Proto institutions in Sustainable Building

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Abstract: The building community is currently undergoing a transformation towards low carbon buildings; this process involves a range of dynamics: Social, cultural, political and regulatory. To analyse this process we use mainly institutional theory as approach to sustainable transition in an attempt to account for contemporary developments, encompassing multiple competing concepts and EU reforms. This theory enables us to address emerging institutions and proto-institutions of sustainable building.. In addition, we draw on political process theory To explain the agency dynamics involving coalitions, alliances in and around the proto-institutions.

The development of sustainable building in Denmark from 2001-2014 is used as a case of a building community dynamics, based on data gathered from desk study and interviews. More than ten concepts of sustainable building are involved. A previous consensus oriented dominant institution broke down around 2002. The normative concepts such as passive houses that then have emerged constitute alliances encompassing technologies, practices, norms and actors. The normative upcoming proto institutions have experienced barriers such as the reputation of being expensive and non-user friendly. This has counterbalanced the emerging legitimacy that for example passive houses draw on through established design principles, design software, certification and a portfolio of realized houses in other countries. Others, such as “energy class 1” are gaining momentum as anticipatory normative institutions and future EU-regulation. A possible future configuration in sustainable building appears to involve multiple institutions and protoinstitutions.

Keywords: sustainable building, institutional theory, sustainable transition, Denmark,

Introduction

Sustainable transition is far from being a unidirectional harmonious process. Rather internal competition and cannibalism appear to be the order of the day. Here climate change mitigation in housing and building is in focus, encompassing the following ten sustainable building concepts: passive houses, active houses, Building Research Establishment Environmental Assessment Method (BREEAM), Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB)/green building council, Leadership in Energy and Environmental Design

(LEED), Swan label (Nordic Eco label), EU Green building, energy class 1, energy class 2 and BR 2020 (Building Regulation 2020, Near zero carbon).

The paper's aim is first to offer an institutionalist theoretical framework for understanding the complex interplay between institutional environment, actors, incumbent institutions, proto-institutions and new institutions. Second, to make a critical analytical status of sustainable building concepts, viewed as protoinstitutions, in the field of sustainable buildings in Denmark. Protoinstitutions are upcoming, but also possibly decaying institutions in internal competition using different form of powers such as legitimacy, normative, and regulative l (Lawrence et al 2002, Zietsma and McKnight 2009).

The paper's theoretical contribution lies in conceptualizing institutional stabilization as several institutions and protoinstitutions coexisting, and to conceptualize agency as multiple types of agents, coalitions and alliances. The empirical contribution is a mapping on the development of more than ten main sustainable building concepts, their actor coalitions and alliances with material elements, processes, competition, experienced barriers and (for some) limited adoption to add to our understanding of a building field status in the area of sustainable building, in the case of Denmark.

The theoretical framework departs from, multilevel perspective (MLP), strategic niche management research (SNM) (Geels 2005, 2011) and Technological Innovation Systems (TIS) (Jacobsson and Bergek 2011). The paper uses institutional theory to address emerging and multiple competing institutions (Dover and Lawrence 2010, Lawrence et al 2002, Meyer 2008, Suddaby 2010, Thornton et al 2012, Zietsma and McKnight 2009) in the field of sustainable buildings. Sustainable building concepts are part of a multifaceted arena of future institutions around an existing dominant institution of built environment. The dominant building institutional regime is challenged from these upcoming institutions and from regulation from EU. A range of actors is part of the field: architectural and engineering firms, contractors, citizens and customers, and labour market associations. The concept "field" is used to underline its character as negotiated social order with vague boundaries and multiple dynamics (Greenwood et al 2011). Combining these dynamics leads to the view that sustainable housing concepts/institutions are only viable in windows of time; and that the contribution of the various institutions is more of steps on the road towards low carbon housing, than final solutions.

Method

The paper adopts an interpretive sociology framework. The methodological design covers the entire argument first positioning institutional theory and second data selection, gathering and analysis. First the theoretical framework: Institutional theory has its strength in understanding social structure, and change processes, yet with a weak agency conceptualisation, whereas some political process theory provides an interactional understanding of change processes

agency as assemblages of human and non-human elements (Koch 2004). Relations between promoting actors of a specific politics are understood as coalitions (temporary) and alliances (long term). The two types of theory are characterised by both relying on interpretive sociology. Institutionalist theory is adopted as the main theory and the concepts of coalitions and alliances are added inspired by organisational politics (Pettigrew 1985). The combination is therefore asymmetric and exploits that the institutional theories have a blind spot in conceptualising agency (Thornton et al 2012), this is a grey area where the combination does not "activate" incommensurability, which their combination in principle might involve (Gioia and Pitre 1990). Multiparadigmatic contributions (Gioia and Pitre 1990, Lewis and Grimes 1999) demonstrate how such combination can be done by associating two theories in synthesised manner. Gioia and Pitre (1990) argue for "transition zones" between paradigms, areas where they don't overlap and where it makes sense to use them in tandem. Thornton et al (2012) claim that institutionalist theory still, after recent years development of institutional entrepreneurship, lack a proper conceptualization of agency, which is where we use an element from political process theory (Koch 2004, Pettigrew 1985). The concepts of coalition and alliances is used for the process agency part of building transition, whereas institutional theory is used for the structural elements in play and for enriching the range of possible elements and process features in the development of protoinstitutions and actor coalition building i.e. types of legitimacy.

The empirical design is a longitudinal study of the development of sustainable building in Denmark from 2001- 2014 using a mixed method approach. The field work design relies on similar studies made by Zietsma & McKnights (2009), Gestel and Hillebrand (2013), Greenwood et al (2002). Data collection commenced in 2009, as we became attentive to the host of concepts proliferating. Data on the materialisation of concepts was gathered in the spring of 2012 including all concepts for buildings found. A second round was carried out in the spring of 2013 and three main opinion leaders in sustainable housing were interviewed in august 2013. The third and fourth round was carried out in late 2013 and spring 2014. The qualitative analysis of competing concepts included the content of the concepts, how they differentiate from each other, what kind of legitimacy do they possess, what institutional powers, the role of technology, and the actor coalitions and alliances. Quantitatively a mapping of the development over time of sustainable housing concepts and their emergence was carried out using desk research; Google, Infomedia (Danish Newspaper database) and other press articles as well as construction and real estate professional sites. The Google search of the presence of each of the concepts covers a period from 2000 to 2014 in Denmark. Search words was found in an iterative manner as some search words created hits that was overly polluted by other data. Also a series of homepages (more than 10) dedicated to various parts of sustainable buildings (like http://ch.usgbc.org/projects with a directory of LEED certified buildings globally). For each of the protoinstitutions a timeline was developed identifying activities involved in developing the upcoming institution (Zietsma and

McKnights 2009), Here the presence of a materialised building following the norms of the protoinstitutions was used as first criteria, but we also mapped the occurrence over time of related initiatives such as training, seminars, establishment of associations and projects of making a building. The development of sites dedicated to the concepts on the internet is also considered as an indicator.

A range of other material has been used to underpin the analysis including university research, consultancy reports, students' work and master theses supervised by the authors. The trustworthiness of the quantitative results, i.e. counting of realised building following a concept, is achieved through triangulation, by the comparison of information collected through different channels (Bryman and Bell, 2007). A lot of the material used is in Danish, and it has been chosen not to reference it here.

It is recognised as a limitation of the paper that the competition of the concepts are not thoroughly mapped. At present official sources in Denmark does not provide a full inventory of sustainable buildings. But the accessible gross estimations, based on the energy labelling are far higher than ours. So even if our search work appear comprehensive the figures still remains indicative

Theoretical framework

This section develops our theoretical framework. In this context one can think of two types of "change towards sustainability" theories. First those which use the label of sustainable transition namely Geels (2005, 2011), Strategic Niche Management SNM and Multi level perspective MLP as well as the Technological Innovation System (TIS) theory (Jacobsson & Bergek 2011). And the second type encompasses theories for understanding various change paths in contemporary society, including those towards sustainability. Here we choose Institutional theory (Greenwood et al 2002, Scott 2001, Røvik 1996, Thornton et al 2012 a.o.) complemented by the political process perspective (Koch 2004, Pettigrew 1985). Using these theories for studying sustainable transition places our contribution in prolongation of previous institutional theory contributions: Fuenfschilling and Truffer (2011, 2014), Munoz (2011), political aspects contributions (Grin et al 2010) as well as ANT contributors: Garud and Gehman (2012), Pohl et al (2009).

We find it fruitful to turn to other types of social scientific contributions in an attempt to conceptualise transition towards a sustainable society as agency involved in changing and establishing institutions.

An institutional approach to sustainable transition

In the following we develop our framework of institutional theory. Institutionalist theory advocates non-rational, cultural socially constructed explanations of societal order and

change. Scott (2001:48) defines institutions as "social structures that have attained a high degree of resilience…[institutions] provide stability and meaning to social life….. Institutions are transmitted by various types of carriers, including symbolic systems, relational systems, routines, and artifacts. Institutions operate at different levels of jurisdiction, from the world system to localized interpersonal relationships. Institutions by definition connote stability but are subject to change processes, both incremental and discontinuous…". Scott (2001) and Thornton et al (2012) conceptualise institutions as consisting of three types of elements; cultural cognitive, normative, and regulative. Despite the original aim of explaining organisational homogeneity and stability, most recent contributions are interested in institutional change, including the discourse on institutional entrepreneurs (Garud et al 2007, Munoz 2011), and also to some extent deinstitutionalisation, diversity of institutions and societal and other non-organisational change (Thornton et al 2012).

Contributions to the understanding of institutional change provide concepts for how an existing institution would be deinstitutionalised, delegitimised, and how a future institution could develop through gaining legitimacy and support (Greenwood et al 2002). Legitimacy is not given but has to be formed through conscious actions by various organisations and individuals in a socio-political process. Gaining legitimacy would involve cognitive, normative as well as regulative aspects. The most commonly described strategy for obtaining legitimacy is to conform to established institutions. However, deinstitutionalisation and re-instutionalisation, as described by Greenwood et al. (2002), is an alternative mean. If legitimacy is attained for a technological innovation this would support obtaining resources for its further development, generating demand and give actors in the institution political strength. For example, Bergek et al (2008) argue that attaining legitimacy is a prerequisite if new industries are to be created around renewable technologies, as the incumbent energy production regimes might otherwise actively counter them. Greenwood et al. (2002) point at several steps to gain legitimacy. They assign early legitimacy as being value-oriented 'moral' legitimacy. If the emerging products and practices cannot be referred to existing institutions, functional superiority has to be established, labelled 'pragmatic' legitimacy. At a later stage the legitimation might solidify and become cognitive (Greenwood et al., 2002).

As touched upon above institutionalist theory also go beyond the single stabilisation of a new institution, through the discussion on concept cycles and deinstitutionalisation. Røvik (1996) took issue with the assumptions of evolutionary economics claiming the selection and adaption mechanisms, assuring that a given concept/institution will be substituted only by one which is technically superior. Røvik points out that the decay of concepts could also occur through other mechanisms. For example, concepts that become institutionalized and therefore widespread, would lose their social differentiation element, and become 'normal'. As a result, leading players could lose interest. Moreover a process of obsolescence could occur where actors through reinterpretation create a socially constructed impression of the concept as "passé". Røvik (1996) describes it as a social contagion leading to trickle-down effects with a

gradual fading of obsolete institutions/concepts as a compromise between rationality and fashionableness.

As argued by institutional entrepreneur contributions (Garud et al 2007) institutional theory is in need of conceptualising agency. Thornton et al (2012) are critical towards the institutional entrepreneurship contributions for trying to, yet not being able to, solve the agency problem, and suggests using a Giddens like structure agency dualism. However this approach risks ending up in overemphasising the individual knowledgeable actor (re. Giddens 1984), which is too limited for the phenomena studied here.

Institutionalist theory tends, as Geels in early versions, to understand transition as a competition between one dominant and one challenger institution (Greenwood et al 2002). Some contributors to institutional theory do however extent this original dualism. There is an increasing number of contributions that conceptualize instutionalism in terms of two or more institutions that coexist is various ways (Gestel and Hillebrand 2013, Kratz and Block 2008, Smets and Jarzabkowski 2013, Thornton et al 2012, Zietsma and McKnight 2009 Waldorff et al 2013). This involved the stabilized "before" situation, where Gestel and Hillebrand (2013) view this as a stabilized coexistence of more institutions. It goes for the institutional change process, which Zietsma &McKnight (2009) describe as a competition between several (proto) institutions occurring as the new institutional constellation stabilized (Smets and Jarzabkowski 2013, Waldorf et al 2013). Here we are in particular interested in the institutional change process. Zietsma and McKnight (2009), drawing on Lawrence et al (2002), suggests thinking of the dynamic emergent coexistence as a competition among protoinstitutions, defined as "*new practices, rules, and technologies that transcend a particular collaborative relationship and may become new institutions if they diffuse sufficiently*" (Lawrence et al 2002).

As demonstrated empirically by Zietsma and McKnight (2009) a range of symbolic and material resources and devices are brought in play to develop support for protoinstitutions. Neither Zietsma and McKnight (2009) nor Lawrence et al (2002) theorize over the mechanisms that might develop support or delegitimize the pro-toinstitutions. Supplementing the legitimacy, technology, practices and norms element we suggest thinking of the building and formation of protoinstitutions as political processes (Koch 2004, Pettigrew 1985). Koch (2004) proposes to understand political processes as a combination of political content development, in a specific context, and involving formation of coalitions of actors and technologies to support the politics. Such coalitions are temporal, can be heterogeneous and asymmetric and the interessement and involvement of actors often lead to changing the political content. Once several joint processes have been carried out the coalition might develop into more long term alliances.

Summarising institutionalist theory offers conceptualisations of central dynamics of societal change, such as transition towards sustainability. This includes regulatory, normative and symbolic aspects and spans from the multinational phenomena to the individual. There is an appreciation of a possible role for agency. Moreover there is an understanding of institutions in competition. Thus institutions coexist both as stabilized constellations and as institutions in the making, protoinstitutions, during processes of institutional change. Moreover institutionalisation in a field can involve a range of technologies/devices, practices and agents. Alliances and coalitions between agents related to a proto-institution can take various forms. Our particular contribution would be to view the process of institutional change (transition) as a competition and coexistence of multiple emerging proto institutions. And to take distance from the idea of an interinstitutional system, leaving it for empirical analysis to investigate whether there is one or more institutions in play and if and how far they are interrelated.

The institutional logic perspective operates with a problematic level thinking close to Geels (2005, 2011). Moreover the opening for agency in our contribution should not mean a fall back to a belief in the knowledgeable individual alone.

Competing future sustainable building institutions in Denmark

From 2005 an increasing number of sustainable housing concepts have emerged. A European survey (EU 2009b) identified 17 terms in use to describe such buildings used across Europe, including low energy house, high-performance house, zero carbon house, zero energy house, energy savings house, energy positive house, 3-litre house etc. All have different scopes, calculation methods and norms for low energy. Below the Danish institutionalisation process is followed from 2001-2014. The description is structured in three: First the community, the concepts and the general process, second the case of a normatively based concept, “passive houses”, and third the case of a regulatory based institution with normative anticipation, energy class 1.

The Dominant Danish building institution

Following the oil crises in 1974, the Danish building sector started a coordinated path of improving insulation and reducing energy consumption (Marsh et al., 2010). In the period 1975-2000 a 19 percent reduction of heat consumption was realized, an improvement that was mitigated by a 69 percent growth in energy consumption due to more intensive use of household appliances and IT (Marsh et al., 2010). A range of planning, fiscal, and regulatory policy initiatives were taken in this period. As a result, energy planning in Denmark changed from oil to natural gas and district heating, produced by centralized combined heat and power plants (Marsh et al., 2010). This period was also characterized by that one institution, the “common”, was underpinned by broad compliance to the regulation and an accompanying consensus. It was therefore rare that buildings would depart from the regulation. Until around

2002, Danish regulation was ahead of those of EU and little space was left for alternative institutions of sustainable buildings in that period. Since then however new building regulations have been implemented in Denmark largely following EU directives and have substantially tightened the demands on energy consumption. The EU directive EUBP 2002 (EU 2003) was implemented in 2006, introducing two energy classes; 1 and 2, also called 2015 and 2010 referring to the years they become obligatory. The building regulation BR10, from august 2011 installs a third class 'BR 2020' with stricter demands built on the near zero carbon directive (EU 2009a). These reforms have been accompanied by a range of initiatives such as Directive No 2010/31/EU on the energy performance of buildings, and the directive No 2009/28/EC (EU 2009a) demanding national renewable energy plans, initiatives of developing sustainable skills amongst the construction workforce, financial and fiscal arrangements. In summary, from 1974-2002, Denmark as a national state had a broad alliance of players pushing "together" for energy savings and accompanying technologies; whereas from 2002 and onwards the initiative shifted to the EU opening up for competing concepts. The reform tempo has been quicker over the past ten years than previously. Like many countries the Danish building sector, had a serious bubble that burst in 2008 (Denmark Statistics 2012).

Identifying the sustainable building institutions

During the timespan studied, 2001-2014, a range of concepts were introduced in the building field, reflecting a dissolution of the previous consensus on creating common norms and the follow them. Taken as a whole the emerging sustainable buildings materialised in houses, office etc. to a very limited degree. In 2013 the Danish authorities estimated that low energy buildings constituted 1,9% of the energy labels issued 2006-2013 equal to some 6000 buildings (compared to more than 100.000 houses built) and that in 2012 some 700 low energy houses were built. This group would encompass all the mentioned protoinstitutions discussed below. They fall into two broad groups according to their main institutional logic: the normatively and the regulatory based upcoming institutions.

The normatively based involve a definition of what a sustainable building is, based on a heterogeneous group of actors and materiality that come to create an internal consensus of the concepts. The normatively based include passive houses, active houses, BREEAM, LEED, DGNB/green building council, Swan label (Nordic eco label), Sabro, ZERO+, and lavenergi.

The regulatory based involve a definition of sustainable building as part of a regulation of buildings by government. These are notable energy class 1 and 2. In the entire period, 2005-2010 actor networks were interested in a normative fashion anticipating the coming regulation. EU green building, which is a norm going 25% below the present regulation at any time even institutionalize the anticipation and interest actors from 2008 and finally the BR 2020 announced in 2011 is the latest example. The interest and emerging proto-institutions

are reflected in an increasing number of hits on energy class 2 until 2010 and a further increase in interest for energy class 1, which both grow much larger than the interest in passive houses. Figure 1 below provides an indicative list of concepts materialised in housing found in Denmark. The year of introduction, as provided the left hand column, is given as when the first realised building occurs. The list is not exhaustive but gives an impression of a veritable cacophony of concepts and indicates a limited breakthrough of sustainable building concepts compared to the overall building activity in the same period (Denmark Statistics 2013 a. o.).

Following the introduction of the concept it is accounted for in the figure at the year where the first building is finished. Obviously press coverage and emerging actor coalitions would commence long before and some concepts will never materialize.

Concept/Year of materialisation in DK	**Found/ Estimated number of projects**	**Actors (examples)**	**Examples of buildings**
Passive house, Darmstadt criteria/ 2008	52 (several multiple houses)		H2 College (dormitory) Komforthusene
Active House (Velux group)/2009	3 (1 with 20 houses)	Velux, association for active houses	Lystrup, University of Cph building
DGNB/2012	13buildings 4 town areas	Green Building Council Danmark Ramboll Ålborg University	Ramboll HQ Company house NCC KPMG Domicil
Svanemærket (Nordic Ecolabel)/ 2011	52	Odense Kommune, pluskontoret, Køge kommune, The green house(Ag. 21)	2 kindergartens Villas of the future, Køge
BREEAM/2010	5	Grontmij DK	Vestas HQ, Sillebroen shopping center, Grontmij HQ
LEED/2010	23	COWI,KPC, Sjælsø	FN-byen, UL Intern. Demko HQ
EU Green House/2008	7	NCC	Skejby Company House I-III (also BREEAM)
Energy Class II (EUBD 2002)/ 2006	>4 large projects 7 villas		KPMG, Flintholm City Court Kolding Christian Union HQ Industriens Hus,
Energy Class I (EUBD 2002)/2006	9 large and small projects 37 villas and 7 under construction	Arkitema, KAB, Ramboll, Pihl, Lind og Risør, a.m.o	Stenløse Syd Multimedia house, Navitas (both Aarhus)
BR 2020 /2011	3, 21 villas		
Other concepts Sabro, ZERO+, lavenergi,	8		Sabroe Sønderborg Zero plus Vordingborg

The process of institutionalization of sustainable building concepts

Energy class 1 and 2 was announced by the EU in 2002, and the first energy class 1 buildings, the Stenløse Syd project, was erected in 2005. Until 2010 using *Energy class 2* would imply going ahead of regulatory demands. A Danish investigation indicates that 10% of all new houses did so in 2007-2009.

In 2008, NCC, a large contractor, introduced an office house following the *EU green building standard*. NCC decided to market the office building following this EU standard in a context of crisis on the market. Their concept, company house, was building on renting out to several businesses and after the first erection in 2008, more followed. The headquarter (HQ) of KPMG got their EU Green building certificate in 2009. This involves Architect firm 3XN and engineer and contractor MT Højgaard (MTH). Also Ørsted School built by MTH realized as a public private partnership in 2011 is Green building certified.

In 2009, the large windows manufacturer Velux introduced a new concept for Europe, the 'active house'. This concept directly targeted the legitimacy of passive house claiming that low energy consumption was not ambitious enough, the houses should actively produce energy. Velux allied with architects engineers, contractors and universities to realize five houses before the COP 15 meeting in Copenhagen. The concept became more than a stunt when a new association 'Active House Alliance' was inaugurated in June 2010. Velux however has recently renamed their concept into "Model Home 2020" still based on active house principles.

From 2009-2010 *Energy Class 2* received attention in Denmark reinforcing the legal demands for the energy performance of new buildings. Several large projects follow such as Sorcer in Hillerod associating the municipality, consulting engineer Cowi and the Danish Technical University under the umbrella of the EU-project Concerto. The projects were realized one year before the before the class became obligatory. Another example, the HQ of KPMG was finalized in 2009.

In 2010, the Green Building Council Denmark was formed, involving consultancy companies such as consulting engineer Ramboll and Ålborg University. The council first carried out a comparison of different concepts, and later became proponents of an adapted version of the German concept DGNB. This modified certification was launched in 2012 introduced in pilot building projects involving ATP Ejendomme (Estate player), MT Højgaard (contractor) and Velux again. Nine auditors and seven certificates have already been attributed.

In 2010, the American *BREEAM* and British *LEED* concepts were introduced in Denmark targeting the larger projects. These concepts do not only focus on energy consumption but assess the environmental performance of the totality of the building, from construction to maintenance Over 2010-2012 a series of project have been launched referring to those two

standards with heavy weight players such as COWI, Carl Bro/Grontmij, Sjælsø, KPC on board. Vestas head quarter and Sillebroen shopping center are highly profiled projects.

Also in 2010 the preparations for BR 2020, started. This involved all the central players in Danish construction and the new norm was introduced in October 2011. When BR 2020 will become law in 2020 it will mean a reduction of 75% compared to 2006 rules. At least three buildings are under construction by autumn 2012.

The description above is not exhaustive but gives an impression of a veritable proliferation of concepts even though several concepts haven't been described here (such as Svanemærket and ZERO+). It also indicates a limited breakthrough compared to the overall building activity in the same period. Besides the choice of one concept is not disqualifying the others; some of the projects are using several concepts such as the KPMG HQ, which is EU Green building and DGNB certified, or the Nordhuset in Kastrup which are both LEED and DGNB certified.

The case of a normatively based institution: passive houses

Passive houses, i.e. with low energy consumption without need for active warming, can be traced back to 1975-1990 in a number of countries, e.g. Austria, US, Sweden, Denmark, Switzerland and Germany. From then on the development around Institut Wohnen und Umwelt, Darmstadt, took precedence. The first houses built according to Darmstadt standards (in Dörpe and Kranichstein, Hinz, 1994), were used to develop a standard for passive houses, incorporating specific design parameters, energy consumption calculation software (PHPP) and tests. A passive house according to the Darmstadt criteria encompasses four central technical properties; the heating per square meter, the heating load, the tightness of the building envelope and the cooling demand. The tightness should be pressure tested. By 2000 around 100 passive houses had been built (Passivhaus Institute, 2012). The Darmstadt institute database of passive houses, most of them single family houses, encompasses by early 2012 1753 projects: 1586 in Germany, 33 in Austria, and 12 in Denmark.

The interest for passive houses in Denmark occurs in a niche in the building community, distinguishing itself from other parts of the industry. Especially the architects in Denmarks second largest city, Aarhus, has been important in constituting this early interested group as the architect school, local architects and alliances of architects, consulting engineers and contractors commenced following the German development from around 2000. From 2005-2007 the consultancy Ellehauge and Kildemoes had funding for the EU-project "Promotion of European Passive Houses" with a range of European partners. Ellehauge and Kildemoes promoted passive houses as a well-documented sustainable solution through a website, educational activities, and study visits to Germany and Austria. The website was afterwards transferred to a new association for passive houses in Denmark. One active person in this niche community, the architect Olav Langenkamp, designed and built his own villa in 2008 according to passive house criteria and got it certified as the first passive house in Denmark.

Langenkamp had to use German suppliers to get components that would be certifiable. The contractor was therefore a German company, Ökologischer Holzbau Sellstedt.

ISOVER, the insulation manufacturer initiated a project of 10 passive houses "komforthusene". Each housed involved new sets of building community actors to obtain as much experience with passive houses as possible. Another goal was to experiment with indoor climate and develop documentation, involving Aalborg University in a three year long measurement program. By September 2008, eight out of the ten houses were inaugurated by the Minister of climate. The remainder two did not obtain the passive house certificate once built. Through these early projects the passive houses got the reputation of being expensive, and difficult to live in as the indoor climate is controlled with complex equipment. A later evaluation report (Isover, 2010) shows that the Komfort houses were indeed 6-12 % more costly but also that the initial expenses are compensated for within fifteen years through low energy consumption. By spring 2012, the indoor climate issues were documented by the evaluation project by Ålborg University and only six of the original ten complied with Darmstadt criteria.

These considerations also apply to the 2009 dormitory project "H2 College" (Bertelsen and Koch, 2011). The 66 student apartments in two blocks were built as passive houses, with a hydrogen conversion installation and thermal (earth) heating. The client was a building association Fruehøjgaard and Aarhus Arkitekterne, the architects, NIRAS, the consulting engineer and Ökologischer Holzbau Sellstedt, the contractor using German components. Over 2009-2010 various component suppliers start engaging in passive house projects. Also in 2009 the standard house manufacturer Trelleborg got one of its houses certified as passive house. In 2010 for example the Danish window manufacturer Rational supplied a vocational training school, built as a passive house. Over the following year the production developed like this

2009 8 projects

2010 10

2011 5

2012 9

2013 6

By the summer 2012, there are hundred engineers and architects being certified passive house designers having taken the formalised education and one consultant company "passivhus.dk" accredited to certify the buildings. But at the yearly Passivhus Norden conference it is mostly other sustainable building subjects that dominate; besides by 2013 critical comments on

passive houses have become increasing prevalent (interviews). One example is the Technical managers of Lind and Risør, a supplier of standard passive houses, stating

"We haven't experienced that big a demand for passive houses, but we are really content with the experiences we have made and which has been transferred to our standard houses" (Jan Hansen to Dansk VVS March 2013)

Similarly the annual Passivhus Norden conference repeated the message from 2012, ie.that other types of sustainable buildings was equally interesting as passive houses.

In summary, the development of passive houses mobilized both small grassroots players as well as larger players in the industry. Most of the Danish passive house projects occur as part of publically financed demonstration or innovation projects aiming at communicating the values and qualities of passive houses to a wider audience and support the legitimization process by providing formalized knowledge about the design, costs, the building process etc. This involves however that the passive houses appear expensive and difficult to live in.

The case of a regulatory based institution with normative anticipation, energy class 1

Energy class 1 was announced by the EU in 2002, with legal status from 2015. However the first energy class 1 buildings, the Stenløse Syd project, was erected (2005- 2008) and encompassing 400 hundred dwellings including housing and villas as well as a kindergarten and an elderly home. The local municipality enforced a set of eco- and energy requirements for new buildings within district area planning, such as nature protection, low-energy building, solar heating systems on each building, on-site rain-water handling (Holm et al 2011: 198). The project was enrolled as show case by EU program Concerto, a range of small players in the villa market became interested and enrolled to the project, also involving the local municipality and a social housing company. The blower door testing of airtightness received extra joint attention, resulting in reported and documented good results assembled by a participating university. The project scale has been radically downsized following the last economic crisis but it still ongoing.

In 2008 a public children institution was built in Hedensted. In 2010 a public bus work shop was realized in Århus. From 2010 the normative anticipation is weakened as energy class from then is "only" the next upcoming regulatory step (to be enforced in 2015). In 2010-2012 several large office and institutional buildings were designed according to energy class 1, This includes two projects in Århus "Navitas" (designed 2010) which is a major education and research facility due to be finished 2014 and a Multimedia house due to be finished 2015. In 2011 an institution for autists was inaugurated involving the social housing company 3B, consulting engineer Dominia and contractor Jönsson.

Energy Class 1 continued to be announced on all market segments until late 2013 (public, private, houses, office building, institutions). Its anticipatory proto-institutional role was then substituted by BR 2020.

Discussion

Below we discuss the emerging of the ten possible future institutions (proto-institutions) of sustainable building in Denmark. First the normatively based, including a special focus on passive houses and then the combined normative regulatory based, focusing on energy class 1. We then go on to discuss similarities across the emerging institutions.

The normative sustainable housing concepts (Passive house Active House, LEED, BREEAM, Svanemærket, DGNB a. o.) all suffer a marginalisation vis-à-vis the dominant built environment institution, as they never raise beyond 10% of buildings realised in the period also indicated by the internet hits. Only a few buildings have materialised. This occurs even if large actors such as contractors such as NCC and MTH, consulting engineers such as Ramboll, COWI, architects such as CF Møller, and Arkitema and building material manufacturers such as Velux are becoming interested, enrolled, and contribute to gained legitimacy, intermediate between them and other elements of the network.

Protoinstitution	**Year of introduction in the field**
Supported by Regulation:	
Energy Class II, (Energy Building Performance Directive, EBPD, EU).	2002
Energy Class I (EBPD , EU)	2002
BR 2020 (Building Regulation, Denmark)	2011
Normatively supported:	
BR 2020 (Building regulations for Denmark)	2011
Passive house, Darmstadt criteria	2008
Active House (Velux group)/	2009
Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB)/ Green Building Council	2012
Svanemærket (Nordic Ecolabel)	2011
Building Research Establishment Environmental Assessment Method (BREEAM)	2010
Leadership in Energy and Environmental Design (LEED)	2010
EU Green House	2008
Other concepts Sabro, ZERO+, lavenergi,	2010

The moral legitimacy has not sufficed however even if supported by cognitive and functional arguments of cost effective energy consumption.

Passive houses interested a handful of architects and consulting engineers around 2000 and developed into a contesting future institution. This early alliance shares features with other grassroot developments of renewable energy, such as wind turbines (Steen et al. in Foxon et al. (2008). An important technology here is the PHPP calculation program that had to be negotiated when enrolled in the network as its competitor the Danish BR06 software, operated with different standards for energy consumption in a building. The alliance developed based on accumulating knowledge of the concept and the EU project obtained by Ellehauge and Kildemose solidified the alliance, and gave it a spokesperson in the absence of actual building projects. The study trips to Germany problematized the cost as barrier since the German houses were subsidised. So despite that the German passive house institution possessed moral and cognitive legitimacy the alliance did not materialise in Denmark. Instead education as certified passive house designer was central for the network. It is characteristic that it is a fiery soul architect, building his own house, commenced the materialisation and this house hold a strong symbolic value for the passive house network. Soon after followed the ISOVER initiated comfort houses. This involved a series of actors. Notably the specialised consultancy companies Cenergia, Ellehauge and Kildemoes, Espensen and Hundsbæk and Henriksen. The blower door test became a difficult materiality to negotiate with as the houses appeared not to be tight enough. Besides through media coverage and building sector word of mouth the houses legitimacy was weakened as the building got the reputation of being too expensive, to be untight, to use more energy than calculated and suffer from poor indoor climate. By spring 2012 these issues were documented by the evaluation project carried out by Ålborg University: This assessment meant to contribute to the cognitive legitimation and theorising of the new upcoming institution (Greenwood et al 2002), ended up by contributing to the contestation of the concept underlining needs for improvement. From 2009, the alliances have been growing through research and funding, the creation of an annual Nordic passive house conference hold for the 6th time last year, as well as training programmes educating designers. All these elements are contributing to create legitimacy intermediating between the elements in the network. This stabilisation is also suggested by the number of internet hits. Yet it is also in 2009 that Velux is introducing the active house concept. This occurs in coalition with architects Aart, consulting engineers Esbensen, Sloth Møller, the architect school of Århus, the engineering polytechnics of Århus, suppliers WindowMaster and Sonnenkraft and contractor KFS Boligbyg. The introduction of the active house concept is a rather direct competitor to passive houses and gains pragmatic legitimacy as its normativity is superior to the passive house concept (i. e. To produce sustainable energy is more proactive than to avoid using energy). Between 2010-2014, passive houses? are discarded when the new BR2020 regulation is developed. The near zero carbon norm is not directly allied with passive houses. By 2012 there is decrease in finalised

houses, compared to 2009 and 2010.There continues to be considerable distance between rhetoric and (partial) stabilisation through materialisation. The continued economic crisis and a stand still on the housing market, the loss of moral and cognitive legitimacy due to indoor climate issues and price probably created reverse salience in the alliance building as the attention turns to the competing sustainable housing concept.

The institutions carried by regulatory dynamics supplemented with normative are in stark contrast to the "only" normative. "Energy class 1" was early a strong brand on the internet and the future institution encompasses early materialisation in the Stenløse project. Also "energy class 2" enjoyed attention especially by 2006. The first energy class 1 project Stenløse Syd was a strong normative anticipatory move, it involved local urban planning (Holm et al 2011), and the municipality was actively enrolled in creating moral and cognitive legitimacy for the project. Also at least two more projects were part of the early movers also related to municipality interessement this time in Århus. However it's first after 2010 that the upcoming institution enrols and mobilises a number of projects. In the summer of 2014, 37 energy class 1 houses were for sale. But at this time the normative element is declining and will be substituted by a regulatory institution by 2015.

Overlap and/or cannibalism between proto-institutions?

The appearance of this host of proto-institutions might lead to mechanisms that hamper the transition; nevertheless we find recurrent elements of overlap. This contradiction is discussed below: Some proto-institutions do appear to be competing and conflicting. The most convincing examples are passive and active houses. At the introduction of active houses in 2009, the press release rhetoric of the active house promoters was rather clearly anti–passive house describing this approach as old fashioned. Nevertheless the two proto-institutions share a number of technologies and practices as well as actors, most notably Espensen. Another variant are the compartmentalization (Smets and Jarzabkowski 2013) : there is one family of concepts for large buildings, BREEAM, LEED, DGNB, and another for single family housing and smaller building such as passive houses and active houses. However several proto-institutions do represent cross over between this disparate groups, including passive houses, active houses and Svanemærket.

We find overlap and recurrent elements between proto-institutions in terms of normative and technological content, in terms of companies and their business strategies, and in terms of alliances involved in more proto-institutions.

Normative and technological content overlap includes both partial "grouped" overlap and more general ones. Two grouped overlap occurs at the sustainability proto-institutions and the energy consumption proto-institutions respectively. In the certifications covering a broader understanding of sustainability, LEED, BREEAM, DGNB and cradle to cradle there are many recurrent elements of environmental sustainability (such as focus on water consumption and

recycling), whereas the energy consumption focused proto-institutions share their focus on energy yet sharpens the demands over time.

Overlap across almost all proto-institutions occurs on how to calculate energy consumption and how to obtain airtightness. Blower door tests with specified results are used at Passive, Active, energy class 1, 2, BR2020 proto-institutions. Airtightness is a technology and practices that are new as it is "counter" to the previous dominant logic in Danish building regulation where ventilation and airshift was incumbent.

Business strategy overlap occurs at a series of large architects, consulting engineers and contractors practice operating in several proto-institutions. Sometimes as part of a comprehensive strategy backed up organisatorically with an entire department, sometimes with a single person responsible for all and sometimes as a more fragmented strategy also partly relying on single persons competence development (such as many architects involvement in Passive houses and DGNB which does not reflect actual projects in their organisation).

Also the sustainable building specialist companies: Cenergia, Esbensen, Ellehauge and Kildemoes and Hundsbæk og Henriksen are engaged in an overlapping manner in a series of the proto-institutions, i.e. active and passive houses, Svanemærket, energy class 1 and 2 and BR 2020. For these companies the possible "coming and going" of proto-institutions is equal to business critical developments and they emphasise to be even anticipating shifts between the companies.

Interesting we do not find many direct examples of central actors *not* engaging in new concepts appearing. It is however difficult to map how many players construct themselves into passive observers of the development.

The architect's association acted in an overlapping role engaging in several proto-institutions. Their education program have contributed to the education of over 100 Passive house designers, while they also contributed to the formation of BR 2020 and they contributed actively to DGNBs development in Denmark.

As an overall observation the incumbent building institutions in Denmark has continued over the last ten years to be relative conservative in "following the rule". Importantly the EU reforms push the dominant institution and provide new legitimation for it. Both the normative and the anticipatory normative (future regulative) institutions remains weak and peripheral but coexists with the dominant

It appears to be the contours of a constellation/configuration (Smets and Jarzabkowski 2013) within sustainable building of institutions and proto-institutions. We have shown the close relationship between the proto-institutions and noted the push of the dominant institution.

The common elements of the proto-institutions are however similar to an extent so they can be viewed as one institution of sustainable building. Neither do we interpret it as an inter-institutional system (Thornton et al 2012) as the relations between the future institutions are too vague.

Common for many of the concepts is the alliance of public institutions and public funding at least partially, large companies showing support, universities either participating in the design or the assessment of the project. Also slight changes of content and labelling involving adaption to BR 2020 are now perceived as the future legislation occurs. Velux for example changed "active house" into "home model 2020", involving a similar principle but under a new name besides being part of various certification projects at the same time.

The multiple embarking could be seen as a marketing stunt towards new markets for the large companies, be it architect, consulting engineers, contractors or suppliers. It does underline a weakness in institutional analysis as it tends to downplay the commodity feature of future institutions and concepts. Concepts of sustainable buildings are by some actors (i.e. architects, consulting engineers and contractors) understood as a (potential) commodity that can be sold. Even if it is also clear that this sustainable concept market can be characterised as "hybrid" as public subsidies plays a role.

The passive house analysis shows slow and hesitant processes, involving public support as the lever for development. It took 16 years from the first realised passive house outside Darmstadt in 1994, to realise 24 Danish projects (in our sample), all built after 2007. As the proto-institution commenced to produce material results a key barrier was the initial price of the houses. As a direct result the passive house concept has experienced limited adoption, keeping it as a proto-institution . This is despite of its German origin and backup, which provides well established knowledge, legitimate institutions, design procedures and more. When the passive house development is juxtaposed with other sustainable building niches and their competition it becomes clear how normative concepts that go beyond what is specified in the legislation have been introduced in succession over time, e.g. passive, active, DGNB. But it is also clear that the early compliance with future legislation, especially energy class 1, has tended to dominate these "voluntary" steps. There are tendencies of segmentation, where LEED, BREEAM, DGNB a.o. are used for office buildings, whereas passive house, active house, Svanemærket and ZERO+ mostly are used for single family houses and smaller buildings such as kindergartens.

Stepping back to a TIS and SNM point, both TIS and SNM highlight the importance of a dominant design. Our study shows that none of the future institutions has obtained this. Instead they continue to exist in parallel. Passive houses represent a well stabilised design with an institutional set up in Germany. Nevertheless this does not render the concept sufficiently strong as concept in what is a growing and active part of the construction market.

We have seen how the EU processes create dominant institutional dynamics that are more prevalent for the development of sustainable buildings than the future voluntary proto-institutions. In a MLP perspective it is usually expected that regime driven institutions would conserve existing ways of working (Geels, 2005; Markard and Truffer, 2008). This is evidenced by the far bigger number of projects built according to the required levels set out in the official regulations during the investigated period. Seen from a grass root perspective the commodification of a type of house, using a certificate is less interesting than promoting sustainable buildings in a broader sense. There will therefore be a tendency for grassroots' engagement to move from one promising future institution to the next, especially if the approaches get too commercial.

Conclusion

This paper set out to investigate the development of sustainable building in the Danish building community, viewing the concepts as possible future (proto) institutions. The analysis showed a slow process, cost and technology barriers, limited adoption and recently an apparent decrease for some of the normative institutions. The proto-institution of passive house has not been able to exploit its basis in formalised knowledge and cognitive legitimisation to become a contester institution. When juxtaposed with other proto institutions, it appears that all the normatively based are weak. It is the anticipatory normative early adoption of future regulatory demands that is prevalent as energy class 1 proliferates as a strong contester of the existing built environment institution. Therefore government policy and regulation is an institutional dynamic contributing more convincingly to institutional change than do contesting small future institutions, counter to Geels' contention. Here regime dynamics are a stronger transition dynamic than niches. Compliant with the theoretical framework however there are multiple dynamics in play. These combined dynamics between sustainable building institutions, and the regime internal dynamic through EU-regulation, leads to the conclusion that sustainable building concepts are only viable in fairly confined windows of time, and that each of the concepts probably provides partial contributions only towards low carbon building.

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