Radical programmes for developing the EU residential building sectors as exemplified by Finland and the Netherlands

Radical Programmes for Developing the EU Residential Building Sector

Mieke Oostra,
Hanze University of Applied Sciences & Saxion University of Applied Sciences
(email: m.a.r.oostra@saxion.nl)
Pekka Huovinen,
Tampere University of Technology
(email: pekka.huovinen@tut.fi)

Abstract

The economic recession has hit especially hard the residential building sector in the EU region, e.g., the number of the housing completions has decreased -49% and the total residential output has been squeezed down by -24% between 2007 and 2014 (Euroconstruct, 2015). In turn, the aim of our paper is to suggest a set of radical, novel programmes for developing the national residential building sectors within EU member countries up to 2025. We have applied the framework of strategic niche management (SNM) to the diagnoses of the current portfolios of the innovation, R&D programs in our two member country contexts. In the case of the Northern Finland, the prime example is Hiukkavaara, the largest district to be built in the City of Oulu. Homes will be constructed for 20,000 new residents. Hiukkavaara is a model for climate-conscious design in the northern hemisphere. Energy and materials are conserved, nature is valued and human beings adapt to their environment. One sub-programme involves Future Buildings and Renewable Energy Project. In the case of the Netherlands, the prime example is Energiesprong (Energy Leap), i.e., the innovation programme commissioned by the Dutch Ministry of the Interior. The aim is to make buildings energy-neutral and boost large-scale initiatives. The sub-programmes are targeting homes owned by housing associations, privately owned homes, office buildings, shops and care institutions. This programme is about ensuring new supply by encouraging companies to package a variety of technical sub-solutions, full services and financing options as well as about asking clients to put out tenders and ask for quotes in novel ways, with the government making changes to the rules and the regulations. Experiences on which the Dutch case in this paper focuses are sub-programmes for residential buildings which includes Rapids, All Lights on Green and Our Home Deserves It. Based on the emerging Finnish and Dutch evidence, we are suggesting key elements to be incorporated into future national residential programmes within EU member countries on: (1) radical direction with balanced stakeholder groups, trustworthy advocates, contextual goal-setting and barriers management, (2) radical networking with entrepreneurial roles and causal links, novel expertise, transparent choices and digital platforms and (3) radical learning processes to arrive at better informed markets on user preferences, co-innovating, new rules and regulations, higher performance/price ratios, higher quality, new roles and responsibilities assignments.

Keywords: Hiukkavaara, Energiesprong, innovation programme, residential building sector

1. Introduction

The economic recession within the EU member countries has had its negative consequences vis-à-vis the real estate and construction sector. Especially, the residential building sector has been hit hard, e.g., the number of the housing completions has decreased -49% and the total residential output has been squeezed by -24% between 2007 and 2014 (Euroconstruct, 2015). Therefore a new innovation impulse is needed. The aim of our paper is to suggest a set of radical, novel programmes for developing the national residential building sectors within the EU.

The concept 'system of innovation' is widely accepted as a unit for studying innovations. Its operating level varies. For industries like construction, the national level is the most appropriate level (Lundvall, 1999). Research is not the only source of industrial innovation, i.e., other sources include knowledge flows, co-operation and technology diffusion (OECD, 1998). Moreover, common culture, legal framework, education, customer preference, institutions and other variables impact innovation. For industries like construction the latter may be more significant than research. Manseau and Saeden (2001) have shown that some countries have established technology and best-practice diffusion networks in construction.

In turn, the aim of our paper is to suggest a set of radical, innovative programmes for developing the national residential building sectors within EU member countries up to 2025. We have adapted the 3-area framework of strategic niche management (SNM) to diagnose national programmes (Section 2). We have selected a case programme within Finland (Section 3) and another within the Netherlands (Section 4) to exemplify and diagnose some radical solutions and features readily being adopted, such as participative district planning and the co-alignment of wilderness and residents. Finally, we put forth the key suggestions (Section 5).

2. Programme diagnosis method and data

2.1 Theoretical diagnosis framework

For innovation at the level of (a part of) an industry, generally the term transition is used. Socio-technical transitions have emerged from evolutionary economics (Nelson & Winter, 1977; Dosi, 1982). From the studies of former major societal changes, the insights have emerged about experimentation, multi stakeholder learning, coevolution of technologies, organisational forms, rules, regulations and financial systems. This has resulted in the theories of Strategic Niche Management (SNM) and Multi Level Perspective (MLP) (Geels & Kemp, 2007; Loorbach & Rotmans, 2006) that can be used to evaluate innovations. Innovations start in niches, but their further development is highly dependent on developments at different societal levels. SNM describes the role of emerging innovative niches in becoming mainstream in combined social and technological systems. This innovation management perspective focuses on the formation of niches in which innovations can flourish. SNM describes the transition by reporting on the three processes which enable for a successful technological niche (Kemp et al., 1998):

- The articulation of expectations and visions. Such articulation would provide a direction to the learning process of parties involved and help to attract attention from necessary stakeholders and legitimate involvement and support.
- Construction of social networks. The interaction of stakeholders is needed to collect resources (time, expertise and money) and commitment required.
- Learning on multiple aspects. Such aspects include technical aspects and design specifications, market and user preferences, cultural and symbolic meaning, infrastructure and maintenance networks, industry and production networks, regulations and governmental policies as well as societal and environmental effects.

In turn, MLP uses the following indicators for reviewing the stabilization of niche-innovations that are ready to break through: (a) learning processes have stabilized in a dominant design, (b) powerful actors have joined a network, (c) price/performance relations have been improved and there are strong expectations of further improvement and (d) the innovation is used in niche markets, which amount to a market share of more than 5% (Grin et al., 2010).

For the context of this paper, we have merged the three processes distinguished by Kemp et al. (1998) and the list of the sub-topics with the indicators specified by Grin et al. (2010) into a diagnosis framework containing (1) clear direction, (2) network formation and (3) learning on the six aspects, i.e., (a) market and user preferences, (b) product and process innovations, (c) new rules and regulations, (d) price and performance improvements, (e) architecture, environment and quality improvements as well as (f) roles and responsibilities.

2.2 Prior empirical studies enabling the diagnosis

The diagnosis of the Finnish innovation programme, Hiukkavaara district in the City of Oulu, is based on the review of references published in English and Finnish, available via the website.

The diagnosis of the Dutch innovation programme is in part based on the case study research on the two of the 4 sub-programmes and the annual report of Energy Leap (Energiesprong, 2015). For the study of the Rapids sub-programme different pilot projects were visited in Heerhugowaard (7 April 2015), Nieuw Buinen and Emmen (both on 24 April 2015) and Soesterberg (3 June 2014). More direct information came from the meetings with Energy Leap and Rapids and conversations. The additional information was accessed via the websites of the partners of the programme. The detailed results have been reported via Oostra (2015a-b). In turn, the study of the LALOG sub-programme is based on the experience of Oostra as a member of the board of #ENEXAP between November 2013 and April 2015. Various projects were undertaken to facilitate owner-occupants to make their desires and needs explicit, to analyse the situation in their houses and to gather the information necessary for the inclusion of professionals, the formation of consortia, to provide training to make them fit for the job, etc. Data was gathered via action research, board meetings, occupant meetings, meetings with Energy Leap, study meetings with companies, meetings with other LALOG initiatives and conversations with people involved. The key results have been reported via Oostra (2015b) and Oostra & Been (2016).

3. Finnish case programme diagnosis

3.1 Hiukkavaara District as the case programme

The City of Oulu boasts to be “the Capital of the Northern Scandinavia”. The prime example is the Hiukkavaara, the largest district to be built. The development started in 2008. Homes for 20,000 new residents will be constructed around the old barracks area. The housing plan includes 10 000 homes, i.e., 3 200 apartments, 3 300 terraced houses, 2 000 semi-detached houses and 1 500 single-family houses (City of Oulu, 2015). 1,800 workplaces are being facilitated. In addition, the nearby Hiukkavaara Centre will serve 40,000 Oulu residents. Hiukkavaara is a model for climate-conscious design in the northern hemisphere. The Head of Urban Developments assures that energy and materials are conserved, nature is valued and human beings will adapt to their environment (City of Oulu, 2015). Best practices for developing construction and zero-energy buildings are being identified, assessed and implemented. The construction started in 2013. The first buildings were ready in Summer 2014. The building physical modeling started in the end of 2014. About 80% of the target area will be under construction by Winter 2015. The piloting culture in the City of Oulu is being continued via this project (Seppälä & Mikkonen, 2015).

3.2 Results of the diagnosis of Hiukkavaara district

(1) FINNISH CLEAR DIRECTION. The City of Oulu has defined the 14 guidelines for the development of Hiukkavaara Disctrict, i.e., to take into account (i) the nature and landscape values, (ii) a densely-built neighbourhood of urban houses in a versatile environment, (iii) dense 7-zone residential areas bordering on large green areas, (iv) comprehensive services, (v) cycling, walking and public transportation, (vi) facilities and areas for sports, recreation and outdoor activities, (vii) an integrated storm water system, (viii) alternatives and impact assessments, (ix) participatory planning, (x) cost efficiency, (xi) development projects on Living Lab platform, (xii) energy efficiency, (xiii) city farming and (xiv) art in urban space (Kallioniemi, 2012). During 2008-2015, a series of the pilot projects have concerned calculating life-span efficiency in city building (KERVO; Vainio et al., 2012), integrating urban development concept, partnering for an arctic, smart and sustainable city (INURDECO), consulting builders in choosing concepts for renewable energy efficiency solutions (RESCA), innovating public procurement with life-span and R&D, arranging the Living Lab and services, researching winter city, stimulating the creative sector in the former military barracks area, engineering ICT solutions for traffic, safety and lighting, designing home information systems, and piloting Smart City ICT platform and service center, RadioCity 2020 (Kallioniemi, 2012).

In turn, the goal of the Future Buildings and Renewable Energy Sub-Project is to create common operating models to builders and to exchange and implement the best renewable energy and energy efficiency practices generated during the pilot project. The sub-goals of the joint project are (i) to intensify the development of renewable energy technologies, (ii) to promote the spreading of successful solutions to other cities throughout Finland and (iii) to develop them into business models (Seppälä & Mikkonen, 2015).

(2) FINNISH NETWORK FORMATION. Companies and educational institutions co-develop products and jointly execute research. User experience and information about the operability of new solutions is being collected via Living Lab. A 3-circle network is being established. The inner circle involves the 12 pilot site builders and each of them is collaborating with design offices, material suppliers, etc. The builders have been selected based on their proposals to meet one of the three energy efficiency levels. In Group 1, each project including nearly zero energy solution or E-Number < 35 can freely choose a lot. In Group 2, each project where heat loss and E-Number are at maximum 60% of the minimum level defined in the norms can select the best possible lot after Group 1. In Group 3, each project where heat loss and E-Number are equal or less than 70% of the minimum level defined in the norms can get a lot, if it is not selected earlier. The middle circle consists of Building control of the City of Oulu and Business Oulu's seminars/educational events having around 80 enterprises and nearly 1000 participants. The broader circle with the E-mail list has over 250 contacts (Seppälä & Mikkonen, 2015).

(3a) FINNISH LEARNING ON MARKET AND USER PREFERENCES. City of Oulu is developing its user-oriented Hiukkavaara as follows. It listens to its residents and companies, has conversations with them and serves them. This "low-threshold" city gives its residents space to express themselves and creates opportunities to exercise recreational activities and enjoy the nature. Apartments, buildings, blocks, yards, streets and parks are all designed for human-scale life. Residents can walk, cycle and ski. Nature starts at the front door, yet shops and cultural events are within walking distance. Dwellings are accommodating specific client groups: young, middle-aged and older residents. Future residents can choose their own ways of life. Urban gardening allows for home-grown vegetables and herbs. Services include schools, day-care centres, youth centres, a residential community centre, health services, commercial services, a swimming pool, an ice stadium, a sports hall, sports fields, a fitness centre, Aalikkokangas Sports Centre and 250 kilometers of cross-country ski tracks. Old Hiukkavaara is a meeting point for actions and ideas. The culture life has discovered the renovated old barracks. Crazy ideas have resulted in successful companies. Work, activities and new business ideas are based on creative energy. Hiukkavaara is already one of the biggest centres of the creative sector in the Northern Finland. There are some 250 rehearsing bands. Artists, photographers, graphic designers and sheet-metal workers are merging with the new growth platforms. All this is being blended with the ICT expertise of the city (City of Oulu, 2015). Officials and experts are giving occupants advice on the usage and maintenance of buildings (Seppälä & Mikkonen, 2015).

(3b) FINNISH LEARNING ON PRODUCT AND PROCESS INNOVATIONS. Hiukkavaara district offers premises for R&D, testing and launching to tackle critical issues like "How can a home become energy efficient?", "How are renewable energy sources utilised?" and "What kind of new services are needed in the future?" Companies developing services can get inspiration by observing the behaviour of locals. The performance of energy production and consumption, building automation systems and building physics are being measured and analysed. The challenges are related to the levels of energy design, moisture management as well as automation and control systems. For example, Saikotek Oy has installed the building-physical measurements in its pilot building. University of Oulu is modelling the building-physical operation of structures by utilising data from these measurements. In Sonell Oy's building, heat is produced by a ground-

source heat pump and distributed to room air by a radiant floor heating system. About 30 m2 of the solar collectors are on the roof of a shared technical room. A home automation system is controlling heating, ventilation and safety systems (Seppälä & Mikkonen, 2015). Besides, Hiukkavaara has an international digital service home where ICT companies take part in developing services to support living and recreational activities. Living Lab is packed with the development themes of a sustainable city, i.e., energy efficient dwellings, intelligent electric networks, block models of a winter city, alternative and regenerative forms of energy, ecological water system, centralised waste management, functional public transportation, safe wintertime cycling and related ICT services (City of Oulu, 2015).

(3c) FINNISH LEARNING ON NEW RULES AND REGULATIONS. Subarctic and arctic areas like Hiukkavaara district require special technologies and skills to build climate friendly, energy efficient and user oriented winter cities with innovative services and logistics processes. For example, the Ecocity Evaluator software is used to assess the energy consumption of the community development, the carbon dioxide emissions and the costs based on the master and city plans. The software enables the assessment of the emissions of both production and consumption. The assessment takes into account buildings, traffic, energy production, industry, agriculture and carbon sinks. Comparisons with other Nordic cities are also being relied upon (Kallioniemi, 2012).

(3d) FINNISH LEARNING ON PRICE AND PERFORMANCE IMPROVEMENTS. The initial present value of the life-cycle costs for Hiukkavaara district as a whole is about EUR 3,4 billion. Thereof, the majority share of the residential buildings is EUR 3,0 billion (87%), the share of the community services is EUR 165 million (5%) and the share of the infrastructures is EUR 280 million (8%). Both the present value method and the annuity method have been relied upon. The calculations are based on the 50-year life-cycle and the 3% interest rate. All the costs are reported as those of the first quarter of the year 2012 without VAT. Concerning each of the three sectors, the five sub-cost categories include lot prices, construction, maintenance, operations and demolition. When the district plan accommodates 20 000 residents, the average life-cycle costs per resident is about 170 000 euros (Vainio et al., 2012).

(3e) FINNISH LEARNING ON ARCHITECTURE, ENVIRONMENT AND QUALITY IMPROVEMENTS. Hiukkavaara acts as the centre of city life in all four seasons, also as a big recreational area. The land area is 1,500 hectares. The architecture of a snowy city, the sunshine of a crisp winter day and the joys of winter time sports provide new opportunities for district design. For example, the same designated areas are used in the winter for storing snow and in the summer for playing floorball and basketball. Different routings are provided: if weather is good, people can enjoy fresh air, but if it is bad, they can choose a covered route protecting from rain. Streets and parks create opportunities for walking a dog or doing some parkour. Special attention is being paid to make nature and wilderness an integral part of the design, connecting nearby beaches along riverbanks and lakeside, heathlands, boulder fields and marshes with paths and duckboards. Arctic wilderness involves forest animals, snowmobiles and hounds. Ideally, “recreational areas are within walking or cross-country skiing distance. Seasonally changing light and nature are part of city life. The district is designed to be the model city for sustainable

community planning. Houses, streets, districts and landscapes create a rich and diverse cityscape. Houses come in different shapes and sizes, even on top of each other. Various lifestyles are visible in its architecture. Urban gardening is visible in gardens and on rooftops." (City of Oulu, 2015).

(3f) FINNISH LEARNING ON ROLES AND RESPONSIBILITIES. The adoption of the viewpoint of sustainable development in construction creates new and expands existing business opportunities during all phases within building processes. In addition to life-cycle projects suitable for large companies with risk-bearing capacity or novel networks, sustainable construction offers opportunities also for small, local companies. In the design of one- and two-family house dominated residential areas, value chains from general design to finished residential areas take many years. Designers and contractors alike are being advised to retain possibilities to make future changes instead of meeting exact needs among particular clients. Value chains are developing solutions for changing operating environments and uses of buildings (Vainio et al., 2012).

4. Dutch case programme diagnosis

4.1 Energy Leap as the case programme

The Dutch innovation programme described herein is Energy Leap (Energiesprong, 2015), commissioned by the Dutch Ministry of the Interior. The extended programme ran between 2010 and 2015. The aim was to make buildings energy-neutral and boost large-scale initiatives targeting dwellings, office buildings, shops and care institutions. The four most ambitious sub-programmes targeted at dwellings, i.e., (i) All Lights on Green (LALOG Lokaal Alle Lichten Op Groen) with owner-occupants was seeking to make homes energy-neutral, (ii) Rapids Rental (Stroomversnelling huur) was set to renovate rental houses to the level of nearly zero energy buildings and to overcome the financial problems and the restricted resources that the housing associations were dealing with, (iii) Rapids Purchase (Stroomversnelling koop) focused on the market for owner-occupants and (iv) Our Home Deserves It (Ons huis verdient het) campaign was launched to show to banks and companies that owner-occupants are interested in converting their homes to net zero homes and the TV show highlighted the results of Rapids Purchase. When the national funding of Energy Leap came to an end in December 2015, the arrangements have been put in place to continue the funding via the partners already involved. In many regions, e.g., Utrecht, Brabant and Overijssel/Gelderland, plans have been made to set up regional agreements with dedicated (new) partners to retrofit substantial amounts of dwellings.

4.2 Results of the diagnosis of the four sub-programmes and the pilot projects

(1) DUTCH CLEAR DIRECTION. LALOG provided support to the groups of owners in Apeldoorn, Wageningen, Den Bosch, Hoorn, Amsterdam and Amersfoort. The objective was to bring at least 20 homes in each municipality to energy-neutral via the process of learning by doing by residents, builders, municipal officers, contractors, brokers, appraisers and bankers. In turn, the goal of Rapids Rental was set to deeply retrofit and convert the 111.000 rental houses owned

by the associations before 2020 to the level of zero-to-the-meter (on a yearly basis), block by block, within two weeks, for 45k/dwelling and satisfied occupants. This clear goal has become the joint ambition of an entire network. Rapids Rental was considered to be the best example by the Building Performance Institute Europe (Staniaszek, 2014). Rapids Purchase was aiming at similar goals for individual privately owned dwellings.

(2) DUTCH NETWORK FORMATION. Considerable efforts have been made in the building of all sorts of networks to come up with technical and social innovations that are needed for large scale retrofitting of dwellings without additional subsidies. This provided a solid base to further integrate necessary solutions and make operations more cost efficient. At the beginning, ad hoc coalitions were created for zero-to-the-meter retrofitting, project-by-project, in design competitions. The next step was to create coalitions in municipalities, in which demand would be clustered for local builders (LALOG). However, it turned out the incentive for proper innovation was still not enough. Next step in Rapids Rental was to make deals including the supply chains and housing associations for a series of projects and, thus, fostering a situation in which innovations could emerge across projects. Supporting parties like e.g. brokers, municipalities and financial experts have also been linked to the network. This finally got the innovation process going.

(3a) DUTCH LEARNING ON MARKET AND USER PREFERENCES. The Energy Leap programme provided the opportunity to cluster the preferences of housing associations, tenants and private house owners in different municipalities and contexts. The people executing the Energy Leap programme took the time and effort to reflect on this in several settings. This made it possible for them to draw conclusions on what was necessary to develop a highly industrialized approach for the retrofitting of mass-produced housing from the fifties, sixties and seventies. Also attention was given to the preferences of tenants in order to develop approaches to win them over.

(3b) DUTCH LEARNING ON PRODUCT AND PROCESS INNOVATIONS. In Rapids Rental, the idea was that retrofitting methods can be improved and gradually scaled up to industrial production levels by employing integrated prefabricated building components and deals that included the perspective on a series of projects, to convince the construction sector to make the necessary investments. Process changes were also needed to speed up execution, as well as to improve quality and customer satisfaction. (see for more information: Oostra, 2015b) Originally, the knowledge and the experiences gained by each team related to a specific retrofit project, supply chain or client. In Rapids valuable insights were disseminated via planned sessions with all programme participants and focused meetings with e.g. the housing associations only. The contractors, i.e., Volker Wessels, Dura Vermeer, Ballast Nedam and BAM developed and integrated technical solutions and social innovations to meet the high ambitions set for tenant satisfaction, price levels and house performance levels. Now a new, rather large market is opening up for zero-on-the-meter retrofitting, interactions are set up with the big building product suppliers like BASF and Mitsubishi to realise new products for this market and thereby making concepts even more cost effective and of higher quality (e.g., Gent and Lippens, 2015). Major innovative steps have been made including: new facade components & service components as an integral part of new specific retrofit concepts and the use of BIM, lean and 3D scanning to speed

up the preparation and execution processes. All this is fundamentally different from traditional contracting where the room left for project-specific innovations and risk taking is rather restricted.

(3c) DUTCH LEARNING ON NEW RULES AND REGULATIONS. During Rapids Rental, many adjustments to legislation and regulations were deemed necessary. It turned out crucial to make it legal for social housing associations to use the money tenants pay for energy as a source to fund the retrofit. The problem was that for many houses the rent would go up over the allowance-limit for many houses, if the rent would also include the envisioned energy performance fee. Amendments were also needed in the areas of licensing, energy labelling and exemptions. Exemptions were deemed necessary since related procedures often take half a year. Such delays are costly for stakeholders. Environmental assessments can be speeded up because all the Rapids retrofitting concepts are obliged to meet the requirements set out in the rules for zoning, the Building Act and the Flora and Fauna Act.

(3d) DUTCH LEARNING ON PRICE AND PERFORMANCE IMPROVEMENTS. The first three retrofitting projects of Energy Leap were commissioned in the form of a competition. In the De Kroeven project in Roosendaal in 2010, 244 family homes were renovated by the designs of the two architectural firms, at just over 130,000 euros per home. This reduced energy consumption for heating from 200-150 kWh/m2 to 30-20 kWh/m2. In Kerkrade, 153 homes were renovated in 10 days each at an average of 100,000 euros per home. The homes were fitted with the new façades and roofing, solar panels, high-efficiency combi boilers and mechanical heat recovery ventilation. Monthly, this saved 101 euros, but the tenants saw their charges reduced by just 37 euros a month because of a 64 euro rent increase. In Apeldoorn in 2013, 188 homes should have been renovated in Het Schilderskwartier dating from 1951, at an average cost of 80,000 euros. However, none of the consortia met the financial requirements. In the end, only one plan could match the housing association's requirements by providing for the establishment of an energy company called Energy BV. Since the residents did no longer have a say in the matter, their resistance grew and only 60% of the residents approved the plans, well short of the 70% required by law. This is why the plan for this third project has not been executed. Instead, the housing association opted for a regular B label renovation and continued the energy-neutral experiment on a smaller scale (Oostra, 2013). With the more systemic innovation started with Rapids Rental, the costs of a zero-to-the-meter retrofit for standard row houses dropped to 60k. Plans are in place with the housing associations involved to retrofit a substantial part of their portfolio. Although only about 500 dwellings have been retrofitted by 2015 (van de Groep, 2015), the plan is still to retrofit in total 110 000 houses before 2020. In order to attain such high numbers, it is necessary that the government approves the new regulations concerning the energy performance fee. During the 4-year programme, a considerable improvement of quality (architectural concepts, integrated technical solutions and performance) has been realised in combination with a price drop of more then 50% (Oostra 2015b).

(3e) DUTCH LEARNING ON ARCHITECTURE, ENVIRONMENT AND QUALITY IMPROVEMENTS. An important requirement for housing associations is that these concepts improve the architectural quality of the existing dwellings. Dutch housing associations have noticeably attention to maintain or rather improve the architectural qualities of both the dwellings,

as well as the neighbourhood in which these dwellings are located. In New Buinen e.g., the neighbourhood as a whole will be restructured, by swopping public and private side of the houses and by re-introducing a canal, a typical landscape element for these peat areas. Quality improvement was an aim, but of course there were also teething problems in projects part of Rapids. In Heerhugowaard for example, delamination occurred of the facade finishing (Oostra, 2012b).

(3f) DUTCH LEARNING ON ROLES AND RESPONSIBILITIES. The Energy Leap programme has proved that real progress can be made within four years towards a cost-effective, quick, up-scalable and occupant friendly retrofitting approach. These developments forced professionals in private companies and public bodies alike to rethink their roles and the ways to do business. Thus, discussions were, and are still, being held within many consortia to (re-)organize themselves in order to deliver retrofits with ease, performance and cost efficiency. Builders are intensifying and extending the integration of supply chains to deliver suitable solutions. In the same vein, this implies that companies are focusing on the tasks they themselves are good at and able to invest in. Entire supply chains need to become more client-focused. In the case of #ENEXAP, a lot was asked from the professionals involved. The occupants were eager to keep modifications already made to their homes, including the measurements for saving energy and generating durable energy mainly via solar panels. They also asked for additional changes to their home, which made matters for consortia even more complex to handle (Oostra 2015a).

5. Discussion and conclusions

The decisive impacts of the housing sectors on the development of the EU countries, economies, socio-political constellations, technologies and environmental footprints are widely recognized, not forgetting the mutual dependencies between all these spheres, regionally and country by country. In reality, severe barriers are still being met across the EU member countries, such as highly uncertain housing demand, prolonged project development times, late-arriving local public services, still-missing infrastructure, obvious needs for change in involved organisations and supply chains, changing preferences within wider social and institutional context, etc. Thus, we are herein arguing that, for many national stakeholders, it is far from clear how the transition of the EU housing sectors could be directed towards the socio-politically balanced, economically integrated, technologically advanced and high-sustainability sectors we would like them to be, let alone what key roles and tasks stakeholders should become engaged in. This uncertainty triggered us to write this joint paper and explore what kinds of radical elements could be implanted into national residential development programmes within the EU region. For this purpose, we have diagnosed the prime Finnish and Dutch experimental programmes in the previous sections. Relying on the 3-area diagnosis framework introduced in section 2.1, we would like to put forth a set of the suggestions for making radical progress as follows.

For ensuring (1) clearly and radically directed residential programmes, we suggest that key public decision making bodies, at a governmental, regional and/or city/municipality level, or an organisation that is appointed to represent one of these, define clear goals with support from some key stakeholders, daring to be frontrunners. These goals are set (1a) to improve outcomes on each

of the socio-political, economic, institutional, technological and environmental contexts, (1b) to unite stakeholders in terms of balancing their aims and benefits, (1c) to stimulate the sector to include other (only value adding) stakeholder groups in order to be able to reach goals and overcome barriers to be met, and (1d) not to be afraid of asking for radical innovations on key dimensions, such as living quality, space, technical performance, public and private services, mobility, costs, etc. The attainment of ambitious goals and the realization of wide action plans both start with small-scale pilot projects and alike in order to allow for the evaluation and re-setting of goals before programmes are actually started and desired innovations are becoming up-scaled. The Finnish and Dutch experience with the pilots and programmes have proven that such an approach is realistic.

For forming (2) radical networks, we suggest that a range of alternative networks be classified in terms of (2a) developing new key entrepreneurial roles that stakeholders can assume, (2b) initiating multi-dimensional, causal links between different stakeholder/party roles, (2c) leaving room to introduce novel expertise and insightful stakeholders to deal with missing expertise, to advocate, facilitate, enable and moderate during every phase of the (sub-)programme, (2d) evolving memberships through the phases of the programme and beyond, (2e) making key decisions, activities and tasks included in each network class transparent for all to criticise, while not hampering the creativity necessary for innovation and (2f) innovating all kinds of institutional, digital and physical supportive systems and tools that parties can rely upon. A programme directorate then compares gains and losses by each network class, chooses the most radically viable ones and plans networking sub-programmes accordingly directed at upscaling.

For enhancing (3) radical learning, we suggest that a range of alternative ways of learning, exploiting existing knowledge and creating new solutions, be selected and planned by learning areas, to arrive at: (3a) a flexible, highly sustainable market and better knowledge of user preferences in relation to changing demographics, public, private and third sectors, built environment, nature, etc., (3b) product and process innovations, incremental/disruptive, solo/co-innovated, co-funded, given/openly competed, scaled up/down, etc., (3c) new rules and regulations to mend hampering or missing legislation, on city/country/EU levels, by areas and units, etc., (3d) affordable prices, performance improvements and guarantees for stakeholder groups and participant roles, home/apartment/house types, public and private buildings, infrastructure, etc., (3e) improvement of architectural quality, environmental quality and building quality to enhance the realisation of appealing cities, attractive country-sides, meaningful places, true well-being, environmental sustainability, personalised living, inclusive society, regional prosperity, etc. and (3f) commitment from stakeholders to take on new roles and responsibilities designated to realise the goals set and provide performance warranties. The members of the programme compare the alternative routes, choose the most effective ones and integrate them accordingly in designated sub-programmes to start the next learning cycle.

References

City of Oulu (2015) *Hiukkavaara – sustainable arctic winter city*. Brochure. City of Oulu.

Dosi G (1982) "Technological Paradigms and Technological Trajectories." *Research Policy* **11**: 147-162.

Energy Leap (2015) *Evaluatierapport 2014*.

Euroconstruct (2015) *Statistics presented at the 79th Warsaw Euroconstruct Conference*. 12 June 2015.

Geels F W (2002) "Technological Transitions as Evolutionary Reconfiguration Processes: A Multilevel Perspective and a Case-Study." *Research Policy* **31**(8/9): 1257-1274.

Gent van P and Lippens A (2015) *Turn to value.* Speech by BASF and Rapids programme at Building Holland. (available online http://www.youtube.com/watch?v=lAbkHMyxWCA [accessed 11/5/2015])

Grin J, Rotmans J and Schot J (with Geels F, Loorbach D and Routledge D) (2010) *Transitions to Sustainable Development. New Directions in the Study of Long Term Transformative Change*.

Groep J W van de (2015) *Apeldoorn woningmarktdebat, presentation market debate Apeldoorn*, 16 Nov 2015, Apeldoorn, the Netherlands.

Kallioniemi L (2012) *Hiukkavaara. A northern winter city – a human-sized, sustainable forerunner*. Speech given at Climate Congress, 8 June 2012.

Kemp R, Schot J and Hoogma R (1998) "Regime Shifts to Sustainability through Processes of Niche Formation: The Approach of Strategic Niche Management." *Technology Analysis & Strategic Management* **10**(2): 175-195.

Manseau A. and Saeden G, Eds (2001) *Innovation in Construction: An International Review of Public Policies*. Spon Press.

Nelson R R and Sidney G W (1977) "In Search of Useful Theory of Innovation." *Research Policy* **6**: 36-76.

Lokaal alle lichten op groen (2012) Apeldoorn: Positief verleiden, (available online webpage [accessed 29/6/2015.])

Loorbach D and Rotmans J (2006) "Managing Transitions for Sustainable Development", In Olsthoorn X and Wieczorek A J, Eds, *Understanding Industrial Transformation* (pp. 187-2016). Dordrecht: Springer.

Lundvall B-Å (1999) "National Business Systems and National Innovation Systems." *International Studies of Management and Organization,* Summer.

OECD (1998) *Science, Technology and Industry Outlook-Construction*. Paris.

Oostra M (2015a) "De-Burden or Co-Design & Co-Create?", *Proceedings of CIB W104 The Future of Open Building Conference,* 9-11 September 2015, ETH, Zurich, Switzerland.

Oostra M (2015b) "Toward User-Oriented Plug & Play Facades: Upgrading the Energy Performance of Row Houses", *Proceedings of 10th Conf. on Advanced Building Skins*, 4-5 Nov 2015, Bern, Switzerland.

Oostra M and Been L (2016) "An Energy Expedition: Experiences of a Dutch Collective of House Owners Aiming for Energy Neutrality", *Proceedings of the CIB World 2016 Building Conference,* 30 May – 3 June 2016, CIB, RIL and TUT, Tampere, Finland, forthcoming

Seppälä P and Mikkonen L (2015) *Future buildings and renewable energy OULU – Update*, 19 November 2015. City of Oulu Building Control and the Finnish Funding Agency for Innovation. 32 p.

Vainio T, Nissinen K, Möttönen V, Vainio S, Herrala M and Haapasalo H (2012) *Kestävän yhdyskunnan rakentaminen.* VTT Technology Report 40. Espoo.