BECOMING SUSTAINABLE: LEARNING IN DEMONSTRATION PROJECTS

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Summary

Contributions enhancing sustainable development in construction and building are no longer a sport for "early adopters" of eco and green technologies or for companies that can afford to experiment with new paths. After a time of "anarchy", under which norms were disqualified, quality was an individual responsibility and an unbelievable increase of energy use was notified in new building, a time of change seems to characterize the Swedish construction sector. The unsoundness of this change is maybe the effect of what happens in transition phases when these are not actively managed. Implementation is going on. Existing technologies and knowledge, fruits of the many innovations carried on during the last decades, are finally called to be introduced in "normal" building practices and meet obvious difficulty on this direction. Learning goes on in demonstration projects for sustainable building.

Keywords: Becoming sustainable, demonstration projects, energy efficiency, learning

1 Introduction

A general assumption of "sustainable" tasks by all public authorities and organizations has recently mitigated the specific discussions about 'sustainability' in building. Research has moved its action into fields of specific sustainable contents in construction technologies, planning and administration of building and management of firms. Implementation seems to go on different levels. The management of change towards sustainable development is the big challenge. It implies lots of learning handling global problems by solutions for sub-problems and technological components. The initiators of today's projects are no longer the champions of earlier experimental projects: they are instead professionals in current building practices and local authorities forward in starting projects for increased sustainability.

A new tendency seems to be that projects for sustainable building no longer have to carry a 'green' expression. Sustainability has become a matter of measurable performances. At the same time do discussions still show a high rate of resistance against

change focusing on the unclear definitions of what is real sustainable, of which indicators are to be assumed, what is sustainable in the projects and finally which approach is the most sustainable.

Generally, it can be noteworthy to assume that very much knowledge and efforts have been concentrated and codified in the well known "environmental and energy programs" for buildings, capable to list all the environmental impact factors in buildings and willing to control all environmental aspects during the design and building process. Although, a wide tendency to abandon details and goals on the route is noted, so that very little "sustainability" is implemented in the final built environment [1]. The capability of implementing and integrating sustainability in details directly in construction projects is still failing. Implementing and developing the right initial conditions by giving hard focus on the initial program seems not to be enough. Change towards sustainability needs a sharpened perspective on organizational change and management with deliberate actions for organizational learning.

Learning processes within project environments, typical for the construction sector, are in focus for the research study which this paper refers to. It is meant to reach a developed understanding of the complex social settings that building projects consist of. A positive contribution can be to focus the attention on the learning in projects where issues of sustainable building is on talk, understanding the origin of capabilities in project-based practices [2] and how change is enacted in project-knowledge. Starting demonstration projects is proposed as a method which involves current building practices and academic researchers in a common effort to define ambiguities, uncertainties and needs along with knowledge and technologies which are developed and can be used by all. If there were evident solutions, standard technology would supply.

The implementation of sustainable building is now in need of specifications about what is working and what is not, what the problems are and what the sub-problems, which technologies are assumed as established in local contexts and what are the components and sub-components required to assemble them. These definitions may become important establishing a common language for sustainable building to be used by architects, engineers, clients and builders in the necessary conversational interactions needed in projects.

2 Deliberate learning strategies in project practices

Knowledge is historical, contextual and time-bounded. Overemphasis on measurements make resistance to this point and may be aligned with a view that knowledge is universal and objective, a-historic, a-contextual and above all "timeless" as a "view from nowhere" [3]. The contrast between this view and the following contrary, a "view from somewhere", where knowledge "is sought that is context dependent, based on hermeneutics, where truth is emergent and a result of hermeneutic experience" [3] is the core of the change towards sustainable development as an alternative way of reflecting upon and understanding change.

Practice is not enacted within a vacuum. Practice and contexts are reciprocally bended and attempts to "change the context can therefore be as influential and important as attempts to change practice when challenging the status quo" [3]. Reality is however subjective as it is dependent on the individual. In this sense, the view from somewhere relates to an individual's interpretation of something (practice) somewhere (context) as the

basis of action. There is a call for research that engages this reality by similarly engaging with construction practitioners to understand the legitimacy of their actions and their reactions to the content of change.

Actors draw upon knowledge and capabilities. These both are considered by many scholars as historical accretion of past practice and understanding which appear on different levels from a personal experience and meaning to the firms learning strategy [2]. Knowledge and capabilities are considered instrumental in shaping and being shaped by change, and cannot be disconnected in a process of diffusion for change.

This research study seeks to understand knowledgeable and reflexive actors, how they bring their understanding (informed by the past) to the process of diffusion. Actors are engaged in creating and using existing (through interpretative process) recipes, logics, rules, assumptions or institutions to interpret change. "Change cannot be divorced from such knowledge accumulated through time by social actors". Fernie et al [3] with Pettigrew [4] call for insights into managerial practices, change management and diffusion of innovation that attempt to catch reality in flight shaped by and through time. A contextual approach is requested in order to catch practice in a temporal zone: innovations are interpreted from inside and reorganized, codified and transformed in possibilities of "repetition". In the impact with the context of practice, only a few variables seem to stay constant, while the rest is transformed in a complex whole of signs which may not be generalized as they build a "somewhere", maybe similar but never identical. Ideas are shaped capable of becoming sustainable only through construction.

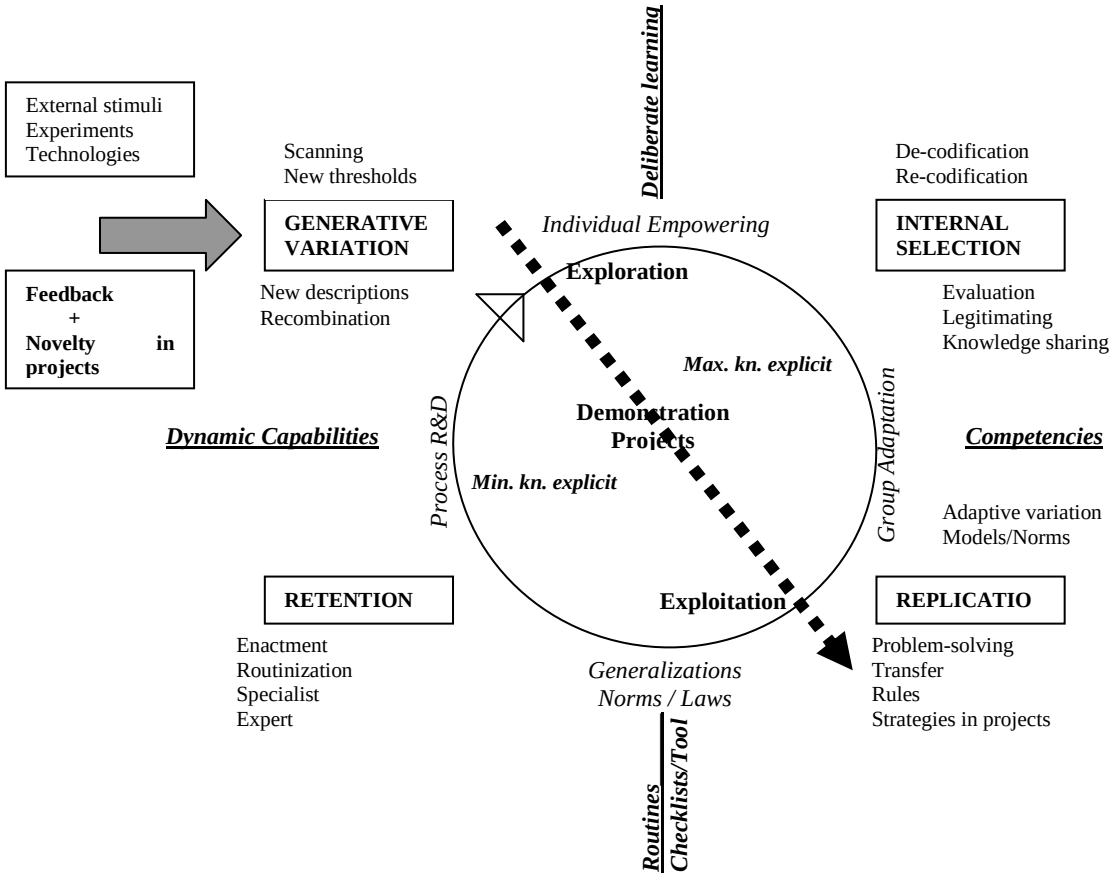

Fig. 1 Learning in project practices: activities in the knowledge evolution cycle(drawn on [2]). The demonstration project line inside the cycle of knowledge

Practitioners are responsible of the **content** of change in details, drawing on a collective knowledge. Hence individual learning, project learning and organizational learning may not be separated. In the specific case of projects for sustainable buildings, drawing on Zollo and Winter [2] and Prencipe et al [5], the object of learning emerges as too ambiguous and unspecified, still too "esoteric" to become the necessary basis for a collective knowledge. Demonstration projects for sustainable building have traditional characteristics of a-contextuality of procedures in their practices, acting as **crossovers** in the cycle that knowledge needs to follow in project-learning, **crossing over** from exploration to exploitation **Fig. 1**. [2].

The introduction of the demonstration project practice inside of the analysis of the cycle of knowledge in project-based practices explains and develops a new interpretation of the cycle of learning in project-based firms drawn on Zollo and Winter **[2]** in **Fig 1**. It is of importance to assume that project-based practices deal with a specific kind of knowledge that is project-bound, collective, multidimensional and contextual. It constitutes a "project-capital" that each individual, firm and organization temporarily uses, invest, capitalize and exchange in local strategies. When this project-capital is transformed in a construction project, **clarity of goals, robustness of codes and transparency of procedures** are preferred. These three qualities can be made possible in demonstration project practices with focus on relenting time along with the presence of an observer. In the acceleration of normal context-embedded practice clarity, robustness and transparency may play a secondary background role. They are necessary but not sufficient variables of a sustainable built environment. Goals of sustainability, rhetorical codes, never ending checklist of environmental impact of materials and constructions may still shadow on other intentions, behavior and antagonisms. It is necessary that the built environment participate in a sustainable development leaving the building sector as dynamic and complex as it is today.

3 The general aspects of sustainability need a language of details

Within the Demo-04 research project, going on at the Chalmers-Architecture in Göteborg, five demonstration projects have been gathered and two follow-ups of ongoing design processes have been made.

The normal description of projects assumes the vision of the client and the visualized description of that vision made by the architect as images of the Problem and of the Solution. Further the projects explored within the research were defined by a wish to become sustainable, still working within normal market contexts. A description of a more sustainable approach called early for other details as the kind of the building enterprise (new construction, refurbishment), the kind of actors involved from the very beginning, the clients' former experience of sustainable building projects, the projects' energy goals, the social and politic/strategic goals, the purposed technique for heating and for warm water, the average U-value of the climate shell, all became elements of the general descriptions and definitions.

The investigation surfaced aspects of sustainability which can be considered as normal ingredients of new buildings in Sweden, as in the list in **Tab. 1**.

Tab. 1 Accepted aspects of sustainability in Swedish projects

Aspects of sustainability	Specific accepted arguments for the project
Material	Use of local materials. Reduce layers. Checklist.
Water	Re-use of water. Harvesting rain-water.
Indoor environment	Comfort.
Surrounding environment	Self-initiated activities. Biodiversity. Places for meeting.
Economic	Life cycle perspective
Social-cultural	Waste recovery systems as co-operation. Strategic vicinity to urban transportation. End-user administration

The true controversies arise when energy efficiency goals are taken for serious and integrated in the context of current practice. **Tab. 3** shows a list under construction of terms which still needs many discussions, interactions, misunderstandings, meanings and codification. They constitute the variables of energy efficient building concepts, highly interactive and capable of induce intense conversational activities in project teams. No one has the final solutions and no standards are still defined. These variables constitute the actual ground for learning towards sustainable building at this moment of the transition to sustainable development.

Tab. 2 A list under construction of new terms for a sustainable building approach.

	Chabo Student housing	**Brogården refurbishment**	**Hamnhuset apartment block**	**Bottneväg row houses**	**Lundby housing**
More time	For the design process + DP	demonstration project	Design process and stipulation of contracts + DP	No. Normal procedures	Competition + normal procedures
More money	Regional incentives	EU and regional incentives. High personal engagement	All pay for exceeding R&D costs	Had already invested in a demo-project 2001	1st Prize in Competition
Tools: Energy balance calculations	Yes. All consultants	Yes.	Yes. All consultants	Yes. VVS consultants	Yes.
Tools: LCC-calculations	Min. upfront investment	Minimize downstream operational costs	Min. downstream operational costs Investment decision	No.	Yes.
Water heating system: Solar panels	No.	Yes. But not in the first stage	Yes. 40 % of total consumption	No.	Yes.
Water heating system: district heating system	Yes.	Yes.	Yes. Winter time		
Threshold values: Indoor temperature	20 ^{o}C	21 ^{o}C	22 ^{o}C	23 ^{o}C	20 ^{o}C
Threshold values: Heating systems energy demand (goals)	70 kWh/ (m^2 year)	55 kWh/ (m^2 year), 115 kWh/ (m^2 year) before refurbishment	32 kWh/ (m^2 year)	70 kWh/ (m^2 year)	27 kWh/ (m^2 year)

Threshold values: Total energy demand	85-95 kWh/ (m^2 year) (110-120 measured)	92 kWh/ (m^2 year) (216 today)	81 kWh/ (m^2 year)	85-95 kWh/ (m^2 year)	81 kWh/ (m^2 year)
Elimination of old supply channels (for space heating, water heating…)	no	Yes. Old radiators are eliminated	Yes. System without radiator	Yes. System without radiators	Yes. System without radiators
District heating system (for space and water heating)	Only for water heating	Water heating winter time	Water winter + excess heat demand in cold conditions	No	No
Space heating technology	Heat pumps + radiators	Forced ventilation with heat recovery	Forced ventilation with heat recovery	Heat pump	Natural ventilation with heat recovery
Technical solutions: Climate shell (U-value)	Prefab concrete 0,4 Law energy	Insulating + bricks passive house	35 cm FTX insulation façade + thick plaster 0.7 passive house	Wood + iron construction Passive house + normal	
Technical solutions: glazing (u-value)	3 glass insulating 1,4	3 glass ins. 1,0	3 glass 1,1		
Concepts: optimization	Low energy Operational system for normal cost for user	Refurbishment of housing from the 60's, lower energy, same hire, minimal downstream costs	Energy and system + min. downstream costs	Low energy housing for normal costs!	??
Concepts: efficiency	Yes. High efficiency	No. Slow	No. Slow	normal	Traditional efficiency
Co-operation	During design + EQM + individual metering and costs+ waste separation	Partnering + individual metering and costs+ standard waste recovery	During design + EQM + individual metering and costs	Standard waste separation units	Planning Common areas for meeting and activities
Self-organization	No.	In the company	In design process	No	In user life
Excess recovery from inside	Exhaust air heat recovery	Ex-new air heat exchanger	Ex-new air heat exchanger	??	??
Information campaign	User instructions + internal info	Public meetings and user instructions	Public info and user instructions	Low energy is no selling argumentation	Publication of competition entries

4 Developing results and conclusions

The realization of a few demonstration projects in a local context does not automatically imply the creation of models to be followed and applied in further design processes. Before

becoming models able to be repeated and exploited demonstration projects must produce (implement) practices which de-codify and re-codify the new terms and tools, give legitimacy to concepts, principles and purposes former absent. The knowledge produced inside projects is filtered through internal selection and shared in the transition from individual learning to collective competence. The usual **crossover** from exploration to exploitation, traditionally used in demonstration projects, cuts of this part of the process and does not function in projects for sustainable buildings. The variables in action are far too many and extremely interactive. Ambiguities in the definition of these variables make solutions weak and isolated. Hence demonstrative projects have signs of robustness and must focus on becoming simple and workable hypothesis for further projects. Confusion in the definitions of tools, the battle of thresholds and acceptable average measures are adversarial elements in the development of clear approaches for sustainable building.

There is a lack of terms in use to describe complex phenomena. Energy efficiency shows its complexity as it appears as the technological principle, the problem to be solved and the purpose of projects today. It is value loaded and is presented as a base-concept on which paradoxically to build up a full architecture. This fact risks simplifying the process of design and puts projects for increased energy and environmental performance in isolation from the dynamics of the building sector, reducing the complexity of the human built environment. But the principles, the components and the variables on talk are a multitude and not always depending only on technology. The learning process in project-teams is messy and almost based on conversational interactions. Solutions are proposed – and fail; parts do not work; re-designs are required; endless testing must be made. Simulations, LCC-calculations, risk-analyses are used tending at minimizing upfront investments and downstream operating costs. Still the global character of the environmental challenge make all these projects for sustainable building resistant to the hazardous tendency, existing within the building sector, to simplify in order to implement efficiency just at a general plan.

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