Standards and innovation in emerging fields: Pushing breakthrough innovation or enrolling actors? An analysis of eco-district standards in France and Denmark

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July 2011

Acknowledgement: We are grateful to PUCA in France for providing research funding for this project.

Abstract

Standards and norms are central objects for institutional studies. However, their role in innovation and the creation of novelty remain unclear, in particular in new / emerging fields. Accordingly, this paper investigates the relationship between standard setting and innovation, in the context of emerging organizational fields. We consider standardization in emerging fields as a socio-technical process, which must simultaneously promote a certain degree of innovation and enroll actors in order to succeed. We apply this perspective to compare standardization processes in the field of eco-districts, both in France and Denmark. Our analysis reveals different tensions, tradeoffs and priorities, among standards, between enrolment priorities, and the need to push forward technical innovation. We discuss how the two issues of constraints and enrollment can be articulated and combined.

INTRODUCTION

Standards and norms constitute central objects for regulating behaviors in contemporary societies (Brunsson & Jacobson 2002). Within neo institutional theory, standards and norms are typically associated with normative institutions (Scott, 1995), which are likely to reinforce isomorphism and conformity within a given organizational field (DiMaggio & Powell, 1983). Standards constitute tools for changing and regulating behaviors, framing fields, claiming authority and diffusing practices in professional settings (Abott, 1988). They constitute central devices through which central constituents of organizational fields and professions struggle for authority over a given area of practice (Hoffman 1999). Once defined and adopted, standards favor stability, enable the diffusion of specific solutions and behaviors, and embed power relationships within an organizational field.

So far, researchers have mostly studied standards for their disciplinary role in mature fields. However, a mounting issue is to better grasp the relationship between standardization, change, and innovation (Allen & Siram, 2001). In this article, we wish to explore this question in the context of emerging fields (Maguire, Hardy and Lawrence, 2004), i.e. in situations where standards proliferate although technical objects and solutions, fields of expertise, and power relationships are not stabilized. These situations raise particular difficulties in terms of standard setting, because exploration (i.e. the creation of new innovations) is still required before any solution can be diffused. In such emerging fields, questions emerge concerning the relationships between standards and innovation such as: does standardization close the debates on the definition of an eco-district and prescribe specific practices/levels of performance? To what extent can standardization contribute to radically increase the social and environmental performance of eco-districts? In contrast, how do actors mitigate the risk to stifle the innovative potential of eco-districts? Through which

means and mechanisms can the innovation potential be maintained while developing standards and reference systems?

To investigate these questions, we propose to consider standardization as a socio-technical process, which simultaneously promotes technical innovation and aggregates collective groups around new objects. We then apply this perspective to compare standardization processes in the field of eco-districts, both in France and Denmark.

Eco-districts constitute a challenging object for standard setting. Standardization is typically prescriptive in nature, requiring clearly defined objects (Brunson & Jacobsson, 2002). However, the concept of an eco-district appears to defy any clear definition. There is debate about their possible form, breadth (city / urban district / residential area, etc.), scope (environment, social diversity, transportation), relevant fields of expertise (engineering, sociology, architectural, urban planners, designers, transportation experts) and objectives. As a result eco-districts can be considered as an *emerging field*, i.e. a field where members, expertise, rules, relationships and activities remain uncertain and contested (Maguire & al. 2004). What is more, a district is, by essence, context specific, which makes standardization an intrinsically difficult task.

The empirical study draws on an analysis of the content and development process (motive, supporting actors, development process and diffusion potential) of each standard, in order to understand how the standard is likely to affect innovation processes. Our analysis reveals different tensions, tradeoffs and priorities, among standards, between the capacity to leverage interest among field constituents, and push forward technical innovation. We discuss how the two issues of constraints and enrollment can be articulated and combined.

THEORY: STANDARDIZATION, INNOVATION AND EMERGING FIELDS

Standardization and innovation: a mixed relationship

Following Brunson and Jaccobson (2002), standards refer to “specific rules about what to do”, i.e. as externally defined and non-mandatory regulations. More specifically, Allen and Sriram (2000: 173) define standards as “documented agreements containing technical guidelines to ensure that materials, products, processes, representations and services are fit for their purpose”. The standardization process is about building codes or standards for sustainability, with the objective to drive design practices toward specific ends at a regional or national level. Standards may be supervised by public authorities but may also emerge from more distributed collective action processes.

Existing work on the relationship between innovation and standardization show mixed relationships. On the one hand, Allen and Sriram (2000) show that the relationship between standardization and innovation is not simple and one-sided. Using an economic perspective, they argue for a generally positive contribution of standardization to innovation: technical standards facilitate cooperation between organizations, increase product performance, homogeneity and interoperability, accelerate the diffusion of technical solutions and products in the diffusion stage of a product life cycle (Utterback, 1994). As regulatory tools, standards are developed to enable comparability, conformity, predictability and external control (Brunsson & Jacobson 2002). As such, they create isomorphism which can accelerate the diffusion of specific practices and innovation in organizational fields (DiMaggio & Powell 1983). On the other hand, standards can have adverse effects on innovation. David (1985) has shown how technical standards such as the ‘qwerty’ keybord can create lock-in effects and make it difficult to adopt a more efficient innovation because of the cost they would create for customers. As a result, there is a risk that standards contribute to institutionalize inefficient practices and stifle the innovation potential of a field.

The regulatory properties of standards can also be largely downplayed when actors can decouple the adoption of a standard from actual practices (Boxenbaum & Jonsson, 2008). In

this perspective, King and Lenox (2000) have analyzed the history and outcomes of the *Chemical Care Program,* and criticize voluntary standards for their lack of control, sanctions and enforcement mechanisms, and shown how this standard may have contributed to slow-down progresses in environmental and safety performance in the US chemical industry. Finally, Chatterjee and Levine (2006) have shown that the proliferation of voluntary standards in the field of social responsibility can make coordination and control complex, favor decoupling, and lead to adverse selection (Akerlof, 1970) where the less stringent standard becomes the most diffused.

Overall, standards may favor the diffusion of existing technical solutions in mature fields. But the relationship between standards and innovation appears much more complex in emerging fields. In emerging fields, actors, expertise, and solutions are still to be established. Standardization has thus to cope with uncertainty, and find a delicate balance between prescribing performance / behaviors while preserving the exploration of new innovations. What is more, as the governance of emerging fields is unstable, there are no definitive and uncontested sources of authority and legitimacy in the field (Maguire & al., 2004). As a result, standards are more likely to proliferate from different sources, be in competition with one another, and struggle for recognition and diffusion. The development process, impact and diffusion of such standards appear more complex than in stable fields. To explore these issues, we propose to build on Actor Network Theory (ANT) (Callon & Ripp, 1986 ; Latour, 1987) and consider standardization as a socio-technical process.

Standardization as a socio-technical process

ANT has developed to reconsider classic distinctions between the social, technical, and natural worlds. Within ANT, innovation is described as a collective achievement and a process connecting social and technical elements through enrollment strategies. Within ANT,

innovation is developed and diffused when technical and social components become intimately tied to one another (Callon & Ripp 1986). Key to this process is the ability to enroll actants (i.e. actors and material devices) in a common network. Yoo, Litinen & Yang (2005) have applied this perspective in technical standards development, in the broadband mobile infrastructure in South Korea. They showed how the development of national technical standards helped assemble various interests around technical solutions, thus accelerating the uptake of this technology in the country. In this perspective, we consider the choices in the design of the standard as the outcome of sociotechnical explorations, i.e., a way to recombine a rearticulate actors' interests, technical constraints, and market development.

In line with this perspective, we consider standardization as a socio-technical process, i.e., a process of enrolling actors and simultaneously changing practices and promoting innovation. In order to promote innovation in practices, the process of standard development implies the combination of two series of constraints. *The first issue is to enroll actors in order to develop the standards' legitimacy, use, and diffusion. The second one is to push forward strong innovation requirements and modify practices.* If a given standard is widely diffused but does not require any specific performance or change in working processes, it will likely favor decoupling and symbolic conformation. Reciprocally, if a standard is very prescriptive and requires breakthrough innovation, but is not diffused, it may have strong innovative consequence for individual organizations that use it, but it will have a low impact on innovation at a larger scale because of the limited number of adopters.

There are a variety of ways through which each issue can be met:

1. *Developing the standards' legitimacy, use, and diffusion.*

From an ANT perspective, legitimacy, use and diffusion of standards are strongly linked with the quality of the underlying enrollment process, resulting in the development of stable actor networks within a field. This issue is particularly challenging in emerging fields where

various initiatives may be in competition with each other. Successful enrolment can be achieved through a variety of mechanisms: standards can be designed through a participative process where all major actors are involved (Acquier & Aggeri, 2007). User involvement can also increase the fit between the standard and user needs, and ultimately the likelihood of adoption and diffusion of the standard (Ives & Olson, 1984). There are also specific devices for interesting actors, in particular practices meant to reward the use of standards by facilitating access to scarce and strategic resources (Pfeffer & Salancik, 1978), such as expertise and financial incentives. The legitimacy and status of the organization that developed the standard (Suchman, 1995), e.g., a national standardizing organization, an existing organization on the field of construction, or the state, also constitute useful resources that can facilitate this enrolment process.

2. *Pushing innovation requirements and modifying practices.*

Innovation and modification of practices can be achieved by introducing new product performance criteria or process transformation, which make business as usual no longer possible. However, even if standards or reference systems may officially require stringent objectives or changes in working processes, actors may be able to decouple the adoption of standards from actual practices (Meyer & Rowan, 1977). Decoupling is made easier when standards or reference systems promote broad objectives rather than accurate and measurable data (Boxenbaum & Johnsson 2008), and when there is no enforcement protocol, verification, and sanctions against free-riders (King & Lenox, 2000). As a result, it is necessary to consider both the innovation potential of standards (i.e. the degree to which they promote new performance criteria and process transformations which make business as usual impossible) and the existence of verification protocols which may mitigate the risk of free-riding and decoupling.

The task of balancing constraint and enrollment appears as a critical task in any standard setting initiative, but we contend that this issue is particularly critical in emerging fields, where objects, expertise, techniques, and market potential appear highly uncertain. By investigating the case of eco-districts standards in France and Denmark, we want to answer the following questions:

- Which similarities and differences are there in various standardization initiatives in terms of the way they manage the articulation between innovation potential and enrollment dynamics?
- Which national influences, if any, exist in the way enrolment and innovation are promoted in standardization initiatives?

METHODOLOGY

The empirical study is designed as a multiple case study, composed of six cases of reference tools for eco-districts. Relative to single or double case studies, multiple case studies allow for comparison across a larger number of cases and hence for a more robust analysis of empirical patterns. This type of design is indicated when the ambition is to build theory about a relatively unexplored topic (Eisenhardt, 1989), which applies to our study. Our ambition is to build theory about the relationship between innovation and standardization through an inductive analysis of six cases of eco-district reference tools.

Multiple case studies also allow for multiple levels of analysis in the same study (Yin, 2003). For instance, Pettigrew (1988) analyzed both the industry level and the firm level in a multiple case study. In the present study, we look at both the project level and the national level of analysis. Each reference tool has been, or is being, developed as a project within a specific organization. Each organization has only one project. The eco-district reference tool project represents one level of analysis in our study. To this we add a national level of

analysis, comparing two cases from Denmark with four cases from France. The idea is to investigate if any patterns observed at the project level seem to be shaped by the national context. Through this embedded research design, we explore recurrent patterns in the relationship between standardization and innovation at the project level while also examining potential national characteristics of the identified patterns.

Case selection

A sector with significant environmental and social impacts, construction has been identified as an object for rationalization on social and environmental issues. The general interest in sustainability has reinforced this ambition. Over the last decade, numerous reference systems and standards have emerged (e.g., BREEAM in the UK, LEED in the US, and CASBEE in Japan) and new regulations have been passed to promote sustainability in the field of construction. As part of this process, various actors have recently argued that it is necessary to move beyond the level of the single building to that of the neighborhood or the city. Their rationale is that an eco-district is more than the simple aggregation of individually optimized buildings and that important sustainability issues related to transportation, social diversity, employment or functional diversity are best tackled at an integrated level. Accordingly, eco-districts have emerged as a new arena for innovation and standardization in sustainable construction. Actors in different countries are developing standards and reference systems in an effort to define what is meant by an "eco-district".

We have selected six eco-district reference tools as our case studies. They are: *Eco-district Norm P99N* (FR), *Eco-district Label* (FR), *HQE Development* (FR), *HQE2R* (FR), *Realdania Process Tool* (DK), *Municipality of Copenhagen's Sustainability Tool* (DK). These six cases represent all the nationally developed eco-district reference tools that we were able to identify in respectively Denmark and France in spring 2011. We have thus excluded cases like BREEAM or LEED that were developed abroad and not adapted specifically to either the Danish or French context. Eco-districts represent a new domain of activity, which is

conducive to innovation. At the same time, reference tools are the closest we come to standardization in this emerging domain. Reference tools refer to guidelines that help define the notion of an eco-district and that thereby influence its conception and design. Eco-district reference tools thus represent a good object of analysis for examining the relationship between innovation and standardization.

Data sources and data collection

The data sources used for studying the six cases include the written description of the reference tools, observation of meetings, and semi-structured interviews with key actors. The reference tools describe the dimensions and indicators that vaguely define the notion of an eco-district and/or the process steps that developers follow to conceive and build an eco-district. We collected these reference tools on the internet or by observing meetings, which we also used to obtain more detailed information on tools in development. In addition, we conducted a total of nine semi-structured interviews with key actors, three in Denmark and six in France. The primary purpose of the interviews was to collect contextual data on the identified reference tool; we secondarily used the occasion to explore the potential existence of other, yet unidentified, reference tools. Our interview guide, reproduced in Appendix 1, explored the origins, current status and future prospects of each reference system. Interviews lasted between 45 min. and two hours, they were recorded and transcribed. We further observed meetings where standards were being developed and collected written material, such as reports, books, and summaries of meetings. We triangulated interview data, observations and written material to validate the collected data.

Data analysis

We analyzed the reference systems by using a comparative table (see Appendix 2). This table contains key descriptive data about the content of each reference tool, its origin, and its connection to actors and established practices in the field of construction. It also contains our analysis of which content elements (indicators and processes) seem unusual relative to other eco-district reference tools and/or highly specified, e.g. a calculation method or another measurable indicator. We singled out unusual and highly specified elements because they carry the potential to pull developers in new directions or to challenge them to reach a difficult goal. We consider these components conducive to innovation. We validated this analysis against interview data and observations.

RESULTS

In this section we first present a general appraisal of the six reference tools for eco-districts. Secondly, we present our findings on their innovative potential, which refer to elements within the tools that carry the potential to change the routines of construction actors because they are highly specific, unusual, or contingent on externalities. The key findings on this topic, reproduced in Figures 1, 2 and 3, constitute what we consider to be the innovative potential of the reference tools. Secondly, we present our findings related to the strategies for enrollment, i.e. interessement, that are used to engage actors in either the conception or the use of the tool. Interessement is important for the ability of an innovation to diffuse and cause large-scale change in construction practice.

General appraisal

The six reference tools for eco-districts that we analyze, four from France and two from Denmark, have been (or are being) developed by both private and public organizations.

The initiators include a norm-developer, a ministry, a municipality, a public construction agency, a private construction foundation, and a private company. These initiators have, as we see in Appendix 2, engaged other actors in developing the reference tool and applying it in practice. Most of the reference tools are still in a state of development or refinement. They are not by any means the first such tools to be developed in the world since the American LEED, the British BREEAM, and the Japanese CASDEN systems are widely used elsewhere. However, they represent the first national initiatives to develop reference tools for eco-districts that are adapted to a French or Danish context.

We first compared the assessment categories of which the reference tool is made, i.e. the elements to be included and evaluated when building an eco-district. Here we note that most of the reference systems adopt a classical division between environmental, social, and economic dimensions of sustainability. One of them (HQE2R) diverges from this classical division and introduces instead a number of cross-cutting themes that seem to exclude economic factors. A comparison of indicators in the different reference systems shows a certain number of standard themes, most of which belong to the environmental dimension, such as energy, transport, water, and waste. Diversity is common to all reference systems in the social dimension. Some indicators are somewhat common. In the environmental dimension, we see landscape, bio-diversity, patrimony, and construction materials. In the social sphere, where it seems particularly difficult to come up with universally applicable indicators, we notice a tendency to include local governance, health, access to employment, and education and training. Finally, there is a tendency in the economic dimension to evaluate the costs of the project and the local economic performance, though the latter seems rather ambiguous and difficult to assess.

Overall, we find a dividing line between reference systems that aim toward a performance rating of eco-districts and those that seek to certify work processes. For instance,

some reference systems let the actors select which themes and indicators they want to work with (e.g., HQE2R and HQE Development) while others insist on using pre-determined indicators (e.g., Eco-District Label and Realdania's Process tool). The two former are oriented toward a certification of the work process like an ISO certification while the two later pursue an assessment of eco-districts as a sustainability product. The reference tools vary according to what they first and foremost seek to standardize: product or process. In both cases do they carry potential for innovation and change.

Innovation

We analyzed the innovative potential of the six reference tools on two axes: the categories for assessing sustainability and the recommended processes for how to use the tool. Our content analysis, reproduced in Appendix 2, reveals a high level of similar categories related to the natural environment, the social tissue, and financial performance. Not only do the reference tools mirror each other in content but they also contain elements that are generally non-disruptive for construction actors to use. Most categories are vaguely formulated, e.g. 'favor social diversity' and 'protect local patrimony', and do not, therefore, require construction actors to develop new practices. The categories that are more specific, such as the maximum levels of energy consumption, tend to reflect European or national legislation that is already integrated into construction practice and hence not a source of novelty. The majority of categories, including the evaluation mechanisms to assess them, do not stimulate actors to develop new practices or to surpass standard performance.

A few categories in the six reference tools stand out as potentially able to provoke rupture in routines. These elements appear on lines 13 of the analytical grid (Appendix 2). Figure 1 represents a division of the potentially innovative categories into components that are a) unusual or b) highly specific without reflecting European or national legislation. We

notice here that most of the unusual components in the French reference tools relate to the protection and integration of agriculture while the Danish reference tools are particularly attuned to the management of rain water.

	Unusual components	Highly specified, unregulated components
Eco-district Norm P99N (FR)	Action area 5 (privilege local food production): Percentage of served meals on the territory that contain at least 50% local foodstuff	Action area 10 (decarbonate the economy): TeCO2 assessment (ADEME)
HQE Development (FR)		
Eco-district Label (FR)	Ambition 15 (preserve economic viability of non-urban and urban operations): introduce policies that protect agricultural territory and reinstate agricultural activities closer to city centers.	
HQE2R (FR)	Target 3b: Regeneration of brown-fields and polluted sites and soils. Target 20b: participation of residents to decision and projects related to the neighbourhood.Target 21c: Cultural links across the globe	
Realdanias Process Tool (DK)	Element 10, operational expenditures, ind. 45 and 49: what are the municipal costs, respectively the societal costs, of dealing with rain water in the way previously proposed?	Ind 9 (element 3, water): which percentage of rain water is led into the sewer system (points attributed to percentages).
Municipality of Copenhagen's Sustainability Tool (DK)		Con 4: water consumption max 110 l/ per person/day in residences; 34 l in business. Con 6: maximum 15 min. by foot to a park, a beach, a nature resort, or a harbor bath facility.

Figure 1: Categories with innovative potential in eco-district reference tools.

Specificity could in principle come from clear and strict evaluation criteria in the tool. However, the evaluation criteria are rather unspecific as seen in Figure 2 below (reproduced from line 16 of Appendix 2). To measure performance, several tools have a quantifiable rating system that rely on scores (0 – 3 in Eco-district Label, 1 - 5 in Realdania's Process Tool and Municipality of Copenhagen's Sustainability Tool) and -3 - +3 in HQE2R. HQE Development has no quantifiable rating system but engages actors in the setting of specific

goals that can be integrated into a contract. The quantifiable reference systems use ‘spider webs’ as a graphic illustration of eco-district performance, some of which add weight to the different dimensions to calculate a score (e.g., Realdania’s process tool), others of which formulate an action plan to facilitate further work (HQE2R). For some tools, the output is tied to an ambition of eventually carrying out a certification of eco-cities (e.g., Eco-district Label and Eco-district Norm P99N) versus a desire to achieve a specific result for the contractor (e.g., HQE Development).

So far, there is no indication that the evaluation criteria push actors to perform beyond their previous capacity (i.e. potentially innovate). We note, however, that some tools lend themselves better than others to an eventual introduction of clear performance criteria. This is the case for reference tools that have an explicit ambition of offering a label or a certification (i.e., Eco-district Norm P99N and Eco-district Label). Another interesting observation is that the Danish tools seek to assess projects relative to other projects while the French tools either aim for absolute criteria (Eco-district Norm P99N and Eco-district Label) or, alternatively, for criteria that are specific to the individual project (HQE Development and HQE2R).

A parallel analysis of the innovation potential in processes comes to a similar conclusion. Most of the process-oriented steps in the tools are continuous with existing construction practice and hence unlikely to provoke innovation or change in construction practice. In fact, some tools have explicitly aligned the processes with established and validated practice (e.g., HQE Development and Municipality of Copenhagen’s Sustainability Tool). As a result, we find little innovative potential in the processes contained within the six reference tools for eco-districts.

	Evaluation
Eco-district Norm P99N (FR)	A guide of best practices, expected in 2011, will specify the category of 'follow-up and evaluation'. Performance required to respect the norm/ obtain a certification is also under development
HQE Development (FR)	In the last process step (assessment - value), there is an assessment and performance measure that could be used to reinforce the contracted objectives, but no suggestion is made to this effect.
Eco-district Label (FR)	Ambition 4 (theme 1): Ensure that the initial objectives are achieved and respected. The aim is to make a label in 2012 where the material required for assessment can be collected at less than 20.000 EUR per project. Required performance level to be determined.
HQE2R (FR)	Phase 3: Quantitative evaluation of scenarios that include sustainable construction targets (INDI, ENVI, ASCOT). Tool assesses the scenarios, not the objectives per se. Visual representation (spider web), using points.
Realdanias Process Tool (DK)	All 14 elements are assigned a score between 1 and 5 where 2 is the national average. The resulting map (spider web) of scores is descriptive and places the project relative to other Danish projects.
Municipality of Copenhagen's Sustainability Tool (DK)	Scores between 1 and 5 assigned to each of the 14 considerations, 3 being average or mandatory level. Description in spider web.

Figure 2: Evaluation in eco-district reference tools.

A few notable exceptions do stand out. Figure 3, reproduced from line 15 of Appendix 2, presents processes that we deem to be either unusual or potentially dependent on external contingencies, and therefore endowed with a potential for innovation. We draw particular attention to the fact that most of the novelty in process relates to financial assessment procedures in two tools: Eco-district Label and Realdanias Process Tool. We also point out that external actors are able to shape the eco-district project in two other tools (the contracting of objectives in HQE Development and the public hearing in Municipality of Copenhagen's sustainability tool). We cannot identify any national pattern at the process level.

	Unusual process steps	Contingency on external actors
Eco-district Norm P99N		
HQE Development		Step 3, choice and contractualization of objectives: contracting of objectives.
Eco-district Label	Ambition 3 (theme 1): optimize the financial arrangements to meet qualitative objectives; ensure their pertinence by integrating the global cost of the project and its life cycle. Ambition 5 (theme 1): privilege and develop research and innovation at all levels.	
HQE2R		
Realdanias Process Tool	Phase 5, assessment of financial implications at multiple levels: project construction, operational expenses, municipal finances, and societal costs.	
Municipality of Copenhagen's Sustainability Tool		Phase 6, municipal process: political approval and public hearing.

Figure 3: Processes with innovative potential in eco-district reference tools.

In sum, we find minor potential for innovation in the reference tools per se. Several of the tools do however lend themselves to a gradual upgrade into a version that becomes more constraining and specific and hence more likely to encourage actors to develop innovative practices. The novel and specific areas are most likely, we argue, to be the ones where innovation occurs.

Enrollment

We find various strategies for enrolling actors and diffusing standards:

	Strategies for enrolling actors in conception of reference tool	Strategies for enrolling users in use of reference tool
Eco-district Norm P99N	Initial interessement of a large French construction company (Bouygues), two urban service providers (Veolia and GDF Suez), professional associations (Order of Architects, Professional office of Urbanists), and a public office (French Environment and Energy Management Agency) centered around the conception of national guidelines for eco-districts. Some actors have disengaged from the initiative after Afnor introduced a normative ambition of creating a label.	The tool is conceived as a precursor to a potential European reference tool for eco-districts. AFNOR engages users with its ambition of presenting this tool to the European Commission as the European norm for sustainable districts.
HQE Development	Interessement consists in extending the already successful French reference tool for sustainable buildings (High Environmental Quality, HQE bâtiment) to the district level. The new tool benefits from previous experience and pursues the same focus on processes and methodological evaluation during conception (not performance and results).	Key stakeholders in the French construction and development sectors have been invited to experiment with the tool as a way to interest more users. Stakeholders include the Union of Land Developers, the construction office (CSTB), the energy agency (ADEME), the Social Union for Housing, Union of Architects, the French Office of Engineering and Consulting, Office of Geometrists, and the Federation of local public companies . The rights to the tool have been sold to a respected certifying organization in France, belonging to the construction office CSTB.
Eco-district Label	The Grenelle Law has set ambitious goals for France in terms of developing eco-districts: all cities with more than 50.000 inhabitants should have one. Cities are mobilized by pressure to make cities of the future sustainable . City majors, NGOs and companies have been invited to co-write the State's Eco-district Doctrine.	MEDDTL has invited researchers and partners with high legitimacy to participate in organizing competitions that use the tool.The public has been invited to participate in these competitions in order to identify best practices that can be employed to develop an eco-district label that can serve as reference for eco-district projects. MEDDTL has further made an Eco-district Club for all 160 participants in its 2008 eco-district competition.
HQE2R	The French construction office, CSTB, mobilized ten European cities in a collective action program to develop a European reference tool for eco-districts.	CSTB abandoned the tool after conception and departure of the initiating team . The tool is diffused on the internet and in four books written by the conceiving team. No

	EU funding facilitated interessement of cities.	pro-active interessement of potential users. Some students of architecture and urbanism use the tool for learning purposes while some collective actors take inspiration from its checklist.
Realdanias Process Tool	Interessement (of Carlsberg and By & Havn) is achieved by emphasizing that new demands for integration and sustainability will affect the Danish construction sector importantly in the coming 10-15 years. New integrative sustainability tools will be needed and new legislation is on its way. This tool proposes to lead the way.	The tool is integrated as a mandatory component of two architectual competitions (Køge Kyst, 2010 and Fredericia C, 2011) where it facilitates dialogue among developers and competing teams who use it in three phases. Interessement consists in guided learning in how to use the tool as well as in financial incentive associated with winning the competition.
Municipality of Copenhagen's Sustainability Tool	Interessement is achieved by voicing the municipality's ambition to make Copenhagen the most sustainable city in the world. The tool has been developed with input from both external and internal actors, who were mobilized by the commitment to integrate this tool into municipal policy and development objectives.	The tool is fully integrated into the existing building process and made simple to use (minor change to routines). Interessement is achieved by emphazing that the tool is obligatory, non-disruptive, and validated in two pilots.

Figure 4: Enrollment strategies

The following types of strategies stand out as important:

1. Formal engagement of end users in the design process. For example, MEEDTL, engages with city representatives in the development of the Ecodistrict Label.
2. Involving other actors from urban planning and construction in the design of the reference tool. For instance, AFNOR's Eco-discrict Norm P99N in France is sometimes perceived as representing the interest of industry members, while HQE is more oriented towards architects, local constituents, and land developers.
3. The organization developing the standard may capitalize on its status, former authority, legitimacy, and past experience in the field of environmental standards or construction. For instance HQE Aménagement was developed by HQE, an association

that has developed, promoted and diffused environmental standards in the French building sector.

4. Linking the label and methodology with funds / grants, competence and financial incentives for actors who initiate the project. Realdania's process tool is an example of this enrollment strategy.

While some promoters of reference systems simultaneously use several enrollment strategies, such patterns are absent in other initiatives. In particular, an interesting case is HQE2R, which, in spite of being the first actor to develop a French eco-district reference system, lost the support of all major actors in the French construction industry. This reference system was developed in the context of a European project, by two actors who adopted a critical position towards existing initiatives and public policies. Hence, they experienced difficulties enrolling actors, at the national level, in their reference system. The case of HQE2R makes it clear that the absence of enrollment strategy, at the national level, can hinder the development and diffusion of a reference system. However, we do not know yet which reference systems will diffuse furthest. At least in France, no actor enjoys the status of an "obligatory passage point", and the game remains open as to which reference system will become the most adopted and used. On the contrary, it could be argued that there is a risk, at least in France, that a major stakeholder in urban planning will develop or adopt its own standard, thus leading to increased confusion and the adoption of the least prescriptive standards (Chatterjee & Levine, 2006).

ANALYSIS AND DISCUSSION

According to our theoretical perspective, the reference tools that are high on both innovative potential and enrolment dynamics have the greatest potential to structure the emerging field of sustainable eco-districts, in as much as they can provoke innovation and mobilize other actors to adopt them in practice. When confronted with our results, it appears unclear that standards and reference systems in the field of eco-districts induce radical innovation, at least in the short term. Our analysis shows limited presence of new performance targets that would be hard to reach, few process constraints that would be likely to induce innovation, and limited case for stringent evaluation. At the same time, the reference systems show heterogeneous patterns in their ability to enroll construction actors, and at least in France, where a variety of reference systems competing with one another are emerging. In the following discussion section, we propose two alternative lines of analysis to explain such results, and we consider how future research could help choose between these two different accounts.

1. Decoupling

In this first perspective, the results of the study can be interpreted as a sign that in emerging fields, standard setting can lead to decoupling between institutional spheres and actual practices. According to this perspective, sustainability has developed as a new broad social goal, and has been progressively diffused to various spheres of social life, including construction and eco-districts. As any social goal, institutional resources are devoted to this overarching goal. In spite of its success, sustainability remains a very open concept, lacking definition, and with infinite ways of operationalization.

In this context, the creation of labels, standards, and reference systems can be understood as strategies to buffer the actual practices from institutional expectations (Meyer

& Rowan, 1977). This situation would explain the development of standards and reference systems that introduce no new practices, few constraints for innovation, and no stringent evaluation protocols. In the end, it is unclear whether the use of any standard or reference system will lead to any improvement of the eco-district performance in the context of sustainability objectives.

In this context, it can be argued that an external authority should intervene in order to sort among the profusion of standards (Chatterjee & Levine, 2006), set more stringent standards, and formulate goals and sanctions in order to prevent the decoupling of reference systems from actual practices. The involvement of the public sector in France could be interpreted as a sign in such a direction, but it is necessary to keep in mind that the Eco-district Label presents the same characteristics (broad objectives, low verification) as the other reference systems. What is more, as private actors, public actors are competing with each other to show their commitment and actions at the European and international level. As a result, the identity of an external authority likely to play such a role remains unclear. Finally, the potential of standards as centralized governance tools for innovation is largely offset by the presence of decoupling mechanisms.

2. Time pacing

The former line of explanation is coherent with NIT. However, by arguing for more accurate prescriptions, verifications, etc., this line of explanation bypasses the fact that eco-districts remains an emerging organizational field, where no actor is currently able and sufficiently legitimate to define precisely what an eco-district is or should be. What is more, as eco-districts are highly context-specific, it is difficult to prescribe universal recipes and objectives, and to compare them without paying attention to their context.

In such emerging fields, the presence of broad objectives and soft verification procedures may not be surprising in early stages of development. Rather than prescribing specific objectives or technical solutions, the link with innovation may reside at another level: a reference system participates in a collective learning process. This is why actors use the term ‘reference systems’ or ‘tools’ rather than standards *per se*. Rather than prescribing definitive solutions or ways of doing, these references act as broad cognitive tools for organizing a project, sharing practices, building networks of actors and competencies around a common project. The issue seems to be the construction of collective networks and the ability to reframe the field of construction. The use of terms such as “clubs”, best practice sharing, etc., all belong to this logic. The most important issue for actors seems to be the process of building collective groups and developing a shared vision of the notion of eco-districts, before prescribing performance constraints.

In this logic, “time pacing” refers to the fact that there would be a time dissociation between a first moment of enrolling actors and sharing visions, and a second moment where the networks would coagulate into more stringent standards, once the collectives are set up. In this perspective, the link with innovation would lie in the quality of the network building process in the first stage, the ability to coordinate various initiatives and stakeholders, and gather different groups and bring various constituencies to get interested in eco-districts, and to develop a common field identity around this object. During this first stage, tolerance to decoupling may even constitute a strategy to enroll actors smoothly, before adopting more stringent objectives and processes.

Complementary data is required to choose between these two logics. In particular, we would need to complement our analysis of the reference systems with more qualitative data on the direct users of the reference systems. This data would enable us to understand more accurately the tendency of actors to decouple standards from actual practices, and would also

enable us to understand the relationship of reference systems and innovation from the users' perspective. Longitudinal data about the use of the standards, and their evolution, would also be useful to analyze the evolution in the content and orientation of the standards. Lastly, in order to understand the feasibility of the time pacing perspective, it would be particularly interesting to understand how the switch can be made between a "soft" approach and a more constraining one.

CONCLUSION

In this paper, we have explored the development of standards in the field of eco-districts in France and Denmark with a special attention to their relationship with innovation. As such, our case study echoes the multiplication of 'soft' standards and reference systems in various social fields (Higgins & Hallström, 2007). In spite of its specific character, this study illustrates the double dimension of standard setting in emerging fields: the necessity to enroll actors and structure a new organizational field on the one side, and the willingness to promote innovation on the other. In the case of eco-districts, we have found that most efforts are on enrolment dynamics, and have found little evidence that standards and reference systems promote breakthrough innovation to date. We have proposed two interpretations of this situation: decoupling and time-pacing. Our case suggests that there is a great tension and a delicate balance to preserve between sustaining collectives and promoting radical innovation.

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Appendix 1: Interview Guide - Standardization / eco-cities

Theme 1: The origin of the reference system

This theme explores the context in which the reference system has been created, the actors involved, the targeted objectives, its financing, events that provoked its emergence, etc.

- Who participated in elaborating it?
- Who supported politically and/ or financially the creation of the reference system – and with which objective in mind?
- Have there been particular events that stimulated its creation?
- Which components of the reference system were considered from the very beginning to be essential and which ones were added later (why)?

Theme 2: Its current status

This theme seeks to shed light on the current diffusion, as precisely as possible, before exploring its current level of use.

- How is it different from/ similar to other reference systems available on the market and also relevant for eco-cities?
- Who is currently using this reference system?
- Why, according to you, do some actors choose to use your reference system (why do other actors not use it)?
- Has the reference system been as popular as hoped for at the outset? If not, how do you explain this development?

Theme 3: Its future prospects

This last theme seeks to understand the political engagement that supports its future diffusion as well as the obstacles that may slow down such diffusion?

- Are there actors, in your group or elsewhere, that are currently fighting for this reference system to become more widespread (what do they do exactly)?
- What are the prospects, in your opinion, that this reference system will become one of the most widespread ones in Denmark/ France ten years from now?
- What are the most important obstacles to its diffusion?

APPENDIX 2 - Assessment of reference tools

	FRANCE				DENMARK	
Title	**Eco-district Norm P99N**	**HQE Development**	**Eco-district Label**	**HQE2R**	**RealDania Process Tool**	**Municipality of Copenhagen's Sustainability Tool**
			BACKGROUND			
Author	AFNOR (French association for standardization)	Association HQE (Association for High Environmental Quality)	MEDDTL (Ministy of ecology, sustainable development, transport, and housing)	An individual within CSTB (Scientific and Technical Centre for Construction) with financial support from the European Commission (FP5). Since then hosted by SUDEN (European association for sustainable urban development).	RealDania Arealudvikling (DK)	Municipality of Copenhagen/ Niras (DK)
Type of organization	Privatized organization (established 1941)	Parapublic organization (law of 1901)	Ministry	Suden is a non-profit organization while CSTB is a para-public organization under ministerial supervision.	Parapublic organization (private fund with a public good mission)	Municipality and associated consultancy
Phase	In development. First pilots expected in 2012.	Developed. 10 pilots in 2007, 18 in 2011. Tool to be commercialized in Sept 2011.	In development. Piloted in eco-territory competitions in 2008 and 2011. Label expected in 2012, pending 2011 report to Minister.	Currently on stand-by. Developed and piloted 2001-2004.	In development. Piloted in eco-territory competitions in 2010 (Køge Kyst) and 2011 (Fredericia C.).	Developed. Initiated in 2007 and piloted in the conception of two eco-territories: Grønttorvet i Valby (2007) and Nordhavn (2009) .
Additional info	AFNOR aims to extend this norm to ISO and GEN (European Committee for Standardization) in 2012.					Applicable to projects of more than 50.000 m2 (multi-storey surface) that require municipal approval.

CONTENTS

Type of assessment	Matrix of six themes, divided into 15 action areas with 19 associated indicators	Three global themes: 1. ensure the integration and the coherence of the neighbourhood with the urban tissue and the other territory levels, 2. preserve natural resources and privilege the environmental and sanitary quality of the construction project, 3. promote social life in the local environment and attend to economic dynamics. The three global themes are divided into 17 themes and 50 suggestions for possible indicators (actors are at liberty to select their own indicators).	Four themes: 1. objective and process, 2. Living context and usages, 3. territory development, 4. preservation of resources and adaptation to climate change. Each theme has 5 ambitions with 404 proposed indicators for action.	Five objectives: 1. to preserve and enhance heritage and conserve resources, 2. Improve the quality of the local environment, 3. to ensure diversity, 4. to improve integration, and 5. to reinforce social life. There are 21 targets, respectively 5, 7, 3, 4, 2 for the 5 objectives, divided into 51 key issues.	Three themes (environment, social/health, finance), with a total of 14 elements: 5 for environment, 4 for social/health, and 5 for finance that flow from the previous 9. These elements are further divided into 51 indicators.	Three themes (environment, social, finance), with a total of 14 considerations: 5 for environment, 5 for social, and 4 for finance.
Indicators/ themes with potential for rupture (novelty or precision)	Action area 5 (privilege local food production): Percentage of served meals on the territory that contain at least 50% local foodstuff. Action area 10 (decarbonate the economy): TeCO2 assessment (ADEME)	The categories are suggestions. Since there is no requirement to fill out all categories, there are no constraints on action	Ambition 15 (preserve economic viability of non-urban and urban operations): introduce policies that protect agricultural territory and reinstate agricultural activities closer to city centers.	Target 3b: Regeneration of brown-fields and polluted sites and soils. Target 20b: participation of residents to decision and projects related to the neighbourhood. Target 21c: Cultural links across the globe.	Ind 9 (element 3, water): which percentage of rain water is led into the sewer system (points attributed to percentages). Element 10, operational expenditures, particularly ind 45 and 49: what are the municipal, respectively societal, costs of dealing with rain water as proposed?	Con 4: water consumption max 110 l/ per person/day in residences; 34 l in business. Con 6: maximum 15 min. by foot to a park, a beach, a nature resort, or a harbour bath facility.

Processes	Nothing (yet)	Focus on process and negotiated goals. Six steps: 1. pre-project launch, 2. pre-project (initial) analysis, 3. choice and contractualization of objectives, 4. project conception and sustainable action plan, 5. construction, 6. evaluation. Documents must be produced at each step.	First theme is entirely about process and contains five ambitions: 1. Initiate and collaborate transversally, 2. clearly situate and define the project, 3. ensure financial, technical and judicial feasibility of the project, 4. manage and evaluate the project and the neighbourhood, 5. ensure project continuity.	Four phases: 1. the toolkit basis, 2. analysis, 3. decision upon the action plan; 4. action and evaluation	Five phases: 1. vision and initial objectives, 2. concrete objectives of each of the 15 elements, 3. assessment of concrete conception proposals, 4. detailed assessment of obejctives and overall balance among themes, 5. assessment of financial consequences for project, operation of eco-city, municipality, and the larger society.	Six phases: 1. information - dialogue (city and developers), 2. information - prioritization, 3. evaluation and qualification - development of program, 4. evaluation and qualification - development of project description, 5. evaluation and qualification - assessment of project(s), 6. Municipal process - formulation of conditions and local development plan.
Processes with potential for rupture (novelty or contingency)	N/A	Step 3, choice and contractualization of objectives: contracting of objectives carries potential for rupture.	Ambition 3 (theme 1): optimize the financial arrangements to meet qualitative objectives; ensure their pertinence by integrating the global cost of the project and its life cycle. Ambition 5 (theme 1): privilege and develop research and innovation at all levels.	None	Phase 5, assessment of financial implications at multiple levels: project construction, operational expenses, municipal finances, and societal costs.	Phase 6, municipal process: political approval and public hearing.
Evaluation	A guide of best practices, expected in 2011, will specify the category of 'follow-up and evaluation'. Performance required to respect the norm/ obtain a certification is also under development.	In the last process step (assessment - value), there is an assessment and performance measure that could be used to reinforce the contractualized objectives, but no suggestion is made to this effect.	Ambition 4 (theme 1): Ensure that the initial objectives are achieved and respected. The aim is to make a label in 2012 where the material required for assessment can be collected at less than 20.000 EUR per project. Required performance level to be determined.	Phase 3: Quantitative evaluation of scenarios that include sustainable construction targets (INDI, ENVI, ASCOT). Tool assesses the scenarios, not the objectives per se. Visual representation (spider web), using points.	All 14 elements are assigned a score between 1 and 5 where 2 is the national average. The resulting map (spider web) of scores is descriptive and place the project relative to other Danish projects.	Scores between 1 and 5 assigned to each of the 14 considerations, 3 being average or mandatory level. Description in spider web.

POLITICAL CONTEXT

Actor support	Bougyues, and private companies paying around 3000 EUR to participate.	Tool developed with support from a range of different stakeholders, including architects, city administration, ministerial actors (MOA, SNAL, ADEME, interministeriel unit of equipement/housing/ culture, DGUHC, UNSFA).	French Environment and Energy Management Agency (ADEME); Caisse des Dépôts et Consignations (public financing); Association of Mayors in France (AMF)	EU, CSTB (until 2004)	Co-developers: Carlsberg Ejendomme A/S (housing project), By & Havn I/S (Copenhagen harbour area), RealDania (para-public construction fund)	
Actor opposition	MEEDTL (AD¤4unit) opposed in 2008			Competition with HQE Amenagement. CSTB opposed after completion.		
Specific law/policy references in tool	"Carbon footprint TeCO2" developed by the French Environment and Energy Management Agency (ADEME). Action area 13:	of AEU tool (Urban Environmental Analysis) developed by the French Environment and Energy Management Agency (ADEME)	Grenelle Laws 1 & 2 : National Plan of adaptation to climate change from June 2010 and Territorial Climate Plans (chapter II, article 8).		Agency measures for CO2 emissions ; Ind 3 & 12: Energy consumption according to Danish building regulations (BR2010/BR2015, passive	Con 3: reference to Danish building regulations (BR) and standards for low energy houses.
Sources of inspiration	French Environment and Energy Management Agency (ADEME), notably its carbon footprint (AEU)	Proposal to use tools from B.E.E.P. (Bati - Environnement - Espace - Pro), a ressource network for energy efficiency and environmental quality.	Several of the 20 ambitions take inspiration from Agenda 21 (Rio 1992) and the Framework for Sustainable Cities (R.F.S.C), developed by the EU and piloted in France. National sources of inspiration aside from Grenelle Laws I & II include the National Strategy for Sustainable Development, Nature in City Plan, the Ecological Solidarity Pact, and the Eco-City Neighnourhood.	Objectives are inspired by the five primary goals of Agenda 21 (Rio 1992): participation, transversality, shared pilots, continuous improvement, evaluation. Also inspiration from HLM (French Social Housing)		Multiple web-links to area development plans, climate plan, city development plans, transportation plans for city, water consumption policy of city, water treatment plans, etc.