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Original research article

Client-oriented evaluation of ‘creative destruction’ in policy mixes: Finnish policies on building energy efficiency transition

Paula Kivimaa^{a,b,*}, Hanna-Liisa Kangas^b, David Lazarevic^{b,c}^a Science Policy Research Unit SPRU, University of Sussex, Jubilee Building, Falmer, Brighton BN1 9SL, UK^b Finnish Environment Institute, P.O. Box 140, 00260 Helsinki, Finland^c Division of Industrial Ecology, KTH – Royal Institute of Technology, Teknikringen 23, SE-100 44, Stockholm, Sweden

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ABSTRACT

This article connects the literatures of policy evaluation, policy mixes and sustainability transition. It utilises client-oriented evaluation to examine national policies in Finland from the perspective of low-carbon buildings transition. In Finland, energy efficiency has traditionally received less focus in energy and climate policy strategies compared to renewable energy. Since 2007, energy efficiency policies addressing buildings gained force. Sixteen new policy instruments were implemented during 2007–2014 and several revisions were made to the building code energy efficiency requirements. To what extent these changes contribute to ‘creative destruction’ in the policy domain is uncertain. Therefore, we conduct a client-oriented evaluation of the policy mix from the perspective of a boundary actor—integrated energy service companies—to analyse its potential for facilitating zero-carbon transition. The findings show a divergence of opinions regarding the policy mix’s disruptive influence. Where potentially disruptive policy instruments can be found, their impact is reduced due to incoherence in policy implementation processes. The usability of client-oriented evaluation for policy mix analysis is found limited on its own but useful in complementing top-down policy evaluations. We also propose an additional function to the creative destruction policy mix: ‘changes in organisational and institutional practices’, linking to the coherence of policy mixes.

1. Introduction

The December 2015 Paris Agreement on Climate Change has placed greater political legitimacy on the need to curtail high carbon intensive practices than ever before. This urgent need to overturn current high carbon intensive practices requires processes of creative destruction (e.g. [1]) that go beyond the stimulation of innovations by destabilising regimes of carbon-intensive production and consumption. A crucial element to address this is the formation of policy mixes that address both the creation of innovations that reduce carbon emissions and involve measures to disrupt the status quo [1]. These kinds of policy mixes link to the idea of ‘transformative’ innovation policy [2] or economic policy [3] with implications on policy organisation, orientation and evaluation.

Recent literature on policy mixes has begun to partly move away from analysing narrow, specifically designed portfolios of policy goals and instruments towards a consideration of broader mixes of policies. Such broader mixes may exist across administrative domains and have negative or positive implications on transitioning towards low carbon and climate resilient futures. For example, Kivimaa and Virkamäki [4]

showed how transport policy mixes are more focused on advancing vehicle and fuel technology and less comprehensive regarding demand reduction. Reichardt et al. [5] and Kern et al. [6] recently demonstrated that the temporal development of the policy mix also influences its effectiveness. Yet these studies do not analyse the mix from the perspective of destabilisation, argued as crucial by Kivimaa and Kern [1] and illustrated by an analysis of a mix of energy efficiency policy instruments in Finland and the UK. In an important contribution to the field, Rogge and Reichardt [7] have argued that a focus merely on goals and instruments in policy mixes (what they name as elements) is too narrow, and that the characteristics and policy processes connecting to policy mixes should also be considered. Empirically, the attention of policy mix studies in sustainability transitions has mostly focused on transport policies (e.g., [8,4,9]) and renewable energy policies [5] with, we argue, too little attention on building energy efficiency.

It has recently been acknowledged that business model innovations have an important role, beside technological change, in stimulating low carbon transitions particularly in the built environment [10]. At the interface of the energy and building sectors, new business models, particularly associated with energy services, are important in inspiring

* Corresponding author at: Science Policy Research Unit SPRU, University of Sussex, Jubilee Building, Falmer, Brighton BN1 9SL, UK.
 E-mail address: p.kivimaa@sussex.ac.uk (P. Kivimaa).

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solutions that both enable the adoption of building-integrated renewable energy and improve energy efficiency through improved insulation, ventilation and building control [11]. Such a holistic take on improving the energy performance of buildings has been associated, for example, with systemic innovation in the form of zero-carbon buildings, passive houses and deep energy retrofits (e.g., [12,13]). Whilst the energy service company (ESCO) model has received most attention (e.g., [14,15]), several other business models also exist at the boundary of the energy and building sectors. Such business models offer novel ways to think about energy use and supply within buildings contrary to conventional modes of construction and use. Hence, we consider integrated energy service companies (IESCs) providing a holistic take on building energy performance as boundary actors, partly detached from the dominant energy and construction regimes, and offering potentially valuable insights on policy mixes through client-oriented evaluation.

Quantitative evaluations on policy mixes are typically unable to capture policy mixes involving non-economic instruments and, thus, the potential or actual effects of policy mixes on transitions comprehensively. Thus, there is a need to explore methods to evaluate broader policy mixes. There is also disconnect between the literatures on policy evaluation and policy mixes for transitions; the former could be employed to shed more light on the different ways in which policy mixes could be evaluated. Thus, in this article, we draw on the literatures of policy and programme evaluation (e.g. [16]), policy mixes (e.g., [1,17,7]), and technological innovation systems (TIS) (e.g., [18,19]) to propose an additional way to evaluate policy mixes from the perspective of sustainability transitions. To our knowledge there are no previous publications connecting the literatures of policy evaluation and policy mixes in sustainability transitions. Previous studies on the evaluation of innovation policy mixes are also detached from the policy and programme evaluation field (with the exception of Magro and Wilson [17]), making this a new contribution in this field. Empirically, drawing on the Kivimaa and Kern [1] and Rogge and Reichardt [7] frameworks, we aim to evaluate the extent to which the building energy efficiency policy mix in Finland portrays characteristics supporting creative destruction towards zero-carbon buildings. We apply ideas from stakeholder and client-oriented evaluation methods [16], focusing on the perceptions of IESCs about the policy mix and contrast it to previous top-down, ex-ante oriented analyses [6,1]. More specifically, we ask:

- 1 How, from the perspective of IESCs, the mix of energy efficiency policies for buildings in Finland addresses the creation of low-carbon innovations and destabilisation of high-carbon building and energy regimes?
- 2 From the perspective of IESCs, how coherent, consistent and comprehensive is the policy mix?
- 3 What is the benefit of client-oriented evaluation for policy mix analysis?

Section 2 outlines the theoretical starting points from the policy mix literature. Section 3 presents our research approach, starting with the need to evaluate the ‘transformativeness’ of policy mixes, outlining relevant policy evaluation approaches and ending with description of methods and the case study background. Section 4 presents the findings, discussed in Section 5. The paper ends with conclusions in Section 6.

2. Theoretical starting points

2.1. Policy mixes

There is an expanding literature on (innovation) policy mixes addressing two main points. First, Flanagan et al. [20] have convincingly demonstrated that policy mixes emerge in ‘real world’ contexts and, therefore, optimally designed mixes of goals and instruments do not

exist. Empirical studies on the Dutch energy sector [21] and UK building energy efficiency policy [6] have shown how new policy instruments are rather added to an existing mix of policies. Howlett and Rayner have, in support of this, illustrated that the way in which policy mixes form over time can have different types of characteristics from the layering of goals and instruments to the replacement of either goals or instruments (drift and conversion), or to redesigning whole mixes [22,23,21], the latter being the rarest case.

Second, policy mixes are formed by (partly overlapping) goals and instruments of different jurisdictions, levels of governance and policy domains; ranging from dedicated science, technology and innovation policy to sectoral policies with influence on innovation even at the absence of specific innovation goals. According to Magro and Wilson [17], increasing policy complexity has made it common that many innovation policies “co-exist within the same country or region, based on different rationales, employing different instruments, and corresponding to different policy domains” (p. 1647). Lanahan and Feldman [24] demonstrate, through the focus on US state and federal innovation policies, how innovation policy operates in a multilevel context, including multiple jurisdictions with overlapping objectives and diverse mandates. Kivimaa and Kern [1], when looking at policies affecting innovation in energy efficiency, observed that the policy mix crosses over several administrative domains pertaining to energy, climate, innovation, transport, environment and fiscal policies. This means that policy mixes influencing innovation tend to be much larger than those intentionally designed to stimulate innovation, and that sectoral policies, such as those addressing building energy efficiency, form part of the innovation policy mix. The existing research has so far addressed this point insufficiently. Further, the broad context of policy mixes creates challenges for policy evaluation.

The literature often associates policy mixes as mixes of regulatory, economic and ‘soft’ instruments (e.g., [25,26]) with the majority of articles addressing mainly instrument mixes. These can then be divided into more specific instrument types, including informational, voluntary, R & D and regulatory instruments as well as public procurement, taxation, and subsidies [6]. However, Rogge and Reichardt [7] argue for the importance of both policy goals and instruments in the mixes, and create a more comprehensive framework to understand them. The interaction between broader policy goals and more detailed policy mixes is important to determine, if policy mixes are actually to address the objectives presented at the broader strategy level. They also point out the importance of examining policy processes (including policy making and implementation) and policy characteristics (consistency of elements, coherence of processes, credibility and comprehensiveness) in addition to policy elements (the policy strategy and instrument mixes). In addition, del Rio [27] has previously paid attention to synergies and conflicts in policy mixes.

The previous literature on policy mixes is only loosely interconnected, because the different sectoral strands (such as for innovation or for energy efficiency) and the political science approach on policy mixes seldom interact. However, when looking at academic literature on policy mixes across these domains, it tends to address three broader topics: (1) the kind of policy mixes that exist and how they have evolved (e.g. [20,23,6,21]); (2) the ways in which the instruments in the policy mix interact with each other (e.g. [27–29]) and; (3) the impacts of the overall policy mix to a given goal, such as renewable energy [30] or innovation [4]. In this paper, we are particularly contributing to the latter through a client-oriented evaluation approach but also pay some attention to the interaction between instruments, goals and policy processes.

In the context of innovation policy mixes, particular attention has recently been paid to low carbon innovation, renewable energy and energy efficiency. For example, Cantner et al. [30] studied how policy mixes influence co-inventor networks in German renewable energy. Kivimaa and Kern [1] focused on energy efficiency in Finland and the UK. Mahzouni [31] analysed the policy mix for low carbon urban

transition in a Swedish city district. Previous studies on energy efficiency policy mixes are oriented to top-down analysis and lack insights on how policy mixes influence different stakeholder groups; our aim here.

Coherence and consistency are among the central features in the policy mix literature. Flanagan et al. [20] connect policy (in)coherence to the dynamics of policy making process, and refer to the opening of ‘policy windows’ that better enable policy change. They also state that “in the real world” policy instruments carry “quite different meanings from time to time, place to place and actor to actor” ([20], p. 706). Supporting this, some empirical analyses have noted incoherence and inconsistency to exist in many areas leading to uncertainty in the eyes of investors and, therefore, reduced innovation potential (e.g. [28,32]). Rogge and Reichardt [7] make a distinction between coherence and consistency. In their framework, consistency addresses how the goals and instruments of the policy mix are aligned with each other, ranging from lack of contradictions to the presence of synergies within and between goals and instruments. This matches with the analyses of Del Rio [27] for renewable energy and Rosenow et al. [29] for building energy efficiency, that examine whether sets of instruments are complementary, neutral, conflicting or overlapping. Coherence, in turn is addressed by Rogge and Reichardt [7] “as referring to synergistic and systematic policy making and implementation processes contributing – either directly or indirectly – towards the achievement of policy objectives”; and, incorporating coherence across policy fields and administrative levels, systematic capabilities of policymakers including, for example, capabilities to accumulate related knowledge, construct networks and involve stakeholders. Many studies have also indicated how policy mixes evolve over time resulting in various compositions and degrees of synergy and conflict; containing evidence from different empirical contexts, including forestry [23], building energy efficiency [6] and off-shore wind [5].

2.2. Policy mixes and sustainability transitions

The last few years have seen the emergence of literature addressing policy mixes in the context of sustainability transitions; a previously under-addressed issue. This connects to the idea that in order to promote transformational change, real-world policy mixes need to support these efforts [1]. Empirically, previous studies have addressed transport policy (e.g. [8,4,9]) and renewable energy policy [5] mixes. In addition, some studies have focused on producing recommendations regarding future policy mixes through scenario building [33] and workshop discussions [8]. Analyses of policy mixes by Kivimaa and Virkamäki [4], Huttunen et al. [28], Reichardt et al. [5], and Kivimaa and Kern [1] have built on the Technological Innovation Systems (TIS) framework.

The TIS framework adopts a systemic perspective to analyse the links between different actors, networks and the institutional contexts around a specific emerging technology [18]. Several authors suggest that a well-functioning TIS is a requirement for the development and diffusion of a technology [18,34]. Hence, analyses often focus on assessing the performance of the TIS by examining how well certain functions, shown to be important for the development of new technologies, are fulfilled. A number of TIS functions have been suggested over the years with some variation between the Swedish [35,36] and Dutch [37,34] scholars. The typology proposed by Bergek et al. [18] has been one of the most popular. It includes the following seven system functions: knowledge development and diffusion; influence on the direction of search; entrepreneurial experimentation; market formation; legitimation; resource mobilisation; and development of positive externalities. The list of functions proposed by, for example, Suurs and Hekkert [19] suggest only slight variations to the above list.

Non-linear multiple interactions between the functions have in the TIS literature been described in terms of cumulative causation [36], virtuous and vicious cycles and motors of changes [34]. For example, Hekkert and Negro [34] suggest that (a) guidance of search often leads

to knowledge development that spurs on entrepreneurial experimentation, (b) entrepreneurs lobby (legitimation) for the mobilisation of resources which can increase expectations, or (c) entrepreneurs lobby for market formation to create a more level playing field. These interdependencies between TIS functions indicate that policy mixes should also try to support all functions when change is urgent and market forces have not sufficiently stimulated a necessary transition.

Kivimaa and Kern [1], in their recent study on innovation policy mixes for creative destruction, expanded on the TIS functions and motors from a policy perspective. What they label as ‘niche support’ functions include: knowledge creation, development and diffusion (C1), establishing market niches/market formation (C2), price-performance improvements (C3), entrepreneurial experimentation (C4), resource mobilisation (C5), support from powerful groups/legitimation (C6) and influence on the direction of search (C7). In this framework, the *positive externalities* function was removed and replaced by *price-performance improvements*. Importantly, Kivimaa and Kern suggested a contrasting set of four “regime destabilising” functions: control policies (D1), significant changes in regime rules (D2), reduced support for dominant regime technologies (D3), and changes in social networks and replacement of key actors (D4). Control policies are possibly the ‘mildest’ form of destabilising policy by internalising environmental externalities to produce an ‘extended level playing field’ for niches and incumbent technologies to compete on similar terms. Such policies put pressure on the dominant sociotechnical regime often without changing the broader institutional or legislative structures.

Significant changes in regime rules are described as larger policy initiatives that involve the reconfiguration of institutional rules that are favourable to path dependent, more incremental development of the existing regime. They can entail policies constituting structural reforms in legislation or significant new overarching laws. Historic examples of major rule changes include the privatisation and liberalisation of electricity markets in the 1990s which completely changed the selection environment within which utilities were operating [1]. Reduced support for dominant regime technologies ranges from the decline or removal of subsidies for dominant, institutionalised technologies to outright bans of polluting technology or practice. Finally, changes in social networks and replacement of key actors adheres to the policy process side of the policy mix. It achieves destabilisation by replacing incumbents with new actors (e.g. in policy making networks), or creating new fora that bypass traditional policy making structures, simultaneously replacing existing skills with new ones. Developments towards experimental governance structures (e.g. Sabel and Zeitlin [49], Kivimaa and Temmes [50]) may contribute to this function.

Taking this framework as our analytical point of departure, and in contrast to previous top-down approaches, we carry out a client-oriented analysis of policies. Such a bottom-up approach is intended to reveal possible shortcomings in the implementation of policies (versus their intention). In addition to the identification of instruments following Kivimaa and Kern’s [1] framework, we also link to the debate on consistency and coherence of policy mixes, utilising Rogge and Reichardt [7] categories of ‘coherence of policy processes’, ‘consistency of policy goals and instruments’, and ‘comprehensiveness of the policy mix’ in our client-oriented evaluation.

3. Research approach and background

3.1. Evaluating ‘transformative’ policy mixes

Evaluation of ‘real world’ policy mixes is useful to complement and contrast the modelling-based and theoretical work. Such models typically analyse a rather narrow set of often economic policy instruments trying to quantify the influence of such policy mixes (e.g. [38,9]). Thus, such analyses miss the broader mix of policies that can support or hinder the implementation of a more narrowly defined set of policies, leading to unrealistic presentation of the potential impact of the policy

mix. In the context of regional innovation policy, Magro and Wilson [17] have highlighted a “need for new forms of evaluation processes that can better capture the interactive effects that characterise complex policy systems” (p. 1647). Further, they argue that evaluations that have a narrow focus on individual or just a few policies give only partial information about how policy affects socio-technical systems and their components [17]. We argue that modelling based quantitative analyses should be complemented with qualitative real-time evaluations, preferably involving stakeholders that are not policymakers. Such evaluations can point out unexpected synergies or conflicts, or problems that have occurred in policy processes, i.e. the preparation or implementation phases.

To our knowledge only Creten et al. [39] have previously addressed evaluation in the sustainability transitions context. They have created and tested evaluation tools particularly in the context of policy programmes set to facilitate such transitions. We could not identify any academic published policy mix evaluations from the perspective of sustainability transitions. Extending policy evaluations to transitions is complicated by the difficulties to set boundaries to what is the evaluand, i.e. the focus of evaluation, and how to evaluate ‘transition’ when it is still under way. The policy and programme evaluation literature contains multiple different models (goal-achievement model, goal-free evaluation, side-effects evaluation, economic evaluation, quasi-experimental evaluation, etc.) and the suitability of these different models to evaluate policy mixes in the context of transitions has not been assessed or debated.

Another nascent and very fragmented literature is the evaluation of policy mixes. This has related, for example, to regional innovation policy mixes [17], the coherence of renewable energy policy instruments [27] and the evolution of policy mixes over time [23]. All strands appear detached from the policy and programme evaluation methodology [16], addressed below.

3.2. Policy mix evaluation from a target group perspective

Policy mixes are messy to evaluate as they entail the goals, inputs, administrative processes, and outputs of all the individual policy programmes and instruments included in the mix. To limit the messiness, we approach the policy mix targeting building energy efficiency from the perspective of a selected target group potentially influenced by these policies; the IESCs. This target group was chosen for its importance for systemic innovation in energy efficiency (cf. [13]), and the novelty of business models in the context of energy disruption [40].

In forming our evaluation design we draw from stakeholder [41,16] and client-oriented [16] evaluation. We, therefore, depart from Murphy et al. [42] who conducted a theory-based evaluation of policy instruments to improve the energy performance of dwellings in the Netherlands.

The stakeholder model in policy evaluation is organised around the “concerns and issues of the people, who have an interest in or are affected by the intervention” and it is argued to be an applicable solution in situations of managing several (potentially) contradictory goals ([16], p. 69). Given that policy mixes typically merge the goals of several (dozens of) policies, models such as goal-attainment evaluation (cf. [43]) prove extremely difficult. However, we also depart from the stakeholder model in that our focus is only on one group of affected interests. We, therefore, connect to the idea of client-oriented evaluation that “takes the goals, expectations, concerns, or even needs of the program addressees as its organizing principle and criterion of merit” ([16], p. 66). Pluralism is an accepted strand of the model and it is intended to co-exist with rather than replace other evaluation models for reasons of democracy [16].

The views of the ‘client’, in this case IESCs, are used to form intervention theories of the impacts of Finnish government policies on building energy efficiency. According to Vedung [16], an intervention theory consists of three parts, although situation theory and normative

theory can be omitted from the evaluation:

- “*Situation theory*. Notions concerning relevant features of the context in which an intervention is supposed to take place. Some or all of the following notions might be relevant to include (a) size of the problem at present; (b) development of the problem up till the present time; (c) size of the problem after x years if nothing is done; (d) causes of the problem, and finally (e) impact of the problem at present and after x years if nothing is done.
- *Causal theory*. Notions concerning how a given intervention/program directly or indirectly through its process of implementation and delivery of outputs will (a) have an impact on the causes of the underlying problem at issue so that the problem will disappear, be reduced, or prevented from becoming aggravated and (b) have possible effects in other areas during the entire process.
- *Normative theory*. Notions concerning why the various aspects of the situation that are supposed to be affected by the intervention are preferable or not preferable to the situation without the intervention or with another intervention” ([41], p. 300).

We will draw on both situation theory and causal theory in detecting the perceptions of IESCs on building energy efficiency policy. The former is addressed not only by analysing the interview responses as one group but by also grouping responses on the basis of (1) how significant a problem the respondents perceive current levels of building energy use to be, and (2) how positively or negatively the interviewees perceive the past 5 years of energy policy development before the interviews took place.

The shortcoming of the client-based approaches is their inability to address all the elements of the policy mix (cf. [7]), in particular the policy strategies and processes in detail. The benefit in our case is, however, that such an analysis is able to shed some light on the policy implementation processes that IESCs are directly influenced by. The analysis carried out is intended to complement, not replace, current research (e.g. [6]) evaluating the Finnish policy mix for building energy efficiency.

3.3. Research method

As described above, we undertook client-oriented evaluation focusing on the impacts of building energy efficiency policy mixes in Finland in 2015, drawing on the Kivimaa and Kern [1] and Rogge and Reichardt [7] frameworks. The empirical data collection and analysis was carried out in the following stages:

1. During May–June 2015, we carried out 14 semi-structured interviews with Finnish IESCs, including 12 company representatives and 2 network organisations. This pool of people represented the majority of actors in this new emerging business field. In the interviews, general questions about the development and status of energy policy were asked, rather than asking about a specific set of policies; to get a more exploratory sense of what policies are relevant and how.
2. The recorded and transcribed interviews were coded in NVivo against the Kivimaa and Kern [1] framework categories (see Section 2.2) separately by two of the authors. This enabled us to obtain an overview of the data and generate initial analytical findings.
3. Subsequently, the responses were divided based on comments surrounding specific policy instruments, noting whether the comments presented a positive or negative view of specific instruments.
4. Given high variation in the interview responses, we undertook further analysis on the basis of perceived problem size, responding to ‘situation theory’ (Section 3.2).
5. To generate more insights on interactions in the policy mix, the interviews were additionally coded, drawing on the Rogge and Reichardt [7] framework, for consistency of policy processes,

coherence between and within policy goals and instruments, and comprehensiveness of the policy mix.

The IESCs interviewed included international firms ($n = 4$), established Finnish companies ($n = 4$), start-ups ($n = 2$) and niche support organisations ($n = 4$).¹ They provided expert services in planning, project management, project implementation, energy management, remote energy control, energy follow-up, supervision, maintenance, reporting and analysis. All interviewed IESCs provided energy services for the building sector, on projects related to industrial buildings, office buildings and schools. Ten of these provided services for the housing sector, mainly through contracts with local authorities or housing associations; only one company providing services directly to individual households.

Appendix A shows the overview of the policy instrument analysis against our analytical framework. This overview demonstrated a large divergence in interview responses making overall evaluation difficult. Thus, based on the frequency of mentions, we selected seven national policies and two EU-level policies (or policy packages) for more detailed analysis. These included either single policy instruments or groups of closely related instruments (e.g. an energy audit programme and a related subsidy scheme). Our focus in the interviews was on national policies; as a result EU policies were seldom mentioned. The policies (or policy packages) selected for more detailed analysis were mentioned by at least five interviewees, resulting in the following categories: (1) the energy audit programme and subsidies, (2) the role of and measures carried out by Motiva, a government-owned energy advisory organisation, (3) the Land Use and Building Act, (4) innovative public procurement, (5) energy efficiency requirements in building regulations, (6) energy certificates, (7) the Energy Efficiency Act, (8) the EU ban of incandescent light bulbs, and (9) other EU-level policies.

We examined the arguments given for each policy (package) and connected these with the creative destruction functions. For each function, we analysed how the interviewee arguments were framed, i.e. were policies described as promoting (positive) or slowing down (negative) improvements in building energy efficiency from that function's perspective. In many cases, we detected that an interviewee stated both positive and negative issues regarding a specific policy. Thus, each interviewee's (positive or negative) view on each policy and TIS function combination was taken into consideration only once. This method allowed us to group the companies to utilise situation theory in the analysis, in the following two ways:

1. The perception of the interviewees regarding energy efficiency policy development during the past 5 years:
 - a. Negative, neutral or varying development (4 interviewees)
 - b. Slightly positive development (4 interviewees)
 - c. Positive development (6 interviewees)
2. The perception of the interviewees regarding the current technical level of building energy efficiency in Finland?
 - a. Significant challenges exist (4 interviewees)
 - b. Varying levels of challenge (e.g. between new and old building stock) (6 interviewees)
 - c. Only small energy efficiency improvements are needed (4 interviewees)

The companies' views on each policy and function were merged as follows: (1) the companies were grouped as presented above; (2) the analysis was performed function specifically so that all policies (and policy packages) under one function were merged; and (3) the results of each company group were weighted according to the number of

companies to remove the possible biases caused by the different sizes of company groups. Lastly, we identified what kind of interaction issues were brought forward by the IESCs regarding consistency of policy processes, coherence of goals and instruments and comprehensiveness (i.e. coverage of the mix).

3.4. Background on energy efficiency policy development in Finland

The Finnish building stock is regarded from an international perspective relatively energy efficient, its main challenges relating to high-carbon heating fuels in areas not covered by district heating [47]. Building energy efficiency has been guided by national legislation since 1976, most influence occurring through the building regulations (National Building Code). While improvement has occurred during the past four decades, the turn of the millennium has been perceived as somewhat a turning point. Since 1999, the Land Use and Building Act also included stipulations related to building energy efficiency; the Energy Efficiency Action Plan was issued in 2000, and cumulative 30% increases in energy efficiency requirements were added to the building code in 2003, 2008, 2010 and 2012. "The 2012 update also included a requirement that the calculation of building energy use is to be based on total primary energy use, with house builders able to choose the measures to meet those criteria, including renewable energy generation" [6]. Kivimaa and Kern [1] regarded this policy revision as a potentially destabilising (D1 and D2) policy measure in the Finnish building energy efficiency policy mix alongside with changes made to the Land Use and Building Act.

Kern et al. [6] describe policy goal development during 2000–2014 as "incremental improvement towards increased energy efficiency and zero-carbon buildings". In 2011, the objective of introducing near zero-carbon new buildings by 2020 was included in the government programme [48]. In addition, the new Energy Efficiency Act (HE 182/2014) introduced general targets to improve energy efficiency by 9% by 2016 and 20% by 2020. Kern et al. [6] also show that during 2000–2014, 31 new policy instruments were introduced and 11 policy instruments removed from the policy mix. Funding for energy efficiency information and advice did not increase after 2012 with cuts in that funding proposed [6]. In addition, there has been a decline in subsidies awarded for energy efficiency.

In terms of the instrument mix, Kern et al. [6] identified "a total of 36 policy instruments, which were in force to influence building energy efficiency in 2014: heating specific (9), electricity specific (4), covering electricity and heating (8), and cross-sectoral (15) policy instruments". Further these were noted to be a mix including subsidies, public procurement, research and development support, taxation, regulatory and 'soft' instruments. In their analysis, subsidies have been important for stimulating energy efficiency of existing buildings, regulation for new buildings, and various information instruments (targeting small and medium enterprises, government departments and households) for both. The responsibility over these policies has been divided among two different ministries (Ministry of the Environment and Ministry of Employment and Economy) and their agencies (Housing Finance and Development Centre (ARA), Energy Authority, and government-owned company Motiva that promotes energy and resource efficiency).

4. Findings

Our client-oriented evaluation of the Finnish policy mix on building energy efficiency was focused on two issues: (1) how were the two sides of 'creative destruction' proposed by Kivimaa and Kern [1] present in the policy mix, and (2) how did the interviewees bring forward issues linking to the coherence of policy processes, consistency of goals and instruments, and comprehensiveness of the policy mix (cf. [7]). Before going in detail to these issues, a brief overview of the policy instrument mix is provided.

¹ Two network organisations, one construction company and one retailer were grouped as niche support organisations as they did not have effective IESC business models at the time of research.

4.1. Overview of findings

Most of the IESCs viewed that policy development pertaining to the improved energy performance of buildings in Finland has been somewhat positive. Despite the generally positive tone, many interviewees also expressed rather critical remarks concerning specific policy instruments and their implementation, including energy certificates, energy efficiency requirements in building regulations and the energy audit programme. Many critical remarks were related to policy processes, mainly concerning incoherence in the implementation with regard to the aims of the policy in question or other energy efficiency policies.

A comparison of our interview analysis to the mix of instruments identified in the policy mapping exercise of Kern et al. [6], shows that the interviewees mentioned 19 of the 36 building energy efficiency related policy instruments (see Appendix A) identified by Kern et al. [6]. The IESCs views were mixed regarding 12 of the 19 instruments; between a positive impact and shortcomings in the policy design or implementation.

Performance standards and informational instruments were seen as most efficient by the IESCs. Contrarily, subsidies and mandatory certification were regarded as ineffective (see Table 1). However, in relation to performance standards (particularly the building regulations), several interviewees noted problems with the enforcement and implementation of the energy efficiency requirements, therefore reducing their potential a destabilising impact (see Section 4.3). Subsidies and voluntary instruments were the most frequently mentioned. While subsidies were perceived in a mixed way, oriented towards problems and shortcomings, only a small number of voluntary instruments were mentioned. Furthermore, the interviews did not bring up the role of the electricity tax, while taxation in other domains (property tax, domestic tax reduction) was brought forward as potentially important instruments influencing building energy efficiency investments by households.

4.2. Niche supporting policies

This sub-section examines how the Finnish policy mix on building energy efficiency addresses functions of niche support, important for the emergence and diffusion of innovations in transitioning towards zero-carbon buildings. Based on the views of the 14 interviewees, the policy mix has gaps regarding *entrepreneurial experimentation* (C4), as noted in previous work [1] as well as *price-performance improvements* (C3) and *legitimisation* (C6). While a number of instruments appear to address *knowledge creation and diffusion* (C1), *market formation* (C2) and *resource mobilisation* (C7), the positive impact of many instruments were mentioned by only one interviewee, not giving much support to this finding.

The interviewees brought forward several policy gaps or shortcomings in existing policies (linked to issues of incoherent policy processes and comprehensiveness; see Section 4.4), limiting the impact of the policy mix for *knowledge creation* (C1), *market formation* (C2), *resource mobilisation* (C5) and *direction of search* (C7). The policy gaps for knowledge creation include, for example, limited innovation policy inputs into the sector, such as funding into product development (supported by two interviews) and a lack of educational policies addressing building energy efficiency (supported by two interviews). In new market formation for energy services, policy problems included the insignificant impact of energy certificates due to poor design and lack of enforcement (supported by four interviews), the latter falling under incoherence in the implementation process. Resource mobilisation has, according to the interviews, been curtailed by the removal of subsidies for building energy efficiency (supported by two interviews) and ineffective design of the subsidy scheme for energy auditing (supported by two interviews). Two interviewees make propositions regarding the extension of the policy mix for resource mobilisation: temporal

extensions to the scheme on tax deductions based on housekeeping costs and connecting real-estate tax to energy efficiency.

Following ‘situation theory’, we divided interview responses to groups on the basis of how the interviewees perceived energy efficiency policy developments in the past 5 years and the building energy efficiency challenge in Finland. For the majority of functions, groups responded as expected, i.e. for ‘perception of energy efficiency policy developments in the past 5 years’ the ‘positive development’ group presented mostly positive responses to the niche support and regime destabilisation functions, likewise for ‘the building energy efficiency challenge in Finland’ the ‘significant’ group had the most negative and least positive responses to the policy mix, and the ‘small’ groups were the most positive and least negative. However, also more surprising findings emerged, detailed below:

- The ‘positive group’, while having the most positive perception of policy mix influence on *knowledge creation* (C1) also bring up several problems concerning that function including, for example, **shortcomings in the energy audit model and limited innovation policy inputs.**
- The ‘small group’ is at the same time the most positive and the most negative regarding policy influence on *market formation* (C2), and express **the limited influence of energy certificates and energy audits.**
- The ‘positive group’ and ‘small group’ perceived support for *entrepreneurial experimentation* (C4) most negatively, referring to **lack of experimentation considerations, for example, in public procurement and the need for more government support on product innovation.**
- The ‘positive group’ while having also positive remarks about *resource mobilisation* (C5) also is the most negative, making remarks about removal of subsidies and the energy audit.
- The ‘small group’ is the most negative about *legitimisation* (C6), noting that **the public sector is tied to traditional solutions in public procurement.**
- The ‘positive group’, while having the most positive perception of influence on the *direction of search* (C7) also brings up several **problems related to the implementation and enforcement of building regulation energy efficiency requirements and the Land Use and Building Act.**

4.3. Destabilising policies

This sub-section examines how the Finnish policy mix on building energy efficiency addresses functions of regime destabilisation, important for creating space for niche innovations to gain ground and speed up transition. In principle, policies such as the revised requirements for energy efficiency in building regulations and in the Land Use and Building Act have potential to destabilise the regime (cf. [1]). Our analysis of interviews gives some support to building regulations as a destabilising control policy (D1, supported by six interviews) and also the 2012 revision as a significant change in regime rules (D2, supported by three interviews), for example, by making the use of new technologies mandatory through tightening performance requirements. The Land Use and Building Act entails energy efficiency requirements and that could be interpreted as a control policy (D1, supported by three interviews) and a significant change in regime rules (D2, supported by two interviews) on the basis of some interview comments. However, five interviewees presented the above policy measures having a limited impact due to lack of monitoring of their enforcement and/or lack of know-how in building inspection in charge of it (i.e. incoherent policy processes; see Section 4.4). In addition, the lack of sanctions for non-compliance was brought forward by three interviewees as factors limiting their potential destabilising impact. The Energy Efficiency Act was also perceived as a control policy (D1) and significant change in regime rules (D2) by one interviewee.

Table 1

Analysis of findings per instrument type and contrasting to Kern et al. [6] policy mapping.

Policy type	Creative vs. destruction function [1]	Instruments in Finland (elaborated from [6])	Perception of energy service companies
<i>Economic instruments</i>			
Taxation	C2, C7, D1, D3	1. Electricity tax (increase)	<i>Not addressed.</i>
Subsidies for deployment	C2, C3, C5, C7, D3	1. Subsidies for replacing oil-based heating systems 2. Renovation and energy aid for the elderly and disabled 3. Subsidies for installing efficient wood-fuelled heating systems 4. Energy audit support for municipalities 5. Renovation aid for apartment buildings 6. Energy support [energiatuki] 7. Tax deduction for domestic services (general) 8. Energy audit programme for industry and service sectors	<i>Mixed-negative perception</i> on positive effects vs. limited functioning of the instruments. Subsidies for renewable heating systems work relatively well whereas problems with subsidies and grants targeting building energy efficiency and audits were mentioned. Also some subsidies have been removed or reduced, creating gaps in the policy mix. Tax deduction was perceived as supportive by one interviewee. The energy audit programme run by Motiva was perceived negatively by four interviewees. One interviewee thought it worked well.
Public procurement	C2	1. Guidelines for Energy Efficiency in the Public Procurement 2. Decision in principle on the promotion of new and sustainable environment and energy solutions (clean tech solutions) in public procurement 3. Innovative public procurement	<i>Mixed-negative perception.</i> One interviewee talked about innovative public procurement pointing out good and bad examples that exist. Six interviewees saw problems related to public procurement law, including lack of knowledge in local councils, hesitance for tendering, or hiding behind public procurement law.
Research, development & demonstration	C1, C2, C3, C5, C6, C7	1. The future of living and housing (ASU-LIVE) 2. Built Environment SHOK 2009–2014 3. Green Growth Programme 2011–2015 4. Funding instruments by organisations such as Tekes and the Academy of Finland (15–20)	<i>Mixed perception:</i> Tekes funding was mentioned twice. Specific programmes were not identified.
<i>Regulatory instruments</i>			
Performance standards	C2, C6, C7, D1, D2	1. National Building Code, inc. energy efficiency requirements for new buildings 2. Energy efficiency requirements for renovation 3. Revision of the Land Use and Building Act (132/1999) 4. Act on Inspection of Air-Conditioning Systems	<i>Mixed-positive perception:</i> Several interviewees highlighted the importance of the building code and land use and building act, applauding the energy related changes. They were also criticised for lack of sanctions or poor implementation through building inspection.
Mandatory certification and labelling	C1, C2, C3, C6, C7, (D1)	1. Act on Energy Certificates for Buildings (50/2013) 2. Act on Eco-design & Energy Labelling	<i>Negative perception:</i> Energy performance certificates were frequently mentioned but they were seen to have very limited impact.
Other regulation	C1, C2, C6, C7, (D1)	1. Act 2011/2009 on the energy-efficiency services of companies 2. Mass roll-out of smart meters 3. Government Decision on energy efficiency	<i>Not addressed</i>
<i>Soft instruments</i>			
Voluntary measures	C1, C4, (C5), C6, C7C1, C4, (C5), C6, C7	1. Increasing the efficiency of space use in government administration 2. Energy Efficiency Agreement for property and building sector 2008–2016 3. Energy efficiency agreement of industry and commerce 2008–2016 (inc. electricity, heat and fuel use) 4. Energy-efficiency agreement for municipalities	<i>Little addressed:</i> Only two interviewees mentioned voluntary instruments apart from the ESCO model promoted by Motiva. The ESCO model received mixed views: two negative, one neutral, and one positive.

(continued on next page)

Table 1 (continued)

Policy type	Creative vs. destruction function [1]	Instruments in Finland (elaborated from [6])	Perception of energy service companies
		2008–2016 (inc. all areas of energy use) 5. Programme for energy conservation in oil-heated buildings and transport, the Höylä III Programme 2008–2016 6. ERA17 Programme 7. Motiva ESCO model	
Information & advice	C1, C2, C7	1. Maintenance and user information in government properties 2. The Swan label Energy labels for windows Energy advice for SMEs by Motiva Energy advice for consumers Consumers Energy Advice Network & Architecture	<i>Positively perceived:</i> Four interviewees mentioned information and advice offered by Motiva, only one interviewee seeing limitations. Other instruments were not mentioned.

When directly asked, seven interviewees could not identify any policies actually *disrupting* the existing energy system and mentioned old fashioned decisions, incremental steps and the lack of energy efficiency in political decision making. Four interviewees found the question too difficult to respond to. Three interviewees were slightly more positive and consider we are in a clear change period with quick policy changes and opening up the production of electricity to consumers, but even they see of lack of practical action behind all the talk.

“I think all the regulatory affairs and others are at such a big turning point and change. We are going to near zero energy... but much of it is talk and real acts are missing.”

“Politically decisions are being made so that anyone can sell heat, waste heat and energy companies can no longer make it as difficult as possible for consumers to sell energy. Legislation and politics are going in the direction that energy can be sold by others than just energy companies”

“Not exactly in that sense [disrupting the energy system] but if we think for example the energy certificate act that was enforced within a year’s process that came about really quickly... The speed of change in legislation comes nationally in a really quick tempo for someone who does not follow up EU policy.”

When grouping the interview responses following ‘situation theory’, largely in all groups some interviewees assign attributes to policies acting as control policies (D1) or significant changes in regime rules (D2). Some individual references are made regarding the removal of support for existing technologies (D3) and none regarding new organisations or replacement of key actors (D4). What is interesting is that the group perceiving policy development the most positively while being most positive about significant changes taking place, simultaneously observed several shortcomings in the policy mix. The shortcomings related to the implementation of building regulations: lack of know how in building control, of monitoring and of sanctions in cases of non-compliance.

4.4. Coherence, consistency and comprehensiveness

This sub-section addresses how the interviewees mentioned issues linking to the coherence of policy processes, consistency of goals and instruments, and comprehensiveness of the policy mix, following Rogge and Reichardt’s [7] definitions. It is important to note that the interviewees were not specifically asked about these but rather about the policy mix and policy development more generally.

Regarding interactions in the policy mix, interestingly issues of incoherence in policy processes appear much more frequent than issues of

inconsistency between policy goals and instruments. The only inconsistency mentioned by more than one interviewee is that the obligation to conduct energy audits is not matched with an obligation to carry out energy improvements identified in the audits (mentioned by two interviewees). In turn, several examples are mentioned where instruments are not only consistent but create positive outcomes through being in synergy (see Appendix B).

In total, the interviews describe six issues of incoherence in policy preparation and implementation processes (see Appendix B). Three cases of incoherence are mentioned in more than one interview:

- the ways in which the public procurement process in often in practice carried out (due to unknowledgeable or too cautious civil servants) hinders innovative building energy efficiency improvement (mentioned in four interviews);
- a lack of knowledge in building inspection hinders monitoring and enforcement of building energy efficiency requirements (mentioned in three interviews); and
- insufficient resources in the Housing Finance and Development Centre (ARA) for monitoring energy certificates and subsidies as well as a lack of sanctions for not meeting the requirements for energy certificates reduces the positive impact of these policies (mentioned in two interviews).

There were few insights on the comprehensiveness of the mix. Many interviewees perceived the policy mix regarding energy efficiency in new build to be sufficient. Two interviewees mentioned how energy efficiency was missing from high level government policy strategies, indicating both a non-comprehensive mix in terms of high level goals and a lack of consistency between high level energy policy goals and sector specific policy objectives and instruments. As noted in the previous sections, the interviewees also identified policy gaps that, in particular, related to how building energy efficiency could be better supported by instruments falling under other administrative domains, including education, innovation and fiscal policy.

The findings also reveal how the coherence of processes and consistency of goals and instruments are linked to each other. For example, policy processes, pushed by the Finnish Independence Fund Sitra and a government-owned energy efficiency company Motiva, to streamline legislation to create a better access for distributed renewable energy to the distribution networks and to reduce inconsistencies in legislation concerning the taxation of electricity have resulted in improved consistency in some parts of the policy mix. As another example, the creation of ERA17 Action Programme on Energy Smart Built Environment, launched in 2010 by the Ministry of the Environment, Sitra, and the Finnish Funding Agency for Technology and Innovation

Tekes, both serves as a process of coherent policy making and as a result produced a more consistent mix of policy instruments (both old and new).

5. Discussion

5.1. Insights into the policy mix from IESCs perspective

In general, IESCs seem to have a somewhat positive view of the building energy efficiency policy mix in Finland and the goals and instruments are largely consistent, giving support to earlier findings of top-down policy analysis [6]. However, the interviewees also bring forward several problematic points concerning policy gaps and the incoherence in policy implementation processes. Many policies in principle contribute to the formation of ‘the energy efficiency market’. In practice, incoherence in implementation processes reduces the support necessary for the early stages of market development. For example, on/off subsidies may first create and soon after stifle emerging markets. In addition, while a market is created by energy efficiency requirements in the Building Code, the effect is reduced by lack of monitoring, enforcement and sanctions for non-compliance; i.e. incoherent implementation processes. In addition, policies may not be improving the price-performance of energy efficient technologies, in some cases even steering towards solutions that are not cost-efficient given the rapid pace of technological development.

Our study showed some indications of a policy mix that acts towards ‘creative destruction’ in the context of advancing a transition towards zero-carbon buildings. These include revisions made to building regulations and the Land Use and Building Act potentially ‘destabilising the building and energy regimes’ and the simultaneous presence of policies supporting the emergence and diffusion of new niches. However, our analysis also identified several policy gaps and shortcomings that reduce the power of the policy mix’s ‘creative destructive motor’ [1]. These include:

- (1) incoherent implementation of potentially destabilising policies pertaining to lack of knowledge in building inspection and lack of sanctions in cases of non-compliance;
- (2) lack of destabilising organisational changes pertaining to *new organisations or replacement of key actors* (D4);
- (3) lack of attention to supporting *entrepreneurial experimentation* (C4); and
- (4) non-optimally functioning policy instruments in the mix, most significant being the energy certificates.

Drawing on Rogge and Reichart [7] idea of policy mixes, that also contain policy processes and their coherence, shows with respect to our findings that problems reducing the destabilising and transformational effect of the policy mix, are caused by both incoherent policy processes—in particular involving implementation of public procurement, building regulations and energy certificates—and a lack of new policy processes matching the new mix of policy goals and policy instruments. Thus, we argue, that it is vital to not only conduct both ex-ante and ex-post evaluations of the mix of instruments but also evaluate the associated policy processes in order to determine how real world policy mixes are likely to influence sustainability transitions.

The non-functionality of regulation and other policy instruments may relate to their design. This is particularly problematic, if they embody the old dominant model of the socio-technical system instead of embracing a new dominant design (cf. [44]) and, new more service-oriented, approaches to building energy efficiency improvement (cf. [15]). In addition, while the policy mix is broadly regarded consistent and comprehensive; our analysis demonstrated that both consistency and comprehensiveness could be increased by improving synergies between the building energy efficiency policy mix and higher level political goals as well as instruments in other policy domains but with

potential effect on building energy efficiency.

On the basis of our findings—revealing problems in the implementation and enforcement of potentially destabilising policies—we propose the addition of a new function, D5 ‘*new organisational or institutional practices and routines*’, to the Kivimaa and Kern [1] framework. The incoherence identified in the implementation of the building energy efficiency requirements and public procurement indicate the need of, not necessarily creating new organisations or actors, but (1) changes within existing organisational practices and (2) the reorientation of incumbent policy actors in support of more effective policy implementation. This addition also supports a more process-oriented view of policy mixes proposed by Rogge and Reichardt [7]. A weak building inspection and enforcement regime, slowing down change towards improved building energy performance, has also been noted by Fischer and Guy [45]. Further, they state that this regime is under much pressure when building regulations have become increasingly complex; the replacement of more easily monitored prescriptive energy efficiency requirements have been replaced by performance-based requirements that leave a much wider scope for interpretation. Therefore, solving the implementation and enforcement issue connects to broader policy change and how it is carried out with respect to different actors in the regime.

The lack of observations pertaining to *new organisations or replacement of key actors* (D4) implies that, in the building energy efficiency sector, there may be too few third party (intermediary) actors that could credibly facilitate policy change and influence. Such intermediaries could act as ‘translators’ of more abstract policy information into practice [45] and improve policy coherence from the perspective of stakeholders. While in Finland intermediaries, such as Sitra, are in place to influence new policy formation [4], the presence of policy implementing ‘translating’ and coherence-seeking intermediaries is less clear. It is also not evident, whether such translators could be architects [45], local authority planning departments [51] or some new institutional actors, including IESCs. Advisory organisations, such as Motiva [4] are likely to be crucial in addressing coherence in the implementation of complex energy efficiency policy mixes.

5.2. Use of client-oriented evaluation for policy mix analysis

We showed how client-oriented evaluation can be used to complement top-down oriented evaluations by bringing up issues not always evident in top-down evaluations, including (1) what are regarded by actors as the core mix of policy goals and instruments, (2) how policies are implemented in practice, and (2) how actors experience the influence of policy goals, instruments and processes crossing administrative boundaries and levels. In doing so, we also confirmed some shortcomings of client-oriented evaluation as a method for policy analysis. When a particular stakeholder group provides a large diversity of opinions on a particular policy mix (or policy), the value of the analysis become debatable. Simultaneously, pluralism in terms of disagreements between respondents in their appraisals is accepted and permitted in client-oriented evaluation [16]. While this diversity complicated our efforts to derive an overall interpretation of the policy mix, it informs policy debates by revealing uncertainties and ambiguities in the policy mix; in effect opening up rather than closing down (cf. [46]). As a complement to top-down policy analysis, our analysis showed that the policy mix could be perceived to function, at least to a degree, in support of ‘creative destruction’ towards zero-carbon buildings [1] and that the overall development of the policy mix has been mostly positive [6]. Yet, it also revealed that implementation and enforcement are important processes that should not be ignored in policy mix analysis and evaluation. Indeed, this gives further support to Rogge and Reichardt [7] who conceptualise policy mixes both in terms of policy goals and instruments and policy processes. We also experienced, however, overlaps between their analytical categories of coherence and consistency, indicating a further need for their refinement for empirical

analysis.

The use of situation theory [16], giving weight to the context of the policy mix and the size of the problem, was found useful to group interview responses. This was important particularly in identifying cases, where those that view the problem largest noted positive policy developments and, conversely, where those that saw only minor improvement needs noted negative policy characteristics.

We recognise that a study with a small sample and orientation towards one type of actor cannot offer conclusive findings regarding the policy mix. It has nevertheless been able to raise important issues for further consideration and more extensive evaluation. Most importantly, our findings indicate that the building energy efficiency policy mix may generate non-optimal outcomes particularly due to problems associated with the design and implementation of many policy instruments that influence the overall effectiveness and coherence of the policy mix.

6. Conclusions

Combining two recent conceptual frameworks created to study policy mixes in the context of sustainability transitions [1,7], we, first, analysed the extent to which the building energy efficiency policy mix in Finland supports creative destruction towards zero-carbon buildings and, second, how coherence of policy processes, consistency of policy goals and instruments, and comprehensiveness of the policy mix was considered by a group of boundary actors, namely IESCs. The novel contribution of this article was to connect policy and programme evaluation studies, and more specifically client-oriented evaluation, to the analysis of policy mixes in transitions. In addition, the article generated new empirical evidence through a bottom-up evaluation of the building energy efficiency policy mix in Finland.

The findings showed, that whilst support for niche creation and regime destabilisation (i.e. creative destruction) through the current policy mix appears piecemeal, some recent changes tentatively indicate the initiation of a destabilising process. However, on the basis of our analysis, it would be bold to claim that a regime destabilisation process would be fully, if at all, underway; demonstrating the challenges of evaluating transitions in-the-making. Interestingly, there are early signs that some recent instrument and legislative revisions may be part of such a phenomenon. Whether destabilisation will occur is strongly dependent (1) on the coherence of implementation processes in the policy mix, such as those linked to revised stipulations in building regulations and the land use and building act but also public procurement, and (2) the interplay of destabilising policies with niche creation policies in forming a ‘motor of creative destruction’. The latter may demonstrate itself as the formation or expansion of markets for building energy efficiency: zero-carbon buildings, holistic energy services and deep retrofits.

Motors of creative destruction mean that new policies on the creative side cannot gain ground without also dismantling existing institutions. Similarly on the destabilising side, the effects of control policies, for example, are limited without supportive changes in other destructive functions, importantly linking to organisational practices, changed regulatory systems and removing attention on dominant technologies.

Appendix A. Policy mix for building energy efficiency in Finland – perspective of energy service companies (number of interviews recognising this policy in brackets)

Function	Policies with positive effect	Policies with shortcomings/limited impact
C1 Knowledge creation, development and diffusion	Consumer information & advice by Motiva (4) Energy grants for audit and repair (1) Energy efficiency agreement (1) Funding by Tekes (1) Land use and building act (1)	Energy performance certificates (2) Energy grants for audit and repair (2) Consumer information & advice by Motiva (1)

The lack of enforcement of some existing policy instruments highlights the need to change existing public sector practices. Hence, we propose that *new organisations or the replacement of key actors* needs to be supported by the reorientation of incumbent policy actors through *new organisational or institutional practices* to support more coherent policy implementation. This is proposed as a fifth destabilising function to complement the Kivimaa and Kern [1] framework. It also better connects the broader policy mix conceptualisation by Rogge and Reichardt [7] to the idea of policy mixes for creative destruction, by demonstrating the important role that policy interaction and policy processes have for such a process.

Empirically, the article demonstrates that more attention needs to be paid to supporting innovation, experimentation and market formation in the boundary of building and energy regimes. In this, for example, targeted research, development and demonstration programmes, improving public procurement processes in practice, and legislative changes supporting experimentation will be important. To go beyond the initial stage of innovation and experimenting, the policy mix needs to include also structural changes and streamlined policy processes supporting transition in the sector. While the overall policy trend towards improved building energy performance is presently positive, the policy mix has not been designed from the perspective of integrated energy services and the kind of innovative business models they can promote.

Finally, we demonstrated how client-oriented policy evaluation can be used to complement top-down policy analysis. It can be used to identify issues not necessarily evident in top-down policy mix evaluations, including what actors regard as the most influential policy goals and instruments and how actors experience in practice the influence of a mix policy goals, instruments and processes crossing administrative boundaries and levels. Whilst only a part of the existing policy mix was recognised by IESCs and much pluralism in evaluation existed, such an approach revealed the lack of policy ‘design’ catering to energy services and the importance of coherence in policy implementation processes. Further research is needed on the usefulness and expansion of existing policy evaluation models for analysing policy mixes in the context of transformative change.

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	ERA17 Programme (1) Energy audit programme (1)	
C2 Market formation	Energy audit programme (3) Energy performance certificates (1) Subsidies for renewable heating systems (1) Subsidies for energy efficiency in buildings (1) Energy grants for audit and repair (1) Innovative public procurement (1)	Energy performance certificates (4) Energy grants for audit and repair (2) Innovative public procurement (2) Subsidies for energy efficiency in buildings (1) Energy efficiency req in building regulations (1) Energy audit programme (1)
C3 Price-performance improvement		
C4 Entrepreneurial experimentation	Innovative public procurement (1)	Innovative public procurement (1) Funding by Tekes (1)
C5 Resource mobilisation	Subsidies for renewable heating systems (3) Energy efficiency agreement (1) Funding by Tekes (1) Energy Aid Scheme (1)	Subsidies for energy efficiency in buildings (2) Energy grants for audit and repair (2) Innovative public procurement (1) Energy audit programme (1)
C6 Support from powerful groups/ legitimisation	Energy efficiency agreement (1)	Innovative public procurement (1)
C7 Influence on the direction of search	Energy efficiency requirements in building regulations (6) Land use and building act (3) Energy performance certificates (1) Subsidies for renewable heating systems (1) Consumer information & advice by Motiva (1) Energy efficiency agreement (1)	Energy efficiency requirements in building regulations (2) Land use and building act (2) Energy performance certificates (1)
D1 Control policies	Energy efficiency requirements in building regulations (6) Land use and building act (3) Energy performance certificates (1) Energy efficiency requirements for renov. (1) Act on energy efficiency services (1)	Energy efficiency requirements in building regulations (3) Land use and building act (2) Energy performance certificates (2) Energy efficiency requirements for renov (1)
D2 Significant changes in regime rules	Energy efficiency requirements in building regulations (3) Land use and building act (2)	Energy efficiency requirements in building regulations (4) Land use and building act (2) Innovative public procurement (1)
D3 Removal of support for existing technologies	Ban of incandescent light bulbs (2)	
D4 New organisations or replacement of key actors		

Appendix B. Remarks in interview responses related to coherence, consistency and comprehensiveness

Coherence of policy processes	Incoherence of policy processes
The ways in which municipal planners (locality specific) and the Energy Authority give advice supports planning guidance on distributed renewable energy. (One interviewee)	Public procurement process (due to unknowledgeable or too cautious civil servants) hinders innovative building energy efficiency improvement. (Four interviewees)
Policy processes, pushed by actors such as Sitra and Motiva, to streamline legislation to create better access for distributed renewable energy to network and reduce inconsistencies in legislation concerning taxation of produced electricity. (One interviewee)	Lack of knowledge in building inspection hinders monitoring and enforcement of building energy efficiency requirements. (Three interviewees)
	Insufficiency in resources in ARA for monitoring energy certificates and subsidies, and lack of sanctions for not meeting the requirements for energy certificates. (Two interviewees).
	Need to improve coordination between different officials. (One interviewee)
	Differing practices across Centres for Economic Development, Transport and the Environment regarding the implementation of subsidies for energy efficiency projects. (One interviewee)
	Preparation process for energy certificates was done in a hurry and the

Ministry of the Environment did not acknowledge the negative comments received in the consultation rounds about how it was designed. (One interviewee)

Consistency of policy goals and instruments	Inconsistency of policy goals and instruments
Energy efficiency requirements in building code [have created a demand] and energy efficiency subsidies have reduced investment risk/had positive effects. (Two interviewees)	An obligation to carry out energy audits is not matched with an obligation to carry out energy improvements identified in the audits. (Two interviewees)
ERA17 Action Programme on Energy Smart Built Environment was a good [coordinating] initiative. (One interviewee)– also an example of aiming for coherence in policy processes	Conflicts within regulatory instruments: <i>“It limits in practice the innovativeness that one cannot do better heat recovery, because its electricity consumption goes above the limit value, which does not have any impact in practice, because the consumption of electricity in ventilation is a fraction compared to heat consumption”</i> . (One interviewee)
Tax deduction for domestic renovations and investment subsidies for energy efficiency can be used jointly to finance retrofit. (One interviewee)	There is a need to connect property tax better to building energy performance. (One interviewee)
Energy certificates and energy audits jointly positively influence the adoption of new technologies or services. (One interviewee)	
Land use planning reducing fragmented building and creation of transportation hubs happening well. (One interviewee)	
Land use and building act together with the tightening building regulations guides planners to do things differently from the start. (One interviewee) – potential influence on improved coherence of policy processes	
Land use and building act requiring maintenance books for new built properties and significantly renovated buildings is in synergy with the legal requirement for continuous assessment of improvement needs for housing cooperatives. (One interviewee)	
Subsidies coupled with energy efficiency agreements. (One interviewee)	
Comprehensiveness	Gaps
Carefully positive about the policy mix. (Two interviewees)	Energy efficiency missing from high level government policy strategies. (Two interviewees)
	Some subsidies have been removed or reduced, creating gaps in the policy mix. (Two interviewees)
	Limited innovation policy inputs. (Two interviewees)
	Lack of educational policies addressing building energy efficiency. (Two interviewees)
	Not possible to deduct an energy efficiency investment in domestic tax deduction over several years. (One interviewee)
	Need for stricter requirements to continually inspect technical appliances. (One interviewee)

References

- [1] P. Kivimaa, F. Kern, Creative destruction or mere niche creation? Innovation policy mixes for sustainability transitions, *Res. Policy* 45 (2016) 205–214.
- [2] J. Schot, W.E. Steinmueller, Framing Innovation Policy for Transformative Change: Innovation Policy 3.0, (2016) Brighton. Last visited 4 September 2017: <http://www.johanschot.com/wordpress/wp-content/uploads/2016/09/Framing-Innovation-Policy-for-Transformative-Change-Innovation-Policy-3.0-2016.pdf>.
- [3] M. Janssen, What Bangs for Your Bucks? Assessing the Design and Impact of Transformative Policy, (2016) Utrecht, Innovation Studies Utrecht (ISU) Working Paper Series, ISU Working Paper 16.05, <http://www.geo.uu.nl/isu/pdf/isu1605.pdf>.
- [4] P. Kivimaa, V. Virkamäki, Policy mixes, policy interplay and low carbon transitions: the case of passenger transport in Finland, *Environ. Policy Gov.* 24 (2014) 28–41.
- [5] K. Reichardt, S.O. Negro, K.S. Rogge, M.P. Hekkert, Analyzing interdependencies between policy mixes and technological innovation systems: the case of offshore wind in Germany, *Technol. Forecast. Soc. Change* 106 (2016) 11–21.
- [6] F. Kern, P. Kivimaa, M. Martiskainen, Policy packaging or policy patching? The development of complex energy efficiency policy mixes, *Energy Res. Soc. Sci.* 23 (2017) 11–25.
- [7] K.S. Rogge, K. Reichardt, Policy mixes for sustainability transitions: an extended concept and framework for analysis, *Res. Policy* 45 (2016) 1620–1635.
- [8] S. Bakker, J.J. Trip, Policy options to support the adoption of electric vehicles in the urban environment, *Transp. Res. Part D* 25 (2013) 18–23.
- [9] A. Van Der Vooren, E. Brouillat, Environmental innovation and societal transitions evaluating CO2 reduction policy mixes in the automotive sector, *Environ. Innov. Soc. Trans.* 14 (2015) 60–83.
- [10] R. Bolton, M. Hannon, Governing sustainability transitions through business model innovation: towards a systems understanding, *Res. Policy* 45 (2016) 1731–1742.
- [11] C. Nolden, S. Sorrell, F. Polzin, Catalysing the energy service market: the role of intermediaries, *Energy Policy* 98 (2016) 420–430.
- [12] H.J. de Vries, W.P. Verhagen, Impact of changes in regulatory performance standards on innovation: a case of energy performance standards for newly-built houses, *Technovation* 48–49 (2014) 56–68.
- [13] E. Mlecnik, Opportunities for supplier-led systemic innovation in highly energy-efficient housing, *J. Clean. Prod.* 56 (2013) 103–111.
- [14] M.J. Hannon, R. Bolton, UK Local Authority engagement with the Energy Service

- Company (ESCo) model: key characteristics, benefits, limitations and considerations, *Energy Policy* 78 (2015) 198–212.
- [15] C. Nolden, S. Sorrell, The UK market for energy service contracts in 2014–2015, *Energy Effic. 9* (6) (2016) 1405–1420, <http://dx.doi.org/10.1007/s12053-016-9430-2>.
- [16] E. Vedung, Evaluation research and fundamental research, *Evaluationsforschung*, VS Verlag für Sozialwissenschaften, 2000, pp. 103–126.
- [17] E. Magro, J.R. Wilson, Complex innovation policy systems: towards an evaluation mix, *Res. Policy* 42 (2013) 1647–1656.
- [18] A. Bergek, S. Jacobsson, B. Carlsson, S. Lindmark, A. Rickne, Analyzing the functional dynamics of technological innovation systems: a scheme of analysis, *Res. Policy* 37 (2008) 407–429.
- [19] R.A.A. Suurs, M.P. Hekkert, Cumulative causation in the formation of a technological innovation system: the case of biofuels in the Netherlands, *Technol. Forecast. Soc. Change* 76 (2009) 1003–1020.
- [20] K. Flanagan, E. Uyarra, M. Laranja, Reconceptualising the policy mix for innovation, *Res. Policy* 40 (2011) 702–713.
- [21] F. Kern, M. Howlett, Implementing transition management as policy reforms: a case study of the Dutch energy sector, *Policy Sci.* 42 (2009) 391–408.
- [22] M. Howlett, J. Rayner, Patching vs packaging in policy formulation complementary effects, goodness of fit, degrees of freedom, and feasibility in policy portfolio design, *Polit. Gov.* 1 (2013) 170–182.
- [23] M. Howlett, J. Rayner, Design principles for policy mixes: cohesion and coherence in new governance arrangements, *Policy Soc.* 26 (2007) 1–18.
- [24] L. Lanahan, M.P. Feldman, Multilevel innovation policy mix: a closer look at state policies that augment the federal SBIR program, *Res. Policy* 44 (2015) 1387–1402.
- [25] S. Borrás, C. Edquist, The choice of innovation policy instruments, *Technol. Forecast. Soc. Change* 80 (2013) 1513–1522.
- [26] C. Nauwelaers, P. Boekholt, B. Mostert, P. Cunningham, K. Guy, R. Hofer, C. Rammer, *Policy Mixes for R & D Europe*, (2009).
- [27] P. del Rio, Analysing the interactions between renewable energy promotion and energy efficiency support schemes: the impact of different instruments and design elements, *Energy Policy* J. 38 (2010) 4978–4989.
- [28] S. Huttunen, P. Kivimaa, V. Virkamäki, The need for policy coherence to trigger a transition to biogas production, *Environ. Innov. Soc. Trans.* 12 (2014) 14–30.
- [29] J. Rosenow, T. Fawcett, N. Eyre, V. Oikonomou, J. Rosenow, T. Fawcett, N. Eyre, Energy efficiency and the policy mix, *Buuld. Res. Inf.* 44 (2016) 562–574.
- [30] U. Cantner, H. Graf, J. Herrmann, M. Kalthaus, Inventor networks in renewable energies: the influence of the policy mix in Germany, *Res. Policy* 45 (2016) 1165–1184.
- [31] A. Mahzouni, The policy mix for sustainable urban transition: the city district of Hammarby Sjöstad in Stockholm, *Environ. Policy Gov.* 25 (2015) 288–302.
- [32] E. Uyarra, P. Shapira, A. Harding, Low carbon innovation and enterprise growth in the UK: challenges of a place-blind policy mix, *Technol. Forecast. Soc. Change* 103 (2016) 264–272.
- [33] L. Bontoux, D. Bengtsson, Using scenarios to assess policy mixes for resource efficiency and eco-innovation in different Fiscal Policy frameworks, *Sustainability* 8 (2016) 309.
- [34] M.P. Hekkert, S.O. Negro, Functions of innovation systems as a framework to understand sustainable technological change: empirical evidence for earlier claims, *Technol. Forecast. Soc. Change* 76 (2009) 584–594.
- [35] A. Bergek, Shaping and Exploiting Technological Opportunities: The Case of Renewable Energy Technology in Sweden, Chalmers University of Technology, 2002.
- [36] S. Jacobsson, A. Bergek, Transforming the energy sector: the evolution of technological systems in renewable energy technology, *Ind. Corp. Change* 13 (2004) 815–849.
- [37] M.P. Hekkert, R.A.A. Suurs, S.O. Negro, S. Kuhlmann, R.E.H.M. Smits, Functions of innovation systems: a new approach for analysing technological change, *Technol. Forecast. Soc. Change* 74 (2007) 413–432.
- [38] H. Kampeidis, B. Kasselouri, P. Kodinari, Evaluating policy options for increasing the RES-E penetration in Greece, *Energy Policy* 39 (2011) 5388–5398.
- [39] T. Creten, S. Happaerts, K. Bachus, Evaluating transition management: synergies between old and new approaches, 5th International Sustainability Transitions Conference, Utrecht (the Netherlands), 26–28, August, 2014, 2014.
- [40] F. Boons, C. Montalvo, J. Quist, M. Wagner, Sustainable innovation, business models and economic performance: an overview, *J. Clean. Prod.* 45 (2013) 1–8.
- [41] M.B. Hansen, E. Vedung, Theory-based stakeholder evaluation, *Am. J. Eval.* 31 (2010) 295–313.
- [42] L. Murphy, F. Meijer, H. Visscher, A qualitative evaluation of policy instruments used to improve energy performance of existing private dwellings in the Netherlands, *Energy Policy* 45 (2012) 459–468.
- [43] H.F. Hansen, Choosing evaluation models, *Evaluation* 11 (2005) 447–462.
- [44] H. Nykamp, A transition to green buildings in Norway, *Environ. Innov. Soc. Trans.* 24 (2016) 83–93, <http://dx.doi.org/10.1016/j.eist.2016.10.006>.
- [45] J. Fischer, S. Guy, Re-interpreting regulations: architects as intermediaries for low-carbon buildings, *Urban Stud.* 46 (2009) 2577–2594.
- [46] A. Ely, P. Van Zwanenberg, A. Stirling, Broadening out and opening up technology assessment: approaches to enhance international development, co-ordination and democratisation, *Res. Policy* 43 (2014) 505–518.
- [47] IEA, Energy Policies of IEA Countries, Finland 2013 Review, International Energy Agency (IEA), Paris, 2013.
- [48] PMO, 2011. Pääministeri Jyrki Katainen hallituksen ohjelma 22.6.2011 [the programme of Prime Minister Jyrki Katainen's government 22.6.2011]. Prime Minister's Office, Finland.
- [49] C. Sabel, J. Zeitlin, Experimentalist governance, in: D. Levi-Faur (Ed.), *The Oxford Handbook of Governance*, Oxford University Press, Oxford, 2012, pp. 169–186.
- [50] P. Kivimaa, A. Temmes, Low Carbon Transition in Finnish Mobility: The clash of experimental transport governance and established practices? in: D. Hopkins, J.E.S. Higham (Eds.), *Low Carbon Mobility Transitions*, Good Fellow Publishers, Oxford, 2016.
- [51] P. Kivimaa, M. Martiskainen, Innovation, low-energy buildings and intermediaries in Europe: Systemic case study review, *Energy Effic.* (2017) (in press), <https://link.springer.com/article/10.1007/s12053-017-9547-y>.