to promote both the sustainability transition and competitive innovation. Touted as the key to a 'Green New Deal', innovation has been used as a 'policy referential' (Muller, 2014) to justify new regulations, incentives and public spending (OECD, 2009a; OECD, 2010; UNEP, 2011; Lipietz, 2012; Jackson, 2009).

### 2.2. A conceptual broadening of innovation to address 'Grand Transition' policy challenges

The R&D and competitiveness approach to innovation policy is not only a dominant policy referential; it has also become a

[1] The concept of 'referential' here is borrowed from Muller (2014) and designates the dominant cognitive schemes, rationales and operating principles used to define, elaborate, justify and implement public policy during a particular historical period of the economy and society.

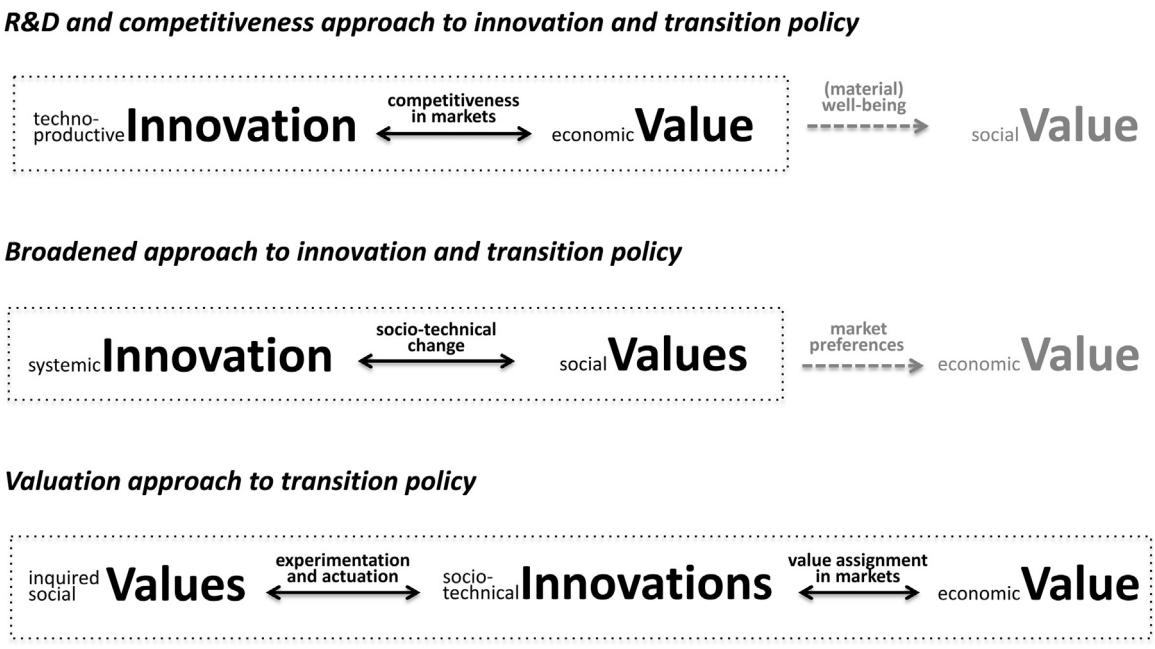


**Fig. 1.** Three ideal-typical approaches to innovation and value creation in transition.
Source: Own elaboration.

positional paradigm for new conceptual interpretations of current innovation (OECD, 2011c; Kallerud et al., 2013). As a result, a great deal of academic literature has recently flourished at the intersection of innovation and transition studies to propose alternative approaches to dominant R&D and competitiveness policies (Markard and Truffer, 2008; Research Policy, 2012).

On the one hand, innovation studies have broadened the problem and analytical framings of innovation to highlight the role of consumers, citizens and civil society organizations in complex and multidimensional sustainable-innovation systems (Hoogma and Schot, 2001; Hekkert et al., 2007). Pointing to the fact that societal challenges are not only about exploring cutting-edge technologies through grand R&D missions, various studies have highlighted the crucial institutional challenge related to the broader adoption, use and co-development of already existing technologies (Foray et al., 2012).

A major policy goal in this respect is developing a shared understanding of technologies and science among the public, scientists and various stakeholders in order to promote awareness and acceptance of new practices in the medium term (EU, 2013). This goal requires 'broad-based' innovation-policy instruments that integrate the public in both debates about science and the shaping of policies through participatory and interactive actions. In line with recent new policy discourses (OECD, 2011a), 'policy mixes' are advocated as a way to go beyond focal ex ante supports to specific technological pathways and trajectories (Flanagan et al., 2011).

On the other hand, transition studies have emphasized how an innovation system co-evolves with the transformation of a broader institutional, cultural, political and technological regime of development (Geels, 2010). Innovation is often conceptualized in a multi-level perspective as lying at the crossroads of two interdependent dynamics caused by the general transformation of a socio-environmental landscape. At the grassroots level, new disruptive niche innovations emerge in response to new societal challenges. These innovations trigger structural and incremental innovations in the existing socio-technical regime, which in turn structures new opportunities for niche innovations (Geels, 2004; Geels and Schot, 2007; Schot and Geels, 2008; Geels, 2010).

In this broadened approach, innovation and transition policies are not viewed simply as instruments that prevent the potential market failure of a radical technological change, but as related to institutional and systemic management attempts to create and protect incubation spaces for new niche innovations, up-scale these innovations by organizing their diffusion and convergence towards new general practices and institutionalize these innovations and practices in a renewed socio-technical regime of development (Kemp et al., 2007; Loorbach, 2007; Rotmans and Loorbach, 2009; Smith and Raven, 2012; Weber and Rohracher 2012). In this approach, innovation and transition policies are not external forces of innovative change, but co-evolving agents of 'learning by doing and doing by learning' processes in the economy and society. In this view, policy innovation is a component of innovation policy.

The aim is here not to provide a complete account of this literature, which has grown rapidly in recent years and already been reviewed in various overviews (see, for instance, Grin et al., 2010; Smith et al., 2010; Research Policy, 2012; Coenen and Truffer, 2012; Lachman, 2013; Falcone, 2014). The aim instead is to emphasize that the dialectical grammar of innovation and transition upon which this literature has developed can generally be interpreted as a conceptual broadening of the traditional innovation approach to transition. This broadening tends, in turn, to confirm and reinforce innovation as the prevailing conceptual approach to transition.

### *2.3. Value creation and value change as an eluded or implicit purpose of transition policies*

Challenging conventional R&D and competitiveness approaches, this conceptual broadening is consistent with other innovation-policy analysts' argument that 'innovation policy studies are at something of a crossroad' (Flanagan et al., 2011: 702, in line with Morlacchi and Martin, 2009; Martin, 2015). Renewed policy agendas have been drafted in the academic literature and policy reports, but providing a pragmatic and integrative conceptual framework for the future of innovation policy is not unproblematic because it requires dealing with highly complex socio-technical relations, production-consumption flows, socio-

political bargaining and spatio-historical situations (Markard et al., 2012).

By conceptualizing transition as involving broad-based systems of innovation and the innovation of systems, the focus of policy has primarily been on the factors of change that can lead to a new socio-technical regime of sustainable development. The aim of promoting value creation and value change in the economy and society is most often eluded or remains implicit: systemic innovations are the fundamental levers of a socio-technical change that encompasses a new social-value regime shaping economic value creation by creating new market preferences (Fig. 1).

In recent years, different socio-economic theories have raised the pertinence of developing a *valuation* perspective to apprehend innovation and societal change. In these theories, social and economic values are perpetually being constructed and reconstructed through socio-technical devices, socio-economic practices and socio-political inquiries (Dewey, 1939, 1946; Stark, 2011; Vatin, 2009; Muniesa, 2011; Helgesson and Muniesa, 2013). Innovation is not per se a driver of new economic and social value creation; instead, value creation emerges through the creation of new products and activities that shape and are shaped by social performances and experiences. Focusing on the purpose behind a sustainability transition rather than on factors of change, a valuation approach can provide a constructive and integrative lens through which to interpret some 'Grand Challenges' in current policy and academic debates.

## 3. Beyond innovation: conceptualizing a valuation approach to transition policies

A valuation approach to transition policies understands institutional change as an open-ended reflexive learning process (Grin et al., 2010) taking place in a strong democratic context (Dryzek, 1997). In this view, policies themselves are subjects of inquiry and experimentation related to the problem of determining and solving societal 'Grand Challenges' (Kuhlmann and Rip, 2014). Based on public consultation and deliberation, valuation involves individuals' participation in collective action and the symmetrical co-evolution of moral and social experimentation. In this sense, a valuation policy can broadly be defined as the public support provided to the collective creation, diffusion and implementation of new social values through concrete technological and social innovations that are economically embedded in complex market constructions (Fig. 1).

A valuation policy thus engages with three fundamental questions linked to the systemic uncertainties faced by societies today. First, *valuation in society* regards identifying and defining a societal problem and why it should be valued through new collective practices, experimentation and solutions. Second, *valuation in socio-technicalchange* regards the uncertain translation of the valued problem into valuable solutions through concrete social and technological innovations. Third, *valuation in markets* regards the uncertain change of socio-economic practices and socio-technical devices in the new assignment of economic value to goods or services.

### 3.1. Valuation policy in society

For Dewey (1939, 1946), valuation is first about *inquiring into new values in society*. In an initial context of radical uncertainty, the inquiry starts with the democratic construction of a problem setting and its related public. It ends with the exploration and implementation of new solutions determined through a shared interpretation of future social challenges. Socio-technical experimentation is embedded in a continuous process of problem setting and problem solving.

Social values are themselves an object of inquiry into 'what our interests and desires are and should be, an inquiry that creates meaning in the sense that it changes the way we are intertwined with the world' (Bidet 2013, as quoted in Kjellberg and Mallard, 2013: 20). In this process, any question, whether ethical, moral or intellectual, may be subject to discussion and rational justification.

A first general policy issue thus relates to which social values are worth promoting and co-developing with enterprises, consumers and civil society in the face of future societal challenges. In determining this issue, public intervention should be conceived not merely as an exogenous regulation framework – as, for instance, in Porter's hypothesis (Porter and Van der Linde, 1995) – but as consubstantial with socio-technical change (Weber and Rohracher, 2012).

In academic research, innovation policy has usually been informed by the innovation processes studied in research, markets and enterprises (Smith et al., 2010; Voß et al., 2009, 2007). This approach to policy epitomizes a well-established conceptualization of innovation as essentially consisting of technological performances for which governmental support is mobilized with 'pre-defined results' (Van den Bosch and Rotmans, 2008) in terms of an expected number of patents and potentially successful economic returns.

However, with the recent push to radically restructure the policymaking framework in response to societal challenges, innovation is increasingly being understood as social in nature. As a result, government support for a given innovation is approached as an open-ended process 'distributed among many societal actors' (Meadowcroft, 2007) and justified on the basis of qualitative sustainability goals. In this regard, policies are increasingly considered social experiments in the evolving construction of long-term shared visions (Sondeijker et al., 2006; Van den Bosch and Rotmans, 2008; Voß et al., 2009). In addressing the challenges of incubating, embedding and institutionalizing new desired values, emphasis is being put on policy instruments as potential bearers of change. Accordingly, policy instruments should be regarded simultaneously as tracers (Lascoumes and Simard, 2011) and agents (Voß et al., 2007) of value change in society. Going beyond top-down political decisions and rhetoric, policy tools are thus intended to guide innovation through an expected shift towards an indeterminate future in a reflexive and evolving manner.

In this perspective, the ultimate essence of policy instruments is to break with established values to open up new socio-technical pathways (Geels and Schot, 2007). These pathways in turn are mobilized as scenarios (Elzen et al., 2004) to be tested, which may eventually result in 'one overarching image and vision' (Sondeijker et al., 2006). While this all-embracing long-term vision helps guide short-term actions in new trajectories, its success remains hypothetical. In the course of determining new values, guiding visions are progressively refined as uncertainties are reduced through the instantiation of concrete socio-technical experiments in a 'circle-by-circle' diffusion process (Grin et al., 2010).

### 3.2. Valuation policy in socio-technical change

A second consequential dimension of valuation is thus how to translate the social values that have been agreed upon into concrete and actual innovations. These innovations do not primarily find their coherence in a Schumpeterian bunch of activities developed along particular industrial or technological trajectories, but in their capacity to engage, in various and complementary ways, with shared social values to which producers, consumers and other social actors are committed (Foray et al., 2012).

This issue draws attention to the fact that innovation policies with sustainability objectives not only have to contend with the uncertainty of economic change related to, for instance, the sunk costs in cutting-edge research and development or the adoption of new, radical technologies in markets. Policies also face radical uncertainty regarding changes in socio-technical values regarding how to produce, consume, work and live.

Addressing this challenge requires focusing on users'/consumers' uptake of technological innovations and the processes underlying this uptake. It requires considering the dynamics of consumer demand (Von Hippel, 2005; Shove and Walker, 2010; Zerka, 2010) as such, but also within a broader understanding of how individuals' agency relates to structural change (Spaargaren and Oosterveer, 2010; Rauschmeier et al., 2015). In line with this aim, *valuation in socio-technical change* sheds light on how general uncertainties linked to the adoption of new and already existing 'green' technologies may be reduced by remaking 'more sustainable' practices in space and time.

*Valuation in socio-technical change* emphasizes the significance of contextualizing technological innovations in networks, culture and institutions (Rip and Kemp, 1998). While some new representations attached to path-breaking practices emerge through the embedding of innovations, other might die out or be readjusted (Grin et al., 2010). In a circular loop, the operationalization of transition aspirations accordingly prompts the reformulation of 'universalizing' questions regarding transition into specific contextualized issues that shed light on unforeseen socio-technical problems and solutions, thereby gradually re-shaping established norms and procedures (Kemp et al., 1998).

In a valuation policy perspective, 'hybrid forums' (Callon et al., 2001) epitomize the way in which these processes occur. Constituted as nexuses between science, individual actors/organizations and civil society, such forums actuate the inquiry of new values in socio-technical change. Crystallized around exemplary experiments in real-world situations, they anchor socio-technical value matters in social and infrastructural networks of interaction (Elzen et al., 2012). As they objectify values as both components of innovations and subjects of public debate, they spur open learning dynamics (Hoogma and Schot, 2001) and contribute to the progressive creation of an audience. Directly or indirectly related to innovations, hybrid forums trigger public controversies on socio-technical valuations and ultimately serve to create potential convergent aspirations, themselves the foundation of coordinated collective action.

### 3.3. Valuation policy in markets

A third constitutive dimension of valuation relates to the ways in which these various innovations are turned into economic value through a socio-economic market construction. In the innovation perspective, the economic value of innovation is usually realized in the capacity to produce and sell new competitive goods or services on an external market. In this sense, developing a valuation policy perspective is also about understanding how innovations are integrated into ever more complex business models (Teece, 2010; Osterwalder et al., 2005; Chesbrough, 2013).

In post-crisis discourses, the most desirable type of growth is 'inclusive growth' (OECD, 2012: 2). Inclusive growth is thus a reaction to the global crisis and challenges 'business-as-usual', including established regulatory frameworks. At the same time, this crisis has crystallized major global social pressures. New reflections have emerged that draw on the interlinked structural, environmental, institutional and societal aspects of progress. Policies no longer focus exclusively on economic development, but instead attempt to integrate societal aspirations (OECD, 2011b). Innovation is regarded not merely as a means of promoting renewed growth in trade across competing productive regions and nations, but also as a democratized opportunity to enhance social well-being, improve the quality of life and reduce social disparities through alternative forms of production and consumption.

In a similar vein, the scope of *valuation policy in markets* extends beyond the technological boundaries of innovation. The environmental dimension of innovation involves radical, systemic and long-term socio-technical shifts (Markard et al., 2012), which implies a need to spur new expectations in a broader selection environment.

Although values have always infused human activities, they are particularly topical in the face of our looming ecological crisis and the need to deploy novel 'clean' and efficient technologies. At present, routines have not yet been stabilized, and prices do not constitute a sufficient incentive for change (Grin et al., 2010; Van den Bergh et al., 2011). In such a context, the particular significance of the interrelation between economic and cultural values is thus emphasized all the more.

*Valuation policy in markets* addresses this issue by examining the processes underlying the naturalization of novel social practices and institutional work in action. The market in this regard is integrated into a wider context in which the state and civil society serve to shape both consumers' preferences and legitimize market actors. Focusing on the interface between economic values and socio-cultural values, *valuation policy in markets* examines how moral values can either prohibit something from having economic value (as in the case of emergent life insurance in the U.S., as analyzed by Zelizer (1979)) or contribute to rapid market growth (as in the case of 'Fair Trade' products) (Aspers and Beckert, 2011).

Taking as a starting point the central problems related to uncertainty and the underlying issues of valuation and pricing, this perspective highlights the role of coordination, qualification and legitimation mechanisms involved in the creation of markets (Vatin, 2009; Stark, 2011; Aspers and Beckert, 2011). Market coordination refers to the shared conventions and understandings regarding the qualities of goods (functional and symbolic) – that is, regarding what qualifies as a quality (Favereau et al., 2002; Aspers and Beckert, 2011). To give an example, from a firm's point of view investing in the reduction of negative environmental externalities is often perceived as inefficient. The deployment of environmental innovations (Kemp and Pearson, 2008: 7) can thus be hindered because the investment cannot be recouped through higher final prices (Van den Bergh et al., 2011: 5).

As illustrated, the social construction of values plays as a crucial function in *valuation policy in markets*. Systems of signification are produced and reproduced through the practices of consumers (who assert their personal value attachment through their purchases), market intermediaries and policies that legitimate given values (Mazzucato, 2014). Shared values come as a result of processes of interaction that make frictions between judged qualities apparent. The diverse assessments among consumers and producers are mediated through rewards and various rankings appraising the new values. On the basis of this new data, new means to register value in the economy are established. Evaluation within categories of goods (putting products in categories, establishing categories and making them commensurable) makes it possible to reduce complexity within particular markets. The process of evaluation may end through the intervention of monetary exchanges that mobilize contextual resources.

## 4. Pilot and demonstration projects: emblematic of a changing, yet ambivalent, policy conception

In recent years, P&D projects have become crucial instruments of sustainability transition policies. While such instruments are

not new in various policy fields, only recently has their role in innovation and transition been recognized and stressed by public authorities and academic researchers. This new interest is emblematic of the broader policy issues implied by a sustainability transition and of a renewed understanding of traditional STI policies. Nevertheless, the interpretation and justification of P&D projects remains ambivalent. Two specific, but not mutually exclusive, perspectives can be distinguished (for an overview of the role of P&D projects in innovation and transition, see Klitkou et al., 2013).

The first perspective essentially approaches P&D through a techno-productive lens. In this view, technological progress and economic development are the preconditions for growth and wealth. Considered 'an extension of the prototyping process' to overcome technological and market uncertainties (Klitkou et al., 2013), P&D projects are understood as primarily intended to test a product's technological, financial and commercial feasibility (Klitkou et al., 2013). These projects also indicate policy priorities to a broader spectrum of stakeholders – a function conceptually captured by technological innovation systems' approaches as the 'guidance of the search' (Hekkert et al., 2007).

The second perspective emphasizes the societal dimension of P&D by paying particular attention to actors' role in the learning and promotion of novel and radical practices (Van den Bosch, 2010). This view emphasizes the normative objectives that shape societal progress and translate into human development. Designed to facilitate the alignment of promising technologies, markets and institutions, they are used to explore 'transition pathways' (Geels and Schot, 2007) through the co-evolutionary dynamics of up-scaled niche dynamics or so-called 'shielding spaces' (Smith and Raven, 2012). P&D projects thus have the potential to steer change in actors' perceptions and expectations' (Geels and Raven, 2006) and reorient policy agendas through the practice of 'reflexive governance' (Hendriks and Grin, 2007; Walker and Shove, 2007). Involving a broad range of actors in debates (scientists, policymakers, interest groups, regulators and civil society), P&D projects trigger discussions about a new policy's normative aims and mobilize vested interests. Serving to 'empower' emergent representations linked to path-breaking innovations, these debates in turn have the potential to trigger reflexive processes of policy learning regarding the projects' positive and negative outcomes (Smith and Raven, 2012).

Rather than drawing boundaries between these two perspectives, we argue that a valuation policy approach can engage with both of them. In this sense, this approach reveals a novel understanding of innovation, one that articulates the socio-economic and normative dimensions of current policy goals in a comprehensive manner.

Based on this premise, this section emphasizes the resurgence of P&D projects in Switzerland's energy policy and the rationale employed by the federal government to justify its role in innovation policy. In its policy documents and discourses, the federal government is ambivalent in regard to the general purpose of P&D projects. The section follows with a qualitative case study based on three pioneer projects supported by Switzerland's new policy program and emphasizes how they operate within broader valuation processes. The section concludes with a discussion.

### 4.1. The resurgence of an old tool in a new 'policy mix' context

Switzerland has broad objectives and visions similar to those that have underlain global policy agendas since the 2008–2009 financial crisis. In Switzerland, public support for developing a green economy crystallized in 2011, just after the Fukushima nuclear accident, through the implementation of a new strategy, the Cleantech Masterplan, itself part of the Energy Strategy 2050 (admin.ch), a broader long-term strategy to move away from nuclear power. Seen as 'the driving economic force of tomorrow' (translated from Bundesrat, 2011), the Masterplan presented 'cleantech'[2] as an emerging field with global growth potential that would create and sustain competitive jobs.

Coordinating different types of existing policy instruments into a policy mix, the Cleantech Masterplan combines pre-competitive, regulatory and demand-side measures (public procurement, standardization and labeling). Within this policy framework, and in response to the typical market-failure argument to justify innovation-policy interventions, P&D projects have been introduced as 'proto-market' instruments to fill the missing link in a linear chain of innovation (as officially displayed in Fig. 2). Following this logic, P&D projects are intended to reduce this sequence's associated financial risks in order to encourage the private sector to invest in path-breaking technological innovations (OFEN, 2013).

However, an innovation approach can only partly account for the nature of P&D projects in Switzerland. P&D projects have had an ambivalent status in the historical development of Swiss policies in this area. Energy-sector P&D projects were initially developed after the OPEC oil crisis in the 1970s, but funding for them underwent a slow decline in the early years of the new millennium. Catalyzed by political discourses for a new sustainable society, this instrument is currently undergoing a strong 'revival'. Its reinforcement in 2012 and the more than doubling of its overall funding just one year later coincides with both its integration into cleantech innovation policy and the further extension of pilots and 'flagship projects' in 2013 (BFE, 2013) (see Fig. 3). It is in this new policy context that P&D projects have recently witnessed a resurgence (OFEN, 2011).

As a result, a broader argument motivates today's use of P&D projects than the conventional techno-economic justification. P&D projects are not only meant to promote technological transfer, but also intended to 'focus on and make the Energy Strategy 2050 tangible' and 'support the energy dialogue and increase awareness among professional (expert) circles as well as the public' (translated from OFEN, 2014b). As these objectives illustrate, P&D projects are also justified by 'softer' arguments broadening their scope of action to society at large. In light of these goals, P&D projects can be considered archetypes of contemporary practices because they encapsulate the tensions between dominant policy rationales and aspirations for a paradigm shift.

This section examines how general discourses on policy orientation regarding environmental transition and competitiveness in Switzerland are put into practice. Because cleantech policy is a new form of policy organization, P&D energy projects are treated here as political laboratories of inquiry. In our analysis, P&D projects are thus used to illustrate how this inquiry articulates valuation processes. This investigation will be pursued through a detailed analysis of three projects implemented at a local level.

### 4.2. Analyzing and interpreting some pioneer P&D projects through the lens of valuation

To gain insights into Switzerland's case, we carried out qualitative research based on cross-case studies (Yin, 2009). Focusing on both the rules governing interactions and actors' narratives, our study was built on oral and written data. Four documents consisting of directives defining P&D projects' utility, aims and conditions for funding eligibility were examined. In addition, we conducted ten interviews with actors directly involved in the Masterplan and P&D projects. As well, between late 2014 and 2016, we engaged in

[2] The federal administration applies the term 'cleantech' to 'renewable forms of energy, renewable materials, recycling, sustainable farming and forestry, biological production and environmental technology' (admin.ch).

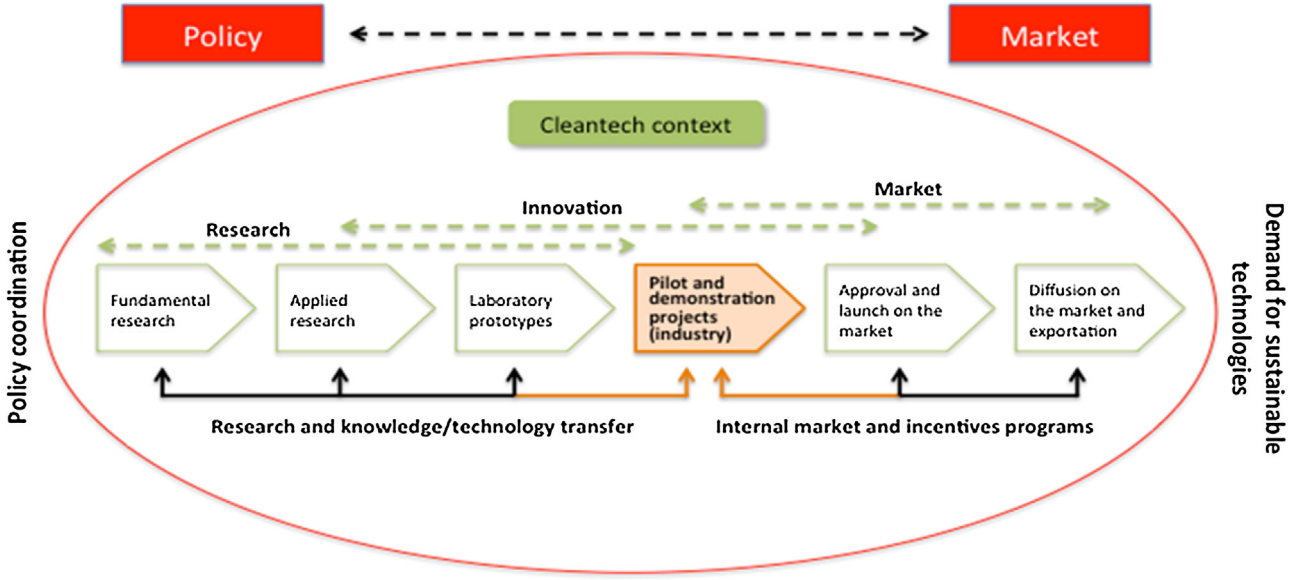


**Fig. 2.** Cleantech Masterplan's illustration of P&D projects.

Source: Cleantech Masterplan 2011.

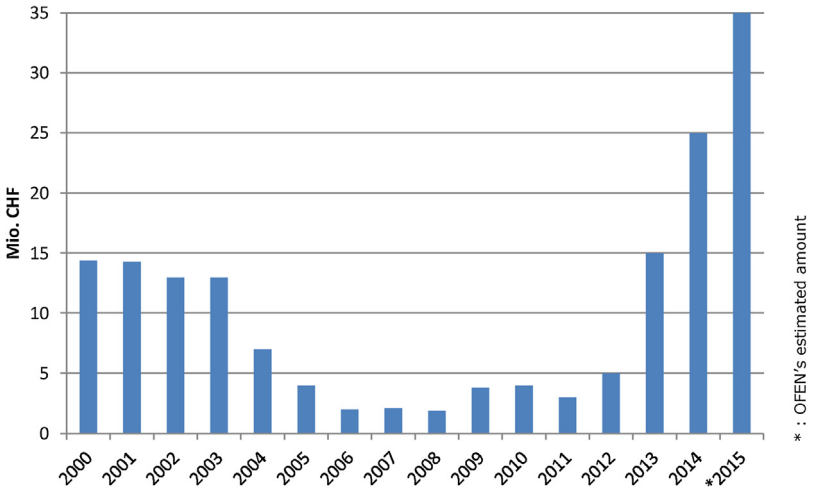


**Fig. 3.** Evolution of P&D funding between 2000 and 2015.

Sources: BFE Sektion Cleantech (2015) and BAFU and BFE (2011).

participant observation (Atkinson et al., 2007) at the Swiss Solar Agency, which enabled us to follow the debates regarding the agency's granting of awards between actors representing various views on energy issues (architects, engineers, scientists and private actors in the industry). Participating in the award-selection process enabled us to observe which major justifications are mobilized to qualify the 'quality' of various projects in the Swiss context. More generally, it served to unveil the role of such an organization in the diffusion of 'best practices'. We also attended several specialized conferences and forums involving public and private actors. Finally, and in line with the open dimension of the projects and the debated character of the topics they relate to, online and paper press articles related to the implementation of renewables and energy efficiency were used to complement our analysis.

To illustrate the three theoretical facets of a valuation policy approach, particular attention was paid to the form taken by innovation, the role played by users/consumers in innovations and the articulation of the different measures of worth. In order to do so, a first step was to identify the actors, the objects and their mutual relations in context. A second step was to interrogate why actors engaged in the projects. This made it possible to understand the values underpinning the projects. A third step, intended to reveal the interaction processes between social values and monetary values in the competition context, consisted in inquiring into how the projects emerged and with what consequences.

Three P&D project field studies supported by Swiss cleantech policy were carried out between late 2011 and 2013. With the aim of illustrating how a valuation policy approach can inform theoretically and conceptually emergent policy dynamics in recent Swiss cleantech policy, we selected from among the few existing cases. Having started our fieldwork just after the Cleantech Masterplan had been implemented, the only available cases were in the energy sector. Despite the limited variety of projects, we believe the chosen cases are consistent with our research aims: to investigate emergent dynamics of innovation policies in consonance with environmental and social issues.

Two of our case studies deal with solar thermal heating system projects intended to reduce CO2 emissions. The two plants involved belong to the two largest milk manufacturers in Switzerland: the Emmi Group's plant in the Swiss Jura, which produces 'Tête de

Moine' cheese, and Cremo SA in the Swiss Midlands, which produces, inter alia, coffee cream. Both require hot water in their milk processing. Both firms commissioned the company NEP Solar, whose initial projects were located in the South Pacific and later spread to the Americas and Europe. The technology it employs, parabolic collectors that pivot with the sun's trajectory, makes it possible to heat water to 150–160 °C.

A third case, the FlexLast Project, involves a 'smart grid' demonstration project involving BKW, the Canton of Bern's electricity provider; IBM's research laboratory in Zürich; Migros, Switzerland's largest retailer and supermarket chain; and Swissgrid, the national grid operator. The project is intended to illustrate how industrial energy consumers can help balance fluctuations in the availability of renewable energy on the energy grid by producing so-called 'secondary energy'. By aggregating information on Migros' biggest cold-storage warehouses and energy data from BKW and Swissgrid, IBM hopes to optimize the balance between production and consumption. Buffering energy is obtained by temporarily running Migros' cooling units at a lower level, shutting them down or making them run full blast (IBM, 2012).

Sections 4.3, 4.4 and 4.5 examine and depict three fundamental valuation processes grounded in the empirical analysis of these case studies. Section 4.6 then provides a synthetic discussion of these processes and relates them to the conceptual framework of the valuation policy proposed by the paper in Section 3.

### 4.3. Creating new meaning through controversy in action

To go beyond established practices and thus overcome fear of novelty and institutional obstacles, P&D projects catalyze the embedding of innovations in spatial and social contexts. As they objectivize change, on the one hand they shed light on the concrete controversial corollaries linked to the use of 'clean' technologies. On the other, they reveal potential new meanings associated with these practices. In Switzerland, renewables and energy-efficiency projects are virtually automatically embedded within debates on their potential foreseen outcomes. These, in turn, often retard or even block the implementation of renewables and the adoption of new ways of doing business (OFEN, 2013). In this context, P&D projects thus make it possible to identify unpredicted contextualized problems and solutions. They also facilitate the wider adoption of new methods of consuming and producing.

OFEN (2013) reports that although solar-panel projects are the least controversial cleantech projects, they nonetheless polarize residents and, to a lesser degree, authorities. The arguments invoked involve issues ranging from aesthetics (harmony and integration with traditional architecture) to landscape protection and land use. Our case studies concerning solar thermal heating relate more particularly to land use, as they highlight the significance, in the context of Swiss 'land scarcity' (ARE, 2014), of industrial rooftop optimization. This is expressed by Cremo's executive, whose remark illustrates that he has internalized the debates linked to land use in Switzerland: 'Each square meter of an industrial roof represents a rare element' (Magazine de la Banque Cantonale de Fribourg, 2011). In Emmi's case, Saignelégier's chief of dairy production had long wanted to install solar panels on a piece of land behind his plant, but it was only when planning the construction of a flat-roofed cave that Emmi's business executives took the decision to implement solar energy. In both cases, the validation of solar troughs was narrowly related to coinciding justifications linked to land preservation and energy efficiency, thus bringing to light the value attributed to solar energy, to the living environment and to the quality of life.

While these projects demonstrate new openings for the implementation of renewables in Switzerland, the grid project sheds light on the exploration of new interests and identities in a context of market change.

The smart grid project epitomizes the radical changes, linked to the advent of green power, that are currently taking place in the energy sector. Thus far, the system has been vertically organized, with clearly defined actors and roles, a clear delineation of electricity costs and benefits and the easy adjustment of electricity production to consumption. Three major consequences of the changes taking place can be identified. First, the energy value chain will increasingly integrate consumers as providers. Second, an increasing number of appliances for everyday life will be integrated into the system in order to balance the power grid. Third, disintermediation may result from decentralized electricity production. Energy suppliers might lose their monopoly and have to look for alternative sources of revenue, such as providing new services linked to energy efficiency. Yet, in spite of the great uncertainty regarding the viability of approximately 700 companies (The Boston Consulting Group, 2013), so far only a minority of companies consider energy efficiency a trade alternative in Switzerland.

In this context, the FlexLast case revealed major issues regarding the role of stakeholders in the system: for both the food supplier and the energy supplier, the challenge may be characterized as one of 'role-hybridization'. Migros broadens its activities through the integration of its appliances into the energy value chain. BKW, at the intersection between demand and supply, experiments with the pooling of electrical capacity.

While investigating how to optimize its cooling warehouses, Migros became aware of the high energy costs incurred as a result of switching its cooling units on and off for short periods. Producing 'secondary energy' implies using more energy than usual, thus entailing supplementary costs. However, these costs are offset by the profits drawn from its sale of secondary energy.[3] Thus, while it a potentially lucrative future market (Energies Renouvelables, 2013), producing secondary energy also entails experimentation with a new active role in the energy system and taking new industrial and commercial risks.

In BKW's case, the key challenges involve its transition to the role of a network coordinator and learning how to address future new solutions packages. BKW's new function within the energy system thus involves broader issues that are linked to the distributed benefits of energy regulation. First, they involve viewing new business models as innovations, and second, they relate to as yet non-existing legal contracts regulating each pool's interface and related risks.

### 4.4. Promoting socio-cultural values rather than selling end products

While aiming to create sense in a context of systemic change, P&D projects display dialogic, open-ended and fundamentally public dimensions that are associated with new logics of socio-economic value creation.

Contrary to a conventional manufacturer-centric approach in which the consumer's role is to have needs that manufacturers fulfill by producing new products, P&D's implemented and tested technologies are renewed as the projects multiply and are adapted to comply with stakeholders' specific uses. Solar high-heat production in milk processing was first used in Grisons (southeast Switzerland), at 1700 m, where temperatures can reach −30 °C in winter, before it was implemented in the Jura and the Swiss Midlands. The solar-collector fields were successively adapted to the various roof sizes and pitches and local climate conditions. They

[3] The Swissgrid representative (19.12.2013) indicated that secondary energy is paid 20% more than other types of energy.

were also expressly renewed to comply with the specific applications (quantity and temperature of heated water required). In the same way, the FlexLast case highlights the primary importance of users in P&D projects. Following earlier experiments on the buffer potential of electric vehicles and household devices in Denmark, the Swiss project aimed to explore that of another type of consumers – large industrial energy consumers. With this aim, IBM's software had to be adapted to the specific context of energy use: Migros' energy consumption (equivalent to 4100 households' annual electricity consumption), the quantity of stocked products and the frequencies of deliveries. The iterative and user-led dimensions of this project are further illustrated by the fact that, parallel to FlexLast's experimentation, a survey was conducted with a wider panel of potentially interested industrial actors in Switzerland. This survey aimed to enlarge the energy pool by including numerous and diversified consuming industries (the aluminum, steel, timber and chemical industries, for example) in line with more realistic applications of future smart grids.

Users' involvement in these projects goes beyond mere individualistic and functional purposes, however. What other people think – in analytical terms, the relational value – of these projects is essential to understanding these projects' underlying socio-economic logics. This is illustrated by Cremo's manager, who stressed the advertising and educative impact of his solar system: 'One sees that the sun could provide what we need, but also that it requires work to be able to get it (Interview with Manager of Cremo: 28.11.2013).

These new creative practices are also designed as glass cases to catch the attention of experts and journalists. In our cases, the projects' exemplary nature was mediatized through two prizes. The first was the Swiss Solar Prize (Swiss Solar Agency, 2014), which rewards the exploitation of solar technologies and aims to encourage renewed applications to reduce Switzerland's reliance on foreign energy.[4] The second was the World Retail Award 2013, which judges retailers on an international scale in various categories, such as 'Customer Experience', 'Advertising Campaign', 'Store Design' and 'CSR Initiatives'. In both prizes, what is primarily acknowledged is not the intrinsic functional quality of the implemented technologies, but the meaning connected to these practices: the Tête de Moine cheese manufacturer was awarded the Swiss Solar Prize in 2013 for the new perspectives it opened in the industrial application of thermal energy consumption (Swiss Solar Agency, 2014). Migros was honored in 2009 as 'the world's most responsible retailer' for implementing initiatives aimed at 'living its values' (World Retail Awards, 2014).

The analysis shows that, contrary to a conventional techno-industrial approach to innovation, which generally conceives of productive capacities as the leading source of value creation, in the case of P&D projects it is the relation between producer and consumer that actually constitutes the linchpin of economic and cultural value creation. Accordingly, the resulting innovations are not to be directly exported, unlike traditional techno-productive innovations. This was notably illustrated in the case of the solar heating system. It is the symbolic incorporation of the values attached to more 'environmentally friendly' ways of producing coffee cream that will be economically valued and monetized in the future: 'What we earn is not to use fossil energy. (...) We are in a totally different world, that's why we want to stick a little sunshine on coffee cream lids' (Interview with Manager of Cremo: 28.11.2013). In the smart grid case, secondary energy's trade is limited to the domestic market for technical reasons. Thus, what will eventually become tradable in the future consists of solution packages with complex business models and indirect revenues (Chesbrough, 2013; Ng, 2010; Osterwalder et al., 2005; Teece, 2010).

### 4.5. Use value through valuation in commitment

Substantiating these new value-creation dynamics, our interviews revealed that actors place social justifications before economic calculations: it is the commitment and meaning attached to these new ways of producing/consuming that are valued by the firms and recognized by market influencers. Moreover, in a context in which environmental preservation and the move away from nuclear energy are considered costs, public actors legitimate these new use values through their support of cleantech projects.

'It is not a way of making money; it is above all the search for ways to use renewable energy' (Interview with Tête de Moine's chief operations officer: 03.11.2013); 'We will have another 20–30 years with petrol; it [renewable energy] will not be profitable for a long time' (Interview with Manager of Cremo: 28.11.2013). As these quotations suggest, economic rationales are not a primary justification for the implementation of energy-efficiency projects. It will take 20 years to amortize the investment in the solar installations, which roughly corresponds to the technology's foreseen lifespan. Furthermore, the proportion of heating oil saved to the total amount required is like a drop in the ocean. The figures in Cremo's case are telling: one oil tank is saved per year, while three to four tanks a day are necessary to run all of the manufacturer's installations. Thus, neither the monetary-saving argument nor that of major CO2 reductions appear to be realistic explanations of the company's practices.

These case studies demonstrate that these firms do not understand their commitment in terms of immediate economic competitiveness, and that they feel a responsibility to contribute to changing the general socio-technical regime: 'If we are not capable of changing, then who is?' (Interview with Tête de Moine chief operations officer: 03:11:2013); 'The bigger the firm, the bigger its responsibility' (Interview with Migros: 11.06.2013). Such discourses show that firms engaged in P&D projects do not merely conceive of these projects in terms of a follower strategy intended to add corporate and social responsibility management to business as usual. Instead, they see themselves as pioneers that are performatively committed to placing this responsibility at the core of their future economic activity, and to promoting new meanings and rationales in the social and political agendas of a sustainability transition.

Correspondingly, public actors' symbolic support was mentioned as a prime driver for the implementation of such projects. The deployment of strategic policies and specific policy measures in the cleantech field signify the importance of firms' activities when linked to the preservation of natural resources. These policies and measures legitimate the new socio-cultural values related to 'responsible' actions (Interview with Migros: 11.06.2013), which subsequently contribute to the co-development of new social values linked to environmental preservation and away from nuclear energy. In this context, public actors not only justify investing in new ways of producing and consuming, but also contribute to the final symbolic value of products, which together represent a significant part of post-modern economic values.

Because their goal is to support 'dialogue' and 'social support' (OFEN, 2014a) through flagship measures, public actors engage in the publicly debatable dimension of new social values. The foreseen marketization of products not only rests on the presentation of technological products in the open – on objectivation – but is also contingent upon collective mobilization, and hence on both society's relation to products and concepts and the meaning society attaches to them. Correspondingly, on the one hand, it is through

[4] The Office Fédéral de la Statistique (OFS, 2014) claims that roughly 70% of Switzerland's energy needs are met through imports.

the staging of successive trials that firms will internalize these new environmental values, which are in turn diffused through the media-symbolic sphere (Kebir et al., 2012). On the other hand, given the uncertainties characterizing the energy field in Switzerland, public actors take part in the co-development of future social and political agendas through the reflexive dynamics of learning by a large range of actors (firms, civil society, politicians). Accordingly, echoing the OECD (2009b) report on the 'New Nature of Innovation', our cases illustrate that the partnering of public entities with the private sector procures added legitimacy both ways. On the one hand, the intervention of high-reputation firms legitimates long-term policy goals in a context of systemic uncertainties. On the other, the public sector's intervention is necessary to legitimate private engagement in new value-laden activities.

### 4.6. Discussion

The resurgence of P&D projects and their implementation in Switzerland's energy-transition policy illustrate the ambivalent justifications behind them, torn as they are between techno-productive and broader socio-economic rationales. While the former is formally used to justify public intervention and spending in pre-competitive innovation, the latter is used to justify policy involvement in the sustainable transformation of the economy and society at large. Interpreting these P&D projects through valuation in society, socio-technical change and markets makes it possible to integrate these two dimensions into a coherent policy approach.

In a *valuation in society perspective*, as our analysis shows, P&D projects first have to deal with the fundamental question of what a transition towards sustainable development should be about in the economy, policy and society. This question places at the fore the radical societal uncertainty regarding the ability to steer development and govern the co-creation of common aspirations in the context of an unpredictable future. By triggering and catalyzing controversies in actual experiments, P&D projects are specific and concrete stages of inquiry through which future social values can be problematized, debated, co-constructed, recognized and justified – democratically and iteratively – in the Swiss context of an energy-transition policy.

Consequently, P&D projects are drivers of *valuation in socio-technical change* because they translate values into disruptive social practices and technical devices. On the one hand, they are specific contingent solutions that trigger as well as actuate alternative ways of producing and consuming. On the other hand, they underpin hybrid forums that engage firms, public authorities and civil society in the redefinition of the use value of context-dependent practices, technologies and infrastructures that could eventually become exemplary for the economy and society more broadly. In this sense, public support for P&D projects goes beyond an innovation policy seeking to prevent the potential 'market failure' of tradable replicable solutions supposed to solve well-identified functional problems. Instead, it should be interpreted as part of a long-term 'transformational-failure framework' that seeks to create concrete arenas of debate that link individual agency with systemic contexts, ultimately enabling a progressive re-shaping of culture and structures (Weber and Rohracher, 2012).

While it is hardly tradeable, the economic value P&D projects builds upon complex *valuation in markets* as well. As illustrated in the case studies, firms that engage in such projects do not expect direct and immediate monetary returns on their investments. Their activities cannot be interpreted as conventional strategies of product innovation or market differentiation based on corporate social responsibility. These firms imagine themselves as central players in a transition whose commitment to sustainable development today will be recognized and marketable in a future value regime. New economic value is thus consequent to and co-developed with the establishing of new social values in markets. Innovative products and services can be economically valued only if the responsible commitment of producers and consumers for the future of the environment and society becomes a recognized quality convention. That is why prizes, awards and the media are crucial devices in assigning a market quality to exemplary practices.

Valuation in the market thus deals with two interdependent processes. On the one hand, actors seek to make their commitment to a sustainable future visible, and to have their commitment acknowledged. On the other hand, market intermediaries (opinions leaders, journalists and experts) precondition the economic value of products and services in the future. In this view, public authorities are not simply innovation promoters or market regulators. They are active market shapers who legitimize discourses and set up socio-technical devices that assign a market quality to particular social values and related path-breaking practices.

## 5. Conclusion

In recent years, the concept of transition has increasingly been used to challenge the dominant intellectual and political rationales related to socio-technical change in the economy and society. The concept of transition has usually not been treated as a new conceptual theory of development, but as an analytical and heuristic framework through which to reconsider and broaden conventional innovation theories and policies based on a techno-productive and competiveness approach to socio-economic development. As such, the concept of transition has never been intended to replace the concept of innovation itself in the policy grammars. While the concept of transition can describe the issues and scope of a general change, the concept of innovation remains the theoretical and operational framework for identifying the resources, actors, practices and devices that can operate this change. In a nutshell, the use of transition rhetoric and analysis have mainly guided the broadening of traditional STI policies in order to engage with systemic changes in society at large.

To discuss 'change in the context of change' (Miller, 2007), this paper has introduced the concept of 'valuation' as an alternative intellectual framework through which to theorize and operationalize the 'Grand Challenges' inherent in the sustainability transition. By advocating this concept, we do not intend to reinvent the wheel and get rid of the rich contributions by other scholars. We do, however, argue that a valuation approach can provide an integrative interpretation of the multi-dimensional and complex dynamics of socio-economic change today. By focusing on the purpose behind contemporary developments in economies and societies rather than the factors that contribute to these developments, this approach offers two main potential benefits for research and policy.

On the one hand, it can provide a dynamic and systemic approach to social and economic value creation that goes beyond supply-oriented competition in markets acting as information and selection mechanisms. In this view, a change in economic value is not reduced to a change in market offerings and preferences. It conceives of value creation as a group of interactive practices related to the inquiry into new social values, the implementation of related socio-technical solutions and the assignment of value to these solutions in markets. This valuation approach does not overlook innovation. Innovation is a constitutive aspect of the perpetual evaluation and valorization of new practices, discourses and devices in the economy and society.

On the other hand, using valuation rather than innovation as a policy referential makes it possible to break with established orders. It comprehensively captures transversal matters of technological, market and societal uncertainties inherent

in transformational change. While engaging with the open-ended, complex, multidimensional, co-evolutionary and long-term dynamics related to sustainability goals, it integrates these issues within the current economic context of competition characterized by ultimately quantifiable growth goals. It provides a novel lens through which to interpret and operationalize broad-based policies and policy mixes concerned with not only problem solving, but also problem setting.

In a 1974 essay, Richard Nelson highlighted the way theoretical models perform policymaking: 'If we can land a man on the moon, why can't we solve the problems of the ghetto?' (p. 376). He argued that established policy models reflect particular intellectual and political rationales that may fail to adequately address actual social problems.

In a similar line of argument, the theoretical and empirical discussion provided in this paper shows that the new 'space race' for clean energy advocated by President Obama reaches far beyond a well-established competitiveness and science-based approach to innovation policy. This new race does not simply involve a framework for economic change consisting of supporting innovation through research, education and industrial policies. What are primarily at stake are the co-development, legitimation, adoption and implementation of new social values shared among social, economic and political players involved in broader societal change. Not simply an exogenous catalyst of innovation, public policy must instead be considered an endogenous force of value transition and development.

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Of course, the responsibility for the interpretation proposed in this paper lies solely with the authors.

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