Towards new shores in the Norwegian AEC-industry – A review of building process-related R&D initiatives and their impact

Anita Moum,
SINTEF Building and Infrastructure, Norway
(email: anita.moum@sintef.no)

Abstract

The overall and increasing awareness about the need to rethink traditional building processes has kicked-off a number of efforts in Norway. This conceptual paper presents a review of building process related R&D initiatives in the Norwegian AEC-industry. The paper reflects on the role of these initiatives as change drivers; in the transformation process from where the AEC-industry is today, towards new shores. The initiatives are many and there is a lack of holistic understanding of how the initiatives work (or not work) together in an ecosystem of change. The paper suggests a holistic framework for gaining better overview and understanding of the interrelationships between initiatives aiming to improve how we organize and execute building projects.

The framework contains two main dimensions. The first dimension is the definition of three levels of activity; the societal/authority level, the AEC-industry level, and the project level. The paper describes several examples of initiatives on each level. The second dimension is the identification of four groups of change drivers and measures; 1) game-changers, 2) top-down initiatives, 3) bottom-up initiatives and 4) incubators. These four groups are characterized by various degrees of being planned or random, and by having long-termed/global impact or short-termed/local impact perspectives. Strengths and weaknesses of the groups are discussed, as well as interrelationships across levels and interfaces. The paper applies a reflective approach, based on observations of practice in the Norwegian AEC-industry, through participation in workshops, discussions, and conferences. The discussions are furthermore based on reviews of key documents such as policy documents, strategies, and research proposals.

The increasing complexity and the rapid development on all levels in the AEC-industry calls for a more systematic, interdisciplinary, continuous and holistic competence and knowledge building. A better understanding of how the related R&D initiatives work, or counteract, can be helpful in optimizing their effect on the building processes.

Keywords: building process, change, holistic framework, R&D, overview.

1. Introduction

"I have yet to see any problem, however complicated, which, when looked at in the right way did not become still more complicated." Poul Anderson.

There seems to be a widespread consensus in the Norwegian AEC-industry (architecture, engineering, construction) about the urgent need for more research-based knowledge on how we should organize and execute our building projects. A number of initiatives with the aim to address this need have been kicked off during the last years.

This conceptual paper presents a review of these initiatives. The paper reflects on their role as change drivers in the transformation from where the AEC-industry is today, to where it should be, according to a number of national policies and strategies. The initiatives are many and there is a lack of holistic understanding of how the initiatives work (or not work) together in an ecosystem of change. The paper suggests a framework for gaining better overview and understanding of the driving forces of building process-related change and improvement in the AEC-industry. The framework is intended as a support for decision- and strategy makers, for funding institutions, and for research environments.

Firstly, the paper describes the backdrop which motivates the current building process-improvement efforts in the Norwegian AEC-industry. The paper briefly presents some theories, which have inspired the approach of the framework. The main part of the paper presents the review and related discussions of the current status in the AEC-industry, based on the application of the holistic framework. The paper concludes with a summary of trends and suggestions for further work.

2. Backdrop

Building, real estate, and infrastructure together represent the largest land-based industry in Norway when it comes to value creation. The sector consists of some few large enterprises and many SMEs. Approximately 320 000 workers in more than 85 000 enterprises are employed in the industry. Thus, directly or indirectly, the industry ensures economic growth and the income of a substantial part of Norwegian employees (Espelien, Theie and Bygballe, 2015). Simultaneously, the industry is responsible for creating and maintaining the built environment which affects us both as a society and as individuals.

In the last decades, groundbreaking innovations in means and modes of collaboration, enabling technologies, and standardization/industrialization of products and processes have unfolded. It is a paradox that the AEC-industry still underperforms when it comes to the quality of its end-products, innovation, and productivity. These aspects affect, in turn, value creation for the end-users and the society. The report of Egan (1998) still seems to be relevant in describing the AEC-industry as "adversarial", "ineffective", "fragmented", and "incapable of delivering for its clients". This is well illustrated in a quote from an American report, stating: "Construction projects frequently suffer from adversarial relationships, low rates of productivity, high rates of

inefficiency and rework, frequent disputes, and lack of innovation, resulting in too many projects that cost too much and/or take too long to build. Also, projects continue to injure or kill too many workers, and owners are often disappointed with the quality of the end product" (Darrington et. al 2010). Key actors in the Norwegian AEC-industry pointed in 2014[1] to industry challenges such as:

- *Dysfunctional and fragmented industry:* The tender structure is competitive. There is a conflict-oriented mode materializing in disagreements and trials. There is a need for efforts and measures way beyond the ability of the individual actor;
- *Communication barriers and lack of trust:* There is a lack of transparency in work- and decision-making processes, as well as trust-based relationships and empowered employees;
- There is a need for collaborative efforts engaging and involving actors across the organizational barriers we traditionally face;
- *Short-term goals and focus on the "lowest bid":* Actors of the building process sub-optimize due to short-term focus on economy as decision criteria, rather than contract and order regimes that focuses on performance. There is a need to focus on long term goals, results/end products, user needs and value creation;
- *Increasing complexity:* The numbers of specialists, with different and often divergent needs and aims have increased and add complexity to the process. There is a need for cross-disciplinary approaches and multidisciplinary research activities;
- *Lack of implementation and adaption of projects to new technology and vice-versa:* The technology develops rapidly. This poses great challenges to the actors of the building process in adjusting and keeping up with the pace and the industry lacks trained personnel;
- *Lack of superior role models:* There are few locomotives of innovation within the industry, as it can be found in other successful industries (e.g. the offshore industry). There is a need for superior role models to push forward the innovation front.

This paints a rather gloomy picture of the AEC-industry. However, in several industry-wide discussions, participants emphasize that we should not disregard the stories of success and not forget to look critically on established industry "myths and truths". Yet the overall opinion of the AEC-industry seems to be that there is a need for change in how building projects are organized and executed, and that more R&D is urgently required. This need is further accentuated by:

- Societal challenges such as health and welfare, scarcity of resources, climate change, mitigation and adaptation;
- Urbanization, population growth and related productivity pressure;
- Increased globalization and international market competition, workforce migration;
- Changing markets and user needs, new legal requirements, and clients who are more demanding.

[1] Identified in industry workshops and gatherings arranged by NTNU (2012-2013) and Bygg21.

Why does the AEC-industry underperform, in spite of all R&D-efforts and groundbreaking innovations, which obviously have enhanced great improvements in other industries? Past efforts show that there is no obvious or easy formula or recipe to success. A better understanding of the interrelationships between the drivers and measures that change how we organize and execute building projects can be helpful. In order to achieve such understanding, we need applicable tools and frameworks.

3. A holistic framework

3.1 Change one thing, change everything?

The current societal, economic and technological trends are requiring, driving and enabling change of practice, research and education across traditional disciplines and curricula. The AEC-industry can be said to be in a transition phase, on its way towards new shores. As a bi-product of this transition phase we see that the AEC-community face an increasing complexity which makes it highly challenging to address the various, partly conflicting, aims and values of all parties involved. The mix of uncertainty, uniqueness, interdependencies and unpredictable cause-effect relations create a context in which AEC-practitioners sometimes are managing mess rather than solving problems. Researchers such as Schön (1991) and Gibbons et al (1994) regards the traditions of Technical Rationality and Mode 1 knowledge production as insufficient in a real-world situation where many solutions cannot be found in a book or manual. Schön (1991) introduces Reflection-in-Action and Reflection-on-Action as fruitful approaches to better understanding how we learn, acquire and apply knowledge. Gibbons et al 1994) introduces Mode 2 knowledge production, which is transdisciplinary, transient, heterarchical and carried out in a context of application.

The awareness that many problems cannot be solved within a single tradition, organization, or on a single level in the AEC-industry, is increasing. This seems to have resulted in a shift from technology-biased focus and "silothinking" approaches, towards more integrated and holistic and interdisciplinary ways of thinking and working in the AEC-industry. There are a growing number of R&D initiatives which are looking at interfaces between entities and traditions, on value-creating synergies and integrated models, on life-cycle scenarios, on "soft" as well as "hard" skills and issues. One of these is consolidated in the CIB priority theme IDDS (Integrated Design and Delivery Systems) (Owen et al, 2010).

3.2 The framework, data and limitations

The idea behind the framework arises out of previous work with developing holistic approaches for better understanding complex phenomena in the AEC-industry (Moum, 2008). It is also based on reflective and explorative analyzes inspired by the thinking of researchers such as Schön (1991) and Gibbons et al (1994). The dimensions and elements of the framework will be explained and demonstrated throughout the review and the discussions which follow in the next section.

This paper is primarily based on observations of practice in the Norwegian AEC-industry, through participation in workshops, discussions, conferences, and on review of key documents such as policy documents, strategies and research proposals. The author has furthermore held key positions in some of the initiatives described. The framework idea and related overview/review is thus based on the reflections of the author, and on a Norwegian context. The paper presents examples of R&D activities, and not a complete summary of everything going on. In the further development of the framework, an extended review of supporting or challenging theories should be carried out, as the framework should be applied on similar situations in other countries. Through this conceptual paper, research fellows are invited to give their view on the framework and its usefulness. The framework and the related reflections are meant to kick off discussions and inspire further R&D activities in the field.

4. A multi-level review of the Status quo

The overall and increasing awareness about the need to rethink traditional building processes has kicked-off efforts on various levels. Three levels represent the first main dimension in the framework: 1) the societal/authority level, 2) the AEC-industry level and 3) the project level. In the following section, a brief overview of change-driving initiatives and measures related to each level is given.

4.1 Societal/authority level

"Buildings and infrastructure create great value and quality for its users and the society. They are flexible and use technology in smart ways. The construction industry contributes to solving social, health-related and environmental challenges in the society. The industry produces error-free, environmental-friendly and cost-efficient buildings and infrastructure, and improves the existing built environment. The construction sector is productive, innovative, competitive and strongly positioned on the global arena. The sector is effective, has a good reputation and it provides highly attractive work-places." (Ministry of Local Government and Regional Development, 2012. Authors translation).

This 2030-vision is stated in the White paper Good Buildings for a Better Society (2012), which was handed over to the Norwegian Parliament in 2012 by the Ministry of Local Government and Regional Development. The White paper is based on around 30 contributions from academia, organizations and companies/actors representing the entire value chain of the AEC-industry. As a result of the objectives and intentions described in this paper, a collaborative and interactive arena between the public authorities and the AEC-industry was established in 2013. This collaborative program is called Bygg21 (Construction 21), and is hosted by the Agency for Construction Quality (Direktoratet for Byggkvalitet/DiBK).

4.2 AEC-industry level

Bygg21 has developed an overall strategy for the AEC-industry (Bygg21, 2014), which addresses three main activity areas; 1) R&D and innovation, 2) education and 3) knowledge

dissemination. Four building process-related focus-areas of R&D have been identified in this strategy; 1) Standardization and industrial design, 2) Value-creating collaboration, 3) KPIs and benchmarking, and 4) Simplification of laws and regulations.

The board of Bygg21 consists of people representing the CEO-level in leading Norwegian R&D- and AEC-companies. Bygg21 has initiated and partly also funded several ongoing activities on national level. One of these is the "Next step" project – a national guideline which organizes the building process in 8 key stages, from "cradle to grave" (from strategic definition to demolition). The guideline is a modified and Norway-tailored version of RIBAs plan of work[2], and shall contribute to an AEC-industry wide terminology and common understanding of the main stages of the building process. Another important activity is the so-called "performance benchmarking project", where the American Construction Industry Institute's 10-10 benchmarking system[3] is tested out by a number of companies in the Norwegian AEC industry.

In 2012, several key players in the AEC-industry formulated a collective call for more knowledge on building processes. NTNU carried out, on their assignment, a feasibility study on how to organize a national joint effort. This resulted in the establishment of Project Norway in 2014 – The Norwegian Centre of Project-Related Activity[4]. Project Norway includes a program dedicated to the AEC-industry and building process-related R&D (the BAE-program). Today, the program has around 15 partners including NTNU, SINTEF and BI Norwegian Business School. In its strategy, the program states that its partners shall actively contribute to initiating and stimulating experience exchange between R&D projects and activities. The program seeks furthermore to improve the framework conditions for process-related R&D and innovation (funding models, national policies etc.).

Other Norwegian AEC-networks, organizations and communities which have process-related R&D and innovation on their agenda is BuildingSMART Norway, Lean Construction Norway and the professional associations and organizations. Examples of thematic collaborative initiatives (stimulated by the authorities) are joint efforts with the aim to improve HSE (no mortal injuries on the construction site) or avoid AEC-industry criminality and "black" working. One of the latest initiatives on AEC-industry level is to develop a roadmap for a digital AEC-industry (the first gathering took place in October 2015, hosted by The Federation of Norwegian Construction Industries/BNL).

4.3 Project level

Throughout the last five years, a number of building-process related R&D projects have been established. Typically, these are so-called Innovation projects. Innovation Projects for the Industrial Sector are funded by User-driven Research based Innovation (BIA), a programme of

[2] http://www.ribaplanofwork.com/Download.aspx
[3] https://www.construction-institute.org/scriptcontent/10-10_promo.cfm
[4] http://www.prosjektnorge.no

The Research Council of Norway (RCN). The BIA programme aims to promote value creation in Norwegian trade and industry through research-based innovation in companies and the R&D groups with which they cooperate (RCN, 2015). Innovation Projects are owned by a company or organization, and they include research activities and knowledge development needed for implementing innovations and value-creating renewals. These projects call for a research methodology which enables a high degree of interaction between the industrial partners and the involved R&D environments. A successful implementation which enables a subsequently value-creating effect in the companies is crucial.

Table 1 shows ongoing Innovation projects (except BA2015, which is a consortium funded project). This funding model is dominating in the current Norwegian AEC-industry. The projects are commonly based on real-life demonstration projects and/or case-studies. Building projects are actively used as a living lab for collecting data, learning and testing out new solutions. The possibility of in-kind contribution instead of cash seems to lower the threshold for industry partner involvement. This might to some degree explain the dominance of this funding model within building process related R&D.

"Hot topics" are lean design and production, BIM, new collaborative models, value creation, efficiency, project management and the learning from other industries (such as oil and gas).

Table 1: Overview of ongoing R&D projects (Source: BAE-program)

Project	***Purpose***	***Periode***	***Project owner and partners***
OSCAR – Creating value for owner and user (innovation project)	*Focus on early stage planning and experiences from operation and use. Effectiveness.*	*2014-2017*	*Multiconsult AS (consultant company)*
SpeedUp (innovation project)	*50% shorter execution time. Eliminating time-thieves and making processes more efficient.*	*2014 - 2018*	*Reinertsen (consultant company, former contractor)*
SamBIM - BIM-driven collaboration in the building process. (innovation project)	*Develop BIM-driven processes and collaborative models that boost value creation.*	*2012-2016*	*Skanska Norway (contractor)*
HPWS - High Performance Work. (innovation project)	*Development of the Norwegian collaborative model for efficient production in periods with hired workforce.*	*2013-2017*	*Grande Entreprenør (contractor)*
INPRO - Integrated methodology for design management. (innovation project)	*Better understanding management of production based processes, based on involving planning (Involverende Planlegging).*	*2013-2017*	*Veidekke Entreprenør (contractor)*
BA2015	*Improve efficiency and sustainability of the AEC-industry. Focus on benchmarking (collaboration with CII in the USA), and demonstration projects.*	*2013 - 2015*	*Consortium-funded program with 18 partners from industry and academia. Project management by Metier, SINTEF and NTNU.*

5. Discussion

The multi-level status quo shows that there are many process-relevant R&D initiatives going on or on their way. How do they contribute to change and impact, across levels, actors and projects? To which degree are these initiatives drivers or measures for change – and what are their weaknesses? In order to discuss this, the following section explains the second dimension of the conceptual framework: the four groups of change-drivers and measures.

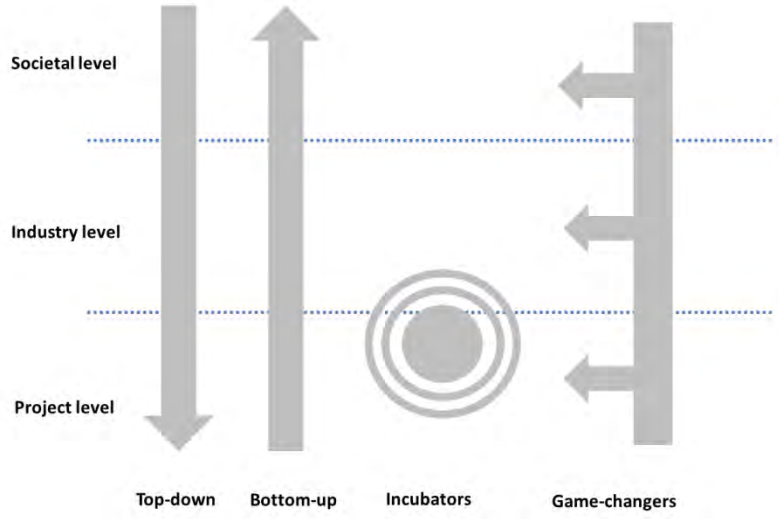

Figure 1: Change drivers

5.1 Game-changers

Game-changers, as we use the term in this paper, are people, products or processes with the power to change mindsets and how we live, collaborate and work. Enabling technologies are obvious examples of game-changers. The last few years have shown us how much Internet, new user-interfaces such as touch-screens, apps, and the social media can influence our daily work and social lives. Future powerful game-changers are expected to be, for instance, 3D printing, nano-technology and the Internet of Things. Non-technological examples of game-changers are political systems, market-mechanisms (global markets and competition) and environmental issues (e.g. earthquakes, global warming, and scarcity of resources).

Technological game-changers can trigger chaos or quantum leaps. They can enable improvement, new businesses, innovation and value creation, *if* we are able to see their possibilities and to implement them, modify them or adjust to them. They create possibilities and challenges on and across all levels. To be an early adapter or even creator of a game-changer, can create completely new business possibilities. Steve Jobs with his Apple-products is a much used example. It is, however, hard to predict what are actual game-changers and not only a dead-end development (the Kodak-effect) or a mayfly phenomenon. It can, on the one hand, be a cost- and time high risk-activity to hop-on an early stage development. As it can, on

the other hand, be a risk not to participate. To make the right decision requires a good understanding of trends and market mechanisms.

In the AEC-industry, much focus has been put on implementing Building Information Modelling and the related standards and software-solutions. Already ten years ago BuildingSMART prophesized a paradigm shift in how we manage and handle information.

5.2 Top-down

Standards, laws and regulations are powerful examples of top-down change-drivers. Other examples are policies, strategies and charters. They are placed on the scale between compulsory and voluntary. Top-down initiatives are mostly strategic and goal-oriented, with a long-term view. They are often initiated by authorities or by the management level in companies and organizations. Thus their creators possess great authority and influence. A weakness of laws, regulations and standards, is that they can be conserving. They can thus hamper innovation and change if they do not match the societal development. In Norway, there is a tradition for involving citizens and employees in the process of establishing top-down initiatives (hearings, workshops etc.). Still, the weaknesses of measures such as strategies and policies, is related to ownership, alienation and commitment. One much used phrase is that "culture eats strategy for breakfast". Without people who are willing to commit, change or improve, it is hardly possible to realize strategies or goals (at least in our part of the world). Thus, many good plans and intentions remain in the management drawers, only to be mentioned in sales material and principal speeches.

Examples of top-down examples in the AEC-industry, apart from laws and regulations, are the governmental policy paper, the strategy of Bygg21 or the Project Norway-program, and the "Next step" initiative. In Norway, the public clients are important role models in the AEC-industry. Statsbygg did already in 2007 require the use of open BIM in their building projects – thus pushing the broad implementation of related technologies in the AEC-industry.

5.3 Bottom-up

"One-man" initiatives, based on personal engagement, belief and commitment are another powerful driver of change. This is particularly the case if the group or person is in the position to convince their companies or networks about the need to change or adapt to something new (for instance by being a project manager). Individuals or groups seem to be closer to the take-up of new ideas and ways of thinking than a big organization. Such initiatives might pop up and "grow" randomly. The management-level might not recognize or attend to them, and they might not be embedded in a strategy or directed towards a common long termed goal. Another weakness is the lack of robustness and the strong dependency on the initiators knowledge/competence and availability. Internal development projects within companies can also be regarded as a kind of "one-man-initiatives" in the AEC-industry, as they are mostly closed and decoupled from other similar activities in other companies.

An example of a bottom-up initiative is the implementation of lean principles in a Statsbygg project (Kunsthøyskolen i Bergen). The project manager is convinced of the usefulness of lean and is applying some of its tools and methods on the management of design and construction. Based on the experiences in this project (which, by the way, has got a lot of prices and awards for its innovative process approach), lean is now implemented in other Statsbygg projects (a shift from bottom-up to top-down).

5.4 Incubators

Incubators are collaborative "local" platforms or R&D projects where for instance research and industry partners join to find new solutions to identified problems (theoretically and/or practically). Such incubators are often closely linked to one single/some few companies' interests and business goals. They are temporary and involving a "closed" consortium of partners. Such projects can be important "low-threshold" incubators of change and improvement in the businesses involved. The strength of the incubators is that they are thematically focused arenas. It might be easier to commit and recruit partners to such initiatives than to permanent, thematically open "top-down" initiatives. Incubators might however have limited impact beyond the consortium and the life-time of the project. It is a risk that such projects can become separate silos of knowledge-development.

The innovation projects in Table 1 are examples of incubators. It is interesting to observe that most of these projects have very broad scopes, each of them aiming to address an array of the industry challenges.

5.5 The ecosystem of change drivers

How do these main groups of drivers and measures of change interact with each other? They are for instance characterized by various degrees of being planned or random, and long-termed or short-termed perspectives (Figure 2).

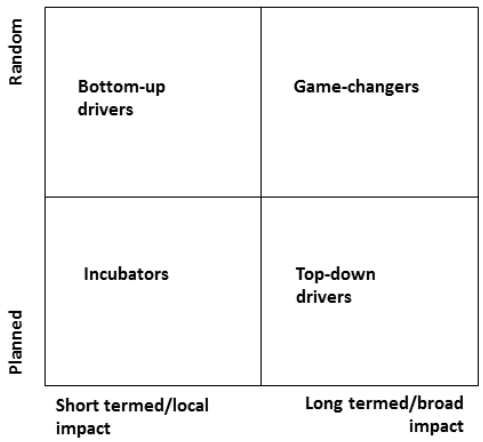

Figure 2: The conceptual framework

The interface between the "boxes" in Figure 2 is dynamic. Initiatives can initially be bottom-up driven, before they become an incubator, and/or integrated in a top-down strategy. Game-changers can inspire bottom-up or top-down initiatives. Incubators and bottom-up initiatives might catalyze new game-changers. The four groups of drivers impact on each-other. They work/play together in an eco-system, where the strengths lie in their additive impact, not in each single box. Game-changers without incubators or top-down/bottom-up initiatives would lack their instruments of implementation. Without game-changers, top-down or bottom-up initiatives would lack an important motivation. Incubators only would lead to a fragmented and unsystematic knowledge development. Top-down initiatives only might become conserving and not well rooted in real-life practice. Bottom-up initiatives only would lead to random and local change, without long-termed perspectives and goals.

The described initiatives did not emerge chronologically or develop step-by-step. They are rooted in a multi-level awareness-wave of the need to improve and change. There has also previously been carried out ambitious initiatives in Norway with the aim to improve processes. They mobilized a lot of partners and kicked-off many projects. Still, they did not have the impact hoped for after they were completed. Perhaps the Norwegian AEC-industry now, 10-15 years later, have reached the maturity, which is needed to improve how we organize and execute building projects.

6. Conclusions

The review in this paper indicates that there is a focus shift in the Norwegian AEC-industry and its process-related R&D:

- There is a growing awareness on all levels that process-improvement is needed in order to secure quality, productivity and competitiveness.
- More focus on life-cycle perspectives, the interfaces between people and process stages, and the need for interdisciplinary and holistic approaches.
- “Outside the box” thinking is increasingly called for. It is a paradox that many attempts of solving the problems are based on the same thinking that originally created them, and that an obvious solution to a problem within one area create new problems in other areas.
- There has been a shift from technology focus to people/culture focus (from "hard" to "soft" and qualitative/hard-to-measure issues).
- More focus on systematic and continuous learning and on the usefulness of looking to other countries and traditions (e.g. several Norwegian contractors have been hiring high-profiled Stanford researchers for implementing VDC).
- Process-Innovation is increasingly recognized and appreciated in the AEC-industry. In 2015 the AEC innovation price was awarded to a contractor for their effort on lean-based process-improvement.

The increasing complexity and the rapid development on all levels call for a more systematic, interdisciplinary, continuous and holistic competence and knowledge building. This greatly

challenges the actors involved, due to capacity, openness, to balancing short- and long-termed goals and activities. Successful change and adjustment requires the ability to take risks, to prioritize, to understand possibilities, to understand what is possible to control and what should not be controlled, to adjust and modify. To bring good intentions and ambitions into action and effect will probably remain a challenging act.

This conceptual paper has presented a review of the current situation in the Norwegian AEC-industry, and suggested a holistic framework for better understanding the interdependencies between various drivers and measures of change. The next step for developing the framework would be to move towards theorizing and selecting relevant theoretical perspectives for understanding the phenomenon. The review indicate however that R&D initiatives, when working together in a balanced ecosystem, might guide the Norwegian AEC-industry towards new shores. On this voyage, a final reminder is appropriate: Change for a reason and not for the sake of change alone.

References

Bygg21 (2014). "Sammen bygger vi fremtiden. En strategi for en konkurransedyktig bygg- og eiendomsnæring." Strategy-document (http://visning.gjerholm.no/i/402613-bygg21-strategirapport)

Darrington, J., Dunne, D. & Lichtig, W. (2010). Organization, Operating System and Commercial Terms. Mclean Va: CMAA.

Egan, J.S. (1998) *Rethinking construction*, Department of the Environment, Transport and the Regions, London.

Espelien, A., Theie, M.G. og Bygballe. L. (2015). *En verdiskapende BAE-næring.* Forskningsrapport nr 1 - 2015. Handelshøyskolen BI.

Gibbons M., Limoges C., Nowotny H., Schwartzman S., Scott P. and Trow M. (1994). *The new production of knowledge. The dynamics of science and research in contemporary societies.* Sage Publication, London. Pp. 1-45.

Moum, A. (2008). *Exploring relations between the architectural design process and ICT – Learning from practitioners' stories.* Doctoral theses at NTNU, 2008:217.

Owen R, Amor R, Palmer M, Dickinson J, Tatum C B, Kazi A S, Prins M, Kiviniemi A and East B (2010) "Challenges for integrated design and delivery solutions." *Architectural Engineering and Design Management* 6:232-240.

Ministry of Local Government and Regional Development, 2012. *"Good buildings for a better society"*. White paper St. 28 (2011-2012) Report to the Storting,.

Schön, D.A (1991). *The reflective practitioner – how professionals think in action.* Ashgate, Aldershot.