Energy Research & Social Science 60 (2020) 101315

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Problems, solutions, and institutional logics: Insights from Dutch domestic energy-efficiency retrofits

Alco Kieft*, Robert Harmsen, Marko P. Hekkert

Copernicus Institute of Sustainable Development, Utrecht University, PO Box 80115, Utrecht 3508 TC, the Netherlands

ARTICLE INFO

Keywords:
Problems
Domestic
Energy-efficiency
Institutional logics
Retrofits
Solutions

ABSTRACT

This paper analyzes the logics that underlie two distinct approaches to energy-efficiency retrofits in the Netherlands. It is explained how these logics lead to differing viewpoints on problems and solutions on the road to scale-up of such retrofits. For this, the paper makes use of the institutional logics approach. The institutional logics approach can be used to understand the reasoning that lies behind material practices and is here applied to two renovation approaches. Institutional logics theory can also explain why actors focus their attention on certain problems and solutions, namely, they focus on the ones consistent with the institutional logics that guide them. The thorough understanding of the empirical domain hereby achieved facilitates the policy formulation process and helps to set suitable system boundaries within frameworks for analyzing technological change processes.

1. Introduction

Energy-efficiency retrofits not only play an important role in reducing CO_2-emissions in the Netherlands but may also reduce heating-costs and increase comfort. As answer to the Paris Agreement, Dutch actors have negotiated a Climate-agreement (Klimaatakkoord) in which the build environment is given the substantial target of reducing 2,4 megaton of CO_2 in 2050. For this, seven million houses and one million other buildings must undergo energy-efficiency retrofits. This is no easy task and a wide range of hurdles must be overcome. Unfortunately, consensus of what the hurdles are, and what solutions should be focused on, is lacking.

Energy-efficiency retrofits can be approaches in many different ways, of which two approaches have become dominant in the Netherlands. The first approach entails stacking individual energy-efficiency measures for particular houses. Owners, either homeowners or housing associations, can take a single measure (e.g. wall-insulation, double glazed glass, a heat pump, a low-temperature heating system,) or may implement multiple measures at once. Such renovations are usually implemented by small- and medium sized companies who specialize in one or a couple of measures. Although the technologies implemented are mostly novel, the approach to combining measures is in line with how renovations have been performed for decades. The second approach is more holistic and revolves around developing renovation plans for particular types of houses, e.g. row houses or flat buildings built with similar construction methods. This leads to so-called renovation concepts, which consist of integrated energy-efficiency measures fit for renovating particular types of houses. Larger construction companies with experience of serial construction in the market for newly-build houses introduced this more serial approach into the renovation sector. Although the technologies used in both approaches are both novel and similar, the way that these technologies are combined differs substantially. Proponents of these renovation approaches perceive vastly different problems and solutions on the road to large-scale energy-efficiency retrofits in the Netherlands. This paper presents an in-depth analysis of these two distinct approaches to energy-efficiency retrofits and the differing viewpoints on problems and solutions to which they lead.

To reach an in-depth understanding of the reasoning that lies behind both renovation approaches we draw on the concept of institutional logics[1] [1]. Institutional logics comprise the cultural knowledge that is available to social actors [2] and are defined as “the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality.” ([3], p804). Fuenfschilling and Truffer [4] put it

* Corresponding author.
E-mail addresses: a.c.kieft@uu.nl (A. Kieft), r.harmsen@uu.nl (R. Harmsen), m.p.hekkert@uu.nl (M.P. Hekkert).

[1] The concept of institutional logics is closely related to the concepts of ‘discourses’ and ‘truth regimes’, as these also ‘represent a particular way of viewing reality’ ([14], p.13). Smink et al. [40] already showed that mismatching institutional logics help explain differences in discourse between actor groups during sustainability transitions [40].

https://doi.org/10.1016/j.erss.2019.101315
Received 27 November 2018; Received in revised form 1 September 2019; Accepted 26 September 2019

this way: "How actors make sense of and act upon reality is contingent on prevailing institutional logics" (p.774). Logics are furthermore "realized in actors' material practices: what people do and how they do it." ([5], p446). In this paper, we show how the two competing renovation approaches in the Netherlands are reflections of conflicting institutional logics.

Empirical domains where actors are guided by more than one institutional logic can show differing perceptions of what situations are seen as problematic and what solutions are brought forward [6]. This is the result of actors - often unconsciously - drawing on these logics during the process of 'sensemaking, problem solving, decision making, and coordination' [1][2]. An explanation of why perceptions of problems and solutions in relation to Dutch energy-efficiency retrofits conflict may thus lie in multiple institutional logics guiding actor behavior. We therefore asked the question what institutional logics guide actor behavior in this empirical domain, and what insights do these provide for understanding the stance of actors on problems and solutions.

The following sections proceed as follows. First, the case of Dutch domestic energy-efficiency retrofits is discussed in further detail and demarcated. Subsequently, the method section discusses our research design. The results section then presents two institutional logics that guide action in our case study and shows how these logics shed light on why actors perceive different problems and solutions. At the end we reflect on the formulated ideal-type logics, on the research design, on implications for the policy formulation process and discuss implications of the identified logics in this empirical domain for further analyzing the process of technological change.

2. The case of Dutch domestic energy-efficiency retrofits

The Netherlands counts about 7.7 million homes of which 4.4 million are owned by homeowners, 2,3 million by housing associations and 1 million by private landlords [7]. The percentage of houses owned by housing associations is high compared to other European countries [8]. For the analysis, we focus on houses built before 1992. In 1992 the regulatory requirements for heat-insulation were significantly increased,[3] giving older houses generally weak insulation and thus high improvement potential. Additionally, targeting such houses is often cost-effective, because taking energy-efficiency measures can be combined with general maintenance activities. In the Netherlands, there are 5.7 million of such houses [9].

To renovate a house using energy-efficiency technologies, multiple technologies may be combined, for instance insulation, heat pumps and solar technologies. Construction companies and installers make use of these technologies during energy-efficiency retrofits commissioned by housing associations or homeowners. We define the case under study as a sector that makes use of a diverse set of energy-efficient retrofit technologies.

Although much research on institutional logics has focused on institutionalization at societal level (e.g. [[10],[11]]), the meta-theory is broad enough to facilitate research at other levels of analysis [2]. In their words, "institutional logics may develop at a variety of different levels, for example organizations, markets, industries, inter-organizational networks, geographic communities, and organizational fields" ([2], p106). When a researcher focusses on such so-called field level logics, it is important that the level at which institutionalization occurs is made clear [2]. Since the field level logics discussed in this paper guide construction companies and installers in how to combine technologies within energy-retrofits, their institutionalization occurs at sectoral level.

Research that sees technological development as desirable is inherently normative (e.g. [12]). Being normative in relation to technological development is however not problematic as long as the normativity is disclosed and justified [13]. The many societal advantages of energy-efficiency retrofit technologies, including reduction of household costs, increased comfort and reduction of CO_2 in our view justify a technology-focused analysis. In addition, research projects focusing on energy-efficiency retrofits are also often normative in relation to the importance of climate change. In this research project our striving has been to remain as neutral as possible on this subject. Interviewees were selected solely based on their experience/expertise with the two renovation approaches under study. During the interviews, it was also left in the middle for what reason energy-efficiency retrofits were desirable (either reducing CO_2-emissions, comfort increase or reduction of household costs). The two identified logics are reflections of the viewpoints as expressed by the interviewees and, as will be shown, also reflect differing viewpoints on the importance of reducing CO_2 in relation to other advantages of energy-efficiency retrofits.

3. Method

Institutional logics as concept is a meta-theory but also a method of analysis [2]. Reay and Jones [5] discuss three ways to identify logics, namely pattern deducing, pattern inducing and pattern matching. Pattern deducing captures logics through quantifying qualitative data, for instance, by counting the co-occurrence of words. Pattern inducing relies upon a bottom-up inductive approach based on coding (labelling) texts. Contrasting these first two techniques, pattern matching starts with formulating so-called 'ideal-type' institutional logics,[4] where each ideal-type logic is associated with a different pattern of expected behavior. They are a deliberate simplification of reality (stereotypes): "ideal types are not for describing an organizational field, but instead are theoretical models for comparing the effects of various meanings" ([2], p110). Methodologically, analysts first distill ideal-type logics - and the associated expected pattern of behavior - from theories and/or an otherwise created understanding of the field under study. These expected patterns of behavior as expressed by the ideal-type logics are subsequently compared to empirical data to see how well they match. In this paper we make use of the pattern matching technique.

The first research step was formulating ideal-type logics. To complement the knowledge we already had as a result of earlier research projects, we followed a human-centered research method [14] that focused on interviewing people with a good overview of the field, for example consultants. Since logics are realized in actors' material practices, we initially focused on understanding how actors in the Netherlands approach renovation projects. This made clear that - in the Netherlands - two substantially different renovation approaches can be distinguished: one based on stacking energy-efficiency measures, and a more holistic one revolving around renovation concepts. Subsequently, to deepen our understanding of these approaches, additional sources were consulted, for instance documents and websites that advocate them and professional magazine articles in which they are compared. Finally, in depth interviews with experts on both renovation approaches were performed. This led to the formulation of two conflicting 'ideal-type' institutional logics. For each logic, we described the expected actor behavior and how this materializes into two distinct renovation approaches.

The second research step consisted of identifying perceptions on problems and solutions, for which we used a combination of interviews, websites and professional magazines. The depth of the interviews was considered more important than the quantity of interviews. Interviews

[2] Although this means that action is restricted by the institutional logics that are prominent in a certain field, actors also influence the institutional logics through the process of institutional entrepreneurship. [41].

[3] From 1992, the Building Code prescribes a minimum heat-insulation for all construction components of Rc 2.5 m^2K/W.

[4] The idea of logics as 'ideal-types' also originates from Max Weber [42].

lasted two hours on average. We started with interviewing people recommended by the earlier interviewees and worked from there (snowball sampling). In total, twenty interviews were conducted with government officials, housing associations, product suppliers, energy cooperatives, construction companies and advisors/consultants. Additionally, websites of retrofit initiatives were consulted, because they explain what problem the initiative tackles and how it provides the solution. Finally, professional magazine articles often contain data on perceived problems and possible solutions. We had access to articles from two professional magazines.[5] Data collection continued until theoretical saturation was achieved. The interviews were transcribed into text and subsequently analyzed together with earlier mentioned data. The analysis started with open coding[6] [15] of both problems and solutions[7] after which coded fragments were grouped into categories according to the guidelines on focused coding [16].

The third step related the identified problems to the characteristics of the formulated ideal-type logics. The interviews proved most useful here. The interviews had allowed asking successive 'why' questions which had stimulated interviewees to articulate their reasons. These reasons provided the information to link a problem to a certain logic characteristic. For example, an interviewee that mentioned the problem of a high tax on electricity explained that this inhibited the unavoidable and necessary transition from fossil fuels to sustainable electric technologies. Additionally, some problems could also logically be related to an ideal-type characteristic. For example, a lack of production capacity for prefab construction parts is only problematic when centralized prefab fits the practice associated with a particular logic. In this way, the characteristics of the ideal-type logics provided the coding scheme to which the problem perceptions were linked. In the fourth step, this exercise was repeated for the identified solutions.

4. Results

The results are presented in five consecutive sections, of which the first four represent the four steps of our research design. The first section presents two ideal-type logics – the *steps* and the *leaps* logic. Both reflect substantially different approaches to renovating houses for energy-efficiency. The second section first addresses the origin and emergence of both logics and subsequently explains what a renovation looks like and how the renovation process is organized when actors are guided by either logic. Then, the third section shows how actors that act within these logics judge the same situation differently, leading to different perceptions of problems. Subsequently, the fourth section illustrates how – even if a situation is considered problematic within both logics – the sensible solution varies. Finally, section five discusses the extent of institutionalization of both ideal-type logics in practice.

Before we begin, it is important to note that when the leaps logic was initially introduced, renovation projects were organized in accordance with *either* the steps logic *or* the leaps logic. However, as the popularity of the leaps logic increased, renovation projects gradually started to reflect a combination of both logics. Nowadays, renovation projects are approached in a multitude of ways, always somewhere on the spectrum between the two extremes as set by the two ideal-types. Despite that they have started to blend, it can still be observed whether a renovation project leans more toward the steps logic or to the leaps logic. We will come back to this 'blending' of both logics in section 5.5, but for now focus on the extremes in the form of the ideal-types.

4.1. Ideal-type logics

An overview of the characteristics of both ideal-type logics can be found in Table 1. The rest of this section will explain the associated pattern of behavior in more detail, whereby the terms used in the table are shown in *italics* in the text.

The Steps logic reflects a *pragmatic stance* toward renovation. It is more important that measures are easy to implement and cheap than that high reduction of energy-use and CO_2-emissions is achieved. The motivation for housing associations is characterized by *compliance* to reaching sectoral goals, whereas the main motivation for homeowners is characterized by achieving *quick wins* in terms of financial gains or comfort increase. The preferred approach revolves around *adaptation* of the house and focusses on implementing *individualistic* measures that fit the criteria of low investment cost, high financial gains and little hassle. Furthermore, *flexibility* is an important value for actors that act within this logic, which builds on the argument that every house, homeowner, and renter is unique. Persuading homeowners to renovate is considered easier when the proposition is tailored to their needs and preferences, and fits the current structure of the house. For example, solar panels are placed around an already existing dormer, the number of installed solar panels depends on household energy-use, and aesthetic preferences of the homeowner determine the choice for a certain type of solar panel (mono, poly or thin-film). Persuading renters to accept a renovation[8] as proposed by a housing association is also considered easier if the proposition is tailored to specific renter needs. Additionally, housing associations and homeowners that act within this logic value the *flexibility* of choosing for a few measures now, while keeping the option open to take additional measures later. Actors guided by this logic are supporters of renovating houses in consecutive steps.

The Leaps logic reflects a more *idealistic stance* toward renovation. Combatting climate change is an important driver and making the housing stock energy-neutral is a means to this end. The main motivation for housing associations is characterized by *commitment* to creating an energy-neutral housing stock, whereas the motivation for homeowners is characterized by achieving *significant change*, both in terms of sustainability and in comfort increase. To make leaps toward energy-neutrality possible, a *transformation* of the house is considered necessary. This requires a *holistic* focus, in which measures are not judged independently, but collectively. Finally, *efficiency* is an important value for actors that act within this logic. Cost-efficiency is considered crucial to persuade housing associations and homeowners to go beyond the quick wins, and process efficiency is the designated path toward reducing the inconveniences of renovation activities. Since the idealistic stance of this logic requires immediate and substantial action, the lack of flexibility in terms of choosing and timing measures is accepted. Actors guided by this logic are supporters of renovating houses in leaps.

4.2. Renovations in accordance with the steps logic and the leaps logic

The rest of this section shortly describes the origin of both logics and portrays the distinct renovation approaches that they induce. The renovation approaches discussed below are realizations of the ideal-type logics in material practice. Table 2 provides an overview of how a renovation is organized, depending on which ideal-type logic guides actor behavior. In the subsequent text, the terms used in the table are again shown in *italics* in the text.

The origin of the steps logic lies in the traditional renovation sector. Originally, there were roughly four reasons to renovate a house, namely periodic maintenance, necessary repairs, house upgrades (e.g. new bathroom, dormer), and comfort increase (e.g. double glazing). The

[5] We had access to articles from two professional magazines, namely Energy & ICT and Klimaat & Sanitair as published by the sector organization for installation companies UNETO-VNI.

[6] A synonym for this term is *initial coding* [16].

[7] For this purpose, the Computer Aided Qualitative Analysis Data Software (CAQDAS) NVivo was used. NVivo qualitative data analysis software; QSR International Pty Ltd. Version 10, 2012.

[8] In the Netherlands, a housing association is only allowed to renovate after the consent of 70% of renters.

Table 1
Ideal-type institutional logics in relation to Dutch energy-efficiency retrofits.

	Steps logic	Leaps logic
Stance	*Pragmatic*	*Idealistic*
Motivation for housing associations	*Compliance*	*Commitment*
Motivation for homeowners	*Quick wins (financial / comfort)*	*Significant change (sustainability / comfort)*
Approach	*Adaptation*	*Transformation*
Focus	*Individualistic*	*Holistic*
Values	*Flexibility*	*Efficiency*

Table 2
Two renovation approaches depending on the guiding ideal-type logics.

	Steps logic	Leaps logic
Goal	*Steps in Energy Label / Energy Index*	*Leaps to Net-Zero-Energy*
Cost criterion	*Investment costs and payback time*	*Cost-neutral*
Measures combining	*Stacked (often only the quick wins)*	*Integrated*
Nature of solutions	*Customization*	*Standardization*
Production location	*Decentralized*	*Centralized*
Energy carrier	*Hybrid (electricity and gas)*	*All-electric*
Company size	*Small and medium sized companies*	*Larger companies and consortia of medium sized companies*
Upfront company investment	*Low*	*High*
Deep renovation	*Exception*	*Norm*

sector had for long been dominated by relatively small companies that specialized in a certain type of renovation activities (painting, placing dormers, replacing installations, making constructional modifications etcetera). It was already then common practice that multiple companies are involved in a single renovation project. A fifth reason to renovate a house emerged when attention for energy-efficiency and renewable energy production increased. Companies added energy-efficiency measures and renewable technologies to their existing portfolio (e.g. insulation and solar panels) and new specialized companies entered the market. In line with the working methods of the traditional renovation sector, actors guided by this logic are supporters of a step-wise approach for implementing energy-efficiency measures and renewable energy technologies, where each company involved only takes responsibility for its own work.

Renovation projects organized in accordance with the steps logic usually set the goal of improving the house's *Energy Label* or *Energy Index*. The Energy Label runs from G to A and indicates energy performance. Each type of energy-efficiency or energy-production measure represents a certain improvement in the Energy label of the house. For example, for a house that has an F label, insulating the walls may mean an increase to C, additionally placing solar panels can bring the Label to B, and finally installing a heat pump may lead to Label A. The contribution of a measure to the improvement of the energy performance (the number of made Label steps) is calculated using the Energy-index methodology. For example, Label B corresponds with an Energy-Index of 1.25.[9] The main cost criteria for selecting measures are the *investment costs and payback time of individual measures* and they are combined by *stacking* them (*often only the quick wins*). Since every renovation project is considered unique, the quick wins may be different for each renovation project and actors thus strive for *customization*. The pragmatic stance and adaptation approach that belong to this logic have as consequence that houses – after renovation - generally keep using a *hybrid* of gas and electricity. Full substitution of gas for electricity requires making substantial simultaneous changes to a house (e.g. thorough insulation, heat pump + radiant floor heating), which does not fit the step-wise approach that is associated with this logic. Since adaptation of the house is strived for, most renovation activities are performed on location (*decentralized*). What is more, this approach is especially prominent with *small- and medium sized companies*. Upfront company investments are *low*, and a step-wise approach fits well their specialization on one or a couple of measures. For example, an insulation company can contribute to making a couple of Label steps, but cannot on its own perform a deep renovation. When actors are guided by this logic, deep renovation is the exception.

The roots of the leaps logic lie in the market for constructing new houses. In the Netherlands, the process of constructing new houses is largely standardized, which is achieved by using standard house designs that are easy to build in series. The sheer size of these housing projects led larger construction companies to dominate the market. These larger construction companies had earlier not shown much interest for renovation. However, this changed after the demand for new houses plummeted during the 2008 financial crisis. As might be expected, their renovation propositions resembled their working methods in the market for new houses. This led to the introduction of a new logic to the market for house renovation that revolved around taking leaps.

Renovations organized in accordance with the leaps logic generally set the goal of reaching *Net-Zero-Energy* (in Dutch Nul-op-de-Meter or 'Zero-on-the-meter'). Net-Zero-Energy is reached when, annually, the amount of energy produced is equal to the energy-use of an average family. Actors choose to transform the house, for instance, replacing the whole house façade with a well-insulated one, replacing the gas-boiler with a heat-pump, and replacing the radiators with floor- or wall heating. The main cost criterion for investment is that the renovation is *cost-neutral*, which means that the payback time of the investment must at least coincide with, or must be lower than, the economic lifetime of the renovation. To achieve this, actors take a holistic focus, which leads measures to be *integrated* as much as possible. For instance, both solar panels and a heat pump are integrated in the roof. Furthermore, actors strive for *standardization* of the renovation process. This is done by creating standardized packages of measures, for which Renovation Concept is a common term. What is more, actors choose to pre-fabricate construction parts in a *centralized* factory and then transport them to the house. At the house, these prefab construction parts are subsequently installed in a matter of days. The idealistic stance makes that natural gas is intrinsically considered unsustainable and undesirable. This generates a strong preference for an *all-electric* solution for hot tap water and heating. Other reasons brought forward to go all-electric are that it makes calculating Net-Zero-Energy easier, and that it reduces network costs. Since the upfront investments to create a renovation concept and establish the prefabrication location are *high*, a company needs to have substantial financial resources available. This explains why developers of renovation concepts are generally *larger companies or consortia of medium sized companies*. When actors are guided by this logic, deep renovation is the norm.

[9] Housing associations recently switched from using both the Energy Label and the Energy Index to using the Energy Index only.

4.3. Institutional logics and the perception of problems

In this section, we discuss how a different guiding logic translates into another perception of the same situation. We give three examples of situations from our data perceived as problematic when sensemaking is shaped by one logic, but not when it is shaped by the other. The three examples relate to 1) the goal of housing associations to reach Energy Label B[10] on average in 2020, 2) a lack of financial resources for pilot project, and 3) the higher tax for electricity than for gas. Table 3 provides an overview of whether these situations are - depending on the guiding logic for interpreting these situations - considered problematic or not and how they are perceived.

The goal of housing associations to reach Label B on average in 2020 is part of a national-wide energy covenant called the Energieakkoord [17]. To reach this goal, many housing associations choose to renovate all their houses to Label B, even though – since the goal is label B *on average* - they can also choose to renovate some houses to energy-neutral and others not at all. When sensemaking is shaped by the steps logic, there is nothing wrong with this situation as each label step contributes to a more energy-efficient housing stock. Taking additional steps is considered something for later concern. Contrasting this, when sensemaking is shaped by the leaps logic, every measure is seen to create sunk costs, and in this way, to reduce the feasibility of taking a single leap to Net-Zero-Energy by using a renovation concept. Thus, depending on the logic, this goal by housing associations is either considered a driver for change or an obstacle.

The second example relates to a lack of financial resources for pilot projects. When the leaps logic guides sensemaking, additional financial resources are still necessary to further develop and test the integration of technologies as renovation concepts are still in the development phase. However, when the steps logic guides sensemaking, further pilot projects are considered unnecessary because all individual technologies are already thoroughly tested. Thus, depending on the logic, money that goes toward pilot projects is either well spend or a waste.

The final example involves the relatively high electricity tax compared to the gas tax.[11] An organization or person whose action is shaped by the leaps logic will consider this problematic as it makes the business case for going all-electric less attractive. Contrasting this, since in the steps logic all-electric technologies are not idealistically preferred over gas-based technology, this same situation is not considered problematic. There are sufficient technologies available that decrease gas-usage (e.g. a hybrid heat pump or a more efficient gas-boiler) and these are all considered viable steps toward an energy-neutral housing stock in the longer term. Thus, depending on the logic, the current energy tax laws are either unfair or fine.

4.4. Institutional logics and the perception of solutions

In this section, we discuss how the perception of solutions depends on the logic used by actors during problem solving. We discuss three situations that were considered problematic by all actors, namely the incompetence of specialized companies, uncertainties in relation to the energy performance of measures, and the inconvenience of renovation activities for homeowners and renters. For each of these problems, we discuss how the solution depends on the guiding logic during problem solving. Table 4 provides an overview of what solutions are proposed depending on the guiding logic.

The first example relates to the incompetence of specialized companies. They are said to be knowledgeable about only a few types of measures, to give selective advice, and to make mistakes during installation. When actors draw on the Steps logic, the most sensible solution for this problem lies in educating them, for instance, through nationally organized educational programs. Contrasting this, actors that draw on the leaps logic propose to circumvent specialized companies all together and move the end-responsibility to better organized concept developers. Thus, depending on the guiding logic, specialized companies should either be empowered or forsaken.

The second example relates to uncertainties around the energy performance of taken measures. Any uncertainty in relation to how much energy (and thus costs) can be reduced, creates reluctance to invest. Providing energy performance guarantees is in theory a solution to this. However, when problem solving is guided by the steps logic, implementing such a guarantee is considered hardly feasible because the energy performance of individual measures is dependent on measures installed by other companies. Companies are very reluctant to take responsibility for someone else's work. In contrast, when problem solving is guided by the leaps logic, providing performance guarantees as solution is considered feasible because the whole renovation is performed under supervision of one concept developer (which can also be a consortium of companies). Thus, depending on the guiding logic, providing energy performance guarantees as solution is thus either feasible or infeasible.

In the final example, different solutions are proposed for the inconvenience of renovation activities for homeowners and renters. Since the steps logic materializes into a decentralized approach with renovation activities taking place on-site, solutions are found in adequate manners and friendly communication by workmen. For instance, always taking off shoes before entering the house, explaining what the activities for that day entail, and making sure that no delays take place. Contrasting this, the leaps logic materializes into a centralized approach where construction parts are prefabricated in a factory. This reduces on-site activities significantly and in this way reduces the inconvenience for homeowners and renters. Clearly, depending on the guiding logic, the solution for the same problem can be quite different.

4.5. Institutionalization of the ideal-type logics

The steps logic was the dominant logic before the leaps logic was introduced. Since a renovation plan is created for each house individually, a steps logic retrofit is suitable for any type of house. The dominance of the steps logic was challenging in 2009 when the Energiesprong program, initiated by the Dutch government, started to advocate the use of concepts for retrofits. Concepts were already common practice on the market for new houses, but were new for renovations. Of course, this sparked the interest of construction companies that already had experience with such concepts. In terms of clients, this development mainly sparked interest of housing associations which ultimately led to the formation of the covenant *Stroomversnelling Huurwoningen* (rough translation: *acceleration rental homes*). The covenant was signed by a consortium of housing associations and large construction companies who set the goal to renovate 111.000 houses using renovation concepts toward Net-Zero-Energy in 2020. Because pilots took longer than expected, around 10.000 have been renovated up to 2019. Renovation concepts remain prominent in current sector plans [18]. The renovation concepts developed by the Stroomversnelling covenant are suitable for row houses constructed in the 1960s and 70 s, and flat buildings build between 1940 and 1970, which amounts to ~700.000 houses or ~35% of the houses owned by housing associations in the Netherlands [9]. Since all houses suitable for using renovation concepts can also be renovated by a step-wise approach, both renovation approaches currently battle for dominance in this market segment. Thus, although some housing associations follow the leaps logic in a relatively ‘pure’ form, they do so only for a part of their housing stock.

For the market of homeowners, a similar covenant was initiated in

[10] This is equivalent to an Energy Index of 1.25.

[11] This can be achieved, for instance, by relating the energy tax to the energy contents of the energy carrier (euro per GJ) instead of to kWh and m^3. Even after the recent increase of the gas tax, and the decrease of the electricity tax in 2016 [43], the gas tax is still a factor 4 higher per GJ.

Table 3
Varying problem perceptions for two conflicting ideal-type logics.

Situation	Problem under Steps logic	Problem under Leaps logic
Goal by housing associations of Label B on average in 2020.	**No** Every small step contributes to a more energy efficient housing stock and additional steps are always possible later.	**Yes** Every small step reduces the feasibility of using a Renovation Concept.
Lack of financial resources for pilot projects.	**No** Technologies have already been thoroughly tested and are ready for implementation.	**Yes** The integration of technologies needs more testing.
Electricity tax relatively high compared to gas tax.	**No** All-electric is not preferred over gas-based technologies.	**Yes** Electrification of the housing stock is necessary and unavoidable. The high electricity tax inhibits this transition.

Table 4
Varying solutions for two conflicting ideal-type logics.

Problems	Solution following Steps logic	Solution following Leaps logic
Incompetent specialized companies.	Educate them.	Circumvent them.
Uncertainties around energy performance of measures.	Providing a performance guarantee for individual measures is not feasible.	Providing a performance guarantee for the whole renovation is feasible.
Inconvenience of renovation activities.	Adequate manners and friendly communication of workmen.	Use of prefab construction parts. On-site activities are limited.

2014 (*Stroomversnelling Koopwoningen* [rough translation: *acceleration owner-occupied houses*]). This covenant focussed on developing concepts for row houses built between 1950 and 1980, which are ∼600.000 houses, or ∼19% of the total houses in this market segment [9]. Developing renovation concepts for homeowners is more challenging than for the rental market for two main reasons. First, since ownership is much more dispersed, even row houses that were alike when they were built may currently be very diverse (e.g. newly placed dormers or extensions). Second, instead of a handful of housing associations, concept developers now have many homeowners as client, each with their own preferences. Thus, renovation concepts for the homeowner segment must be more flexible. What is more, concept developers that focus on homeowners are generally smaller companies that were formerly guided by the steps logic, and this can still be seen in how they organize the renovation process. After pilot-projects proved more challenging than expected, the covenant stopped in 2016. Together, this leads the leaps logic for the market segment of homeowners to be watered down in the direction of the steps logic.

The introduction of the leaps logic also led to changes in the institutionalization of the ideal-type steps logic. Although actors guided by the steps logic initially considered customization absolutely necessary, some actors now advocate using standardized packages of stacked measures. Interestingly, some have started to use the term ‘concept’ for such packages, even though these packages have little in common with the renovation concepts associated with the leaps logic. Thus, also the steps logic is watering down as reaction to the increasing popularity of the leaps logic. These results show that - although the steps and label logics are still clearly visible in the empirical domain of domestic energy-efficiency retrofits - they are slowly moving away from some of their ‘ideal-type’ characteristics and have started to blend.

5. Discussion

In this section we first reflect on the formulated ideal-type logics from the perspective of the institutional logics meta-theory. Subsequently, we deliberate on the implications of multiple logics for the policy formulation process. The research design is also reflected upon. Finally, we discuss how the two institutional logics presented in this paper have consequences for how this empirical domain may be conceptualized within common frameworks for analyzing the process of technological change.

5.1. Reflections on the identified ideal-type logics

The institutional logics meta-theory describes that field level logics are anchored in and shaped by higher institutional orders of society: state, market, profession, corporation, family, and community [1]. We argue that the Label step logic is - because of the prominent role for smaller specialized companies - anchored in the order of the profession, and - because of its decentralized focus - to the order of the community. Contrasting this, the leaps logic is anchored in the order of the corporation: it has its roots in the market segment of newly-built houses which is dominated by larger corporations. The role of the state and the position of the market are uniform for the whole renovation sector, and thus also for the two ideal-type logics. Finally, the order of the family is not applicable, considering the low number of family run companies in the market for renovating houses.

The steps- and leaps logics explained the pattern of inconsistency within our identified problems and solutions well. Our goal, namely to explore whether formulating ideal-type logics leads to a better understanding of why the perceptions of problems and solutions in this empirical domain conflict was thus reached.[12] If further analyzing the institutionalization of these logics is desired, there are multiple methods through which this can be achieved [5].

5.2. Implications for the policy formulation process

Consistency between policy interventions has been emphasized not only for energy transitions more general (e.g. [19–25]) but also specifically for the energy efficiency transition of buildings (e.g. [26]). An important aspect therein is whether the interventions are legitimate in the eyes of all relevant actors. When action is guided by more than one logic this is not self-evident. If not careful, an intervention set may stimulate innovations in agreement with one logic, but block innovations in agreement with another logic thus undermining legitimacy of the proposed interventions. Formulating interventions based on a thorough understanding of existent viewpoints, e.g. through analyzing logics, may contribute to the legitimacy of the proposed intervention set.

A policy mix specific for advancing energy-efficiency retrofits in the

[12] That increased understanding (verstehen) is a viable goal for scientific research is in line with Max Weber [42] who introduced the concept of ideal-type logics.

Netherlands could involve both interventions that stimulate particular technologies, and interventions that stimulate each renovation approach. Stimulating technologies like heat pumps or insulation through for instance subsidies may advance retrofits in general and thus be legitimate in the eyes of proponents of both steps- and leaps logic renovations. In addition, interventions that stimulate one type of retrofits while not affecting the other may also be accepted. For instance, reducing the electricity tax may stimulate the mostly all-electric leaps-logic retrofits while not affecting the rationale for steps logic retrofits other than possibly a different choice for technologies. Finally, leaps logic retrofits are restricted to particular types of houses, whereas steps logic retrofits are not. By stimulating steps retrofits especially for houses unfit for leaps retrofits (e.g. historic or otherwise unique homes), the market for leaps retrofits remains substantial enough for actors to keep investing.

5.3. Research design

The focus in data collection was placed on supply-side actors. End-users, in the form of either homeowners or renters, were only indirectly included. It was a conscious choice to approach the topic of energy-efficiency retrofits from the supply-side since the origin of both the steps- and leaps logics lie there. In addition, supply-side actors were found very conscious of the role and preferences of end-users. For instance, construction companies involve homeowners during the development of renovation concepts and the homeowner is the focal point during pilot projects. The preferences of homeowners and renters were discussed in-depth during the interviews, based on which the logics were formulated. External validity may be further improved by expanding the analysis to actor groups that were not considered (e.g. private landlords) or indirectly considered (e.g. end-users).

Novelty of research may be found in theoretical, methodological or empirical contributions [27]. The novelty of the here presented analysis is mostly empirical and lies in the analysis of the two Dutch retrofitting approaches, and in the understanding that the formulated logics provide in why actors perceive different problems and solutions. Although not explored in this paper, institutional logics theory and associated methods may benefit research on technological change processes. Some considerations for setting suitable system boundaries for this empirical domain within common frameworks for analyzing technological change processes are discussed next.

5.4. Institutional logics and technological change processes

Two prominent frameworks for analyzing technological change processes are the Multi-Level-Perspective (MLP)[13] and the Technological Innovation Systems (TIS) framework. Both are fit for analyzing the process of technological change in relation to Dutch domestic energy-efficiency retrofits and utilizing either one will lead to additional insights within this empirical domain. The two institutional logics identified as part of this paper help in setting suitable system boundaries for this empirical domain within these two frameworks.

Within the Multi-Level-Perspective (MLP) (e.g. [28]), the process of technological change is conceptualized as competition between the sociotechnical configuration around an old way of doing things (the regime) and one around a new way of doing things (the niche). In addition, landscape forces pressure the regime and thereby provides windows of opportunities for the niche to become more dominant and eventually overthrow the regime. A first option for conceptualizing the empirical domain of energy-efficient retrofits within this framework is to see the leaps logic as niche and the steps logic as the regime. An argument for seeing the steps logic as regime is that steps logic energy-efficiency renovations combine measures similarly to more traditional renovations. In our view, this would however undervalue that the sociotechnical configuration around the steps logic has a different identify in comparison to the one around traditional renovations. First of all, a renovation measure like electric floor heating is much less energy-efficient in comparison to floor heating that utilizes a heat pump, even though comfort increase is similar. This places proponents of energy-efficiency retrofits separate from proponents of renovations for comfort increase only. In addition, the advent of steps logic renovations has led to new actors like energy cooperatives and consultants that help clients to combine individual energy-efficiency measures in the most fruitful way. Startup companies are also initiating pilot- and demonstration projects to investigate new energy-efficiency measures, each of which fits within the steps logic of combining measures. In many ways the sociotechnical system around the steps logic thus has characteristics of a niche. This makes it, in our view, necessary to analyze the sociotechnical configuration around the steps logic separate from the traditional retrofit regime. A second option is therefore to conceptualize the case as two niches (one around the steps logic and one around the leaps logic) that both compete with each other, and with the regime of traditional renovations. By all means, it would be a mistake to set boundaries around the broad niche of domestic energy-retrofits as this would cloud the competition between the largely separate sociotechnical configurations around the steps and leaps logics.

Where the MLP framework is particularly fit to understand historical cases, the TIS framework is a better alternative when the formulation of interventions is aimed for that may stimulate the generation, diffusion and utilization of technological innovations. While the initial focus of the innovation systems approach was the nation [29], researchers have since specified the approach for sectors [30], regions [31] and technological domains [32–35]. A TIS-analysis strives to understand why a particular system shows weak system performance based on a detailed analysis of system dynamics. A TIS-analysis leads to the identification of system weaknesses, often called systemic problems[14] [36] for which solutions in the form of interventions can be formulated. In this way, interventions may increase system performance and thereby improve the chances for further development and implementation of the technology or technologies under study. The complexity of this empirical domain, with its two institutional logics, make that system boundaries may be set in multiple ways, each with own benefits and drawbacks.

Although the foundations of the TIS framework lie in analyzing the system around a single technology and has commonly been used for this purpose (e.g. [[32],[37]]) it is also fit to analyze combinations of technologies. Carlsson et al. [38] for instance explain that it can be fruitfully applied "to a technology in the sense of a knowledge field, to a product or an artifact, or finally to a set of related products and artifacts aimed at satisfying a particular function, such as health care or transport (this third level of analysis is henceforth labeled a competence bloc […])" (p.237). In relation to health care, it is explained that the competence bloc "can be viewed as consisting of parts of several technological systems supplying technological artifacts to the health care sector." (p237). For the case of Dutch energy-efficiency retrofits, this opens up a number of different ways to delineate the system within the TIS framework and to incorporate institutional logics within the analysis. A first option is to perceive only the system around the leaps logic as a TIS since it is the most innovative approach to renovation. However, proponents of the steps logic would then become part of the TIS context against which the TIS is competing. In line with efforts to

[13] See for instance Araújo [44] or Cherp et al. [45] for discussions on where the innovation systems and MLP framework stands in relation to other perspectives on energy transitions.

[14] The terms systemic problem and blocking mechanisms [46] are both prominent in the technological innovation systems strand, whereas system failure is prominent in literature on innovation systems in general [[47],[48]]. For a discussion of the conceptual link between these terms see Kieft et al. [49].

integrate the TIS and MLP frameworks [39], this would effectively conceptualize the steps logic as a regime. However, as also explained above, the steps logic sociotechnical system shows many similarities with a niche. This argues for distinguishing between two TISs, one for the steps logic and one for the leaps logic. The worth of analyzing institutional logics then lies in reaching in-depth understanding of the reasoning on which both TISs are built and on why the perception of problems and solutions by actors in both systems differ. However, making the distinction between two separate TISs runs the risk of placing too much emphasis on only their internal dynamics, thereby moving the competition between proponents of the steps and leaps logic to the background. A final option is to delineate this case as a single TIS, namely around the competence bloc of technologies used during energy-efficiency retrofits. The institutional logics presented in this paper then reflect two different ways of combining the technologies within the competence bloc. The advantage of delineating the TIS in this manner is that struggles around both renovation approaches become part of the internal TIS dynamics, thereby effectively forcing the analyst to make it part of the analysis. Although this way of conceptualizing a TIS is not conventional, it fits within the definition of a competence bloc as given above and is in our view warranted considering this advantage. Since all three conceptualizations have benefits and drawbacks, analysts may choose either one depending on personal preference and where emphasis is necessary. In any event, the analysis of institutional logics presented in this paper showed it would be a mistake to conceptualize this domain as a single TIS around domestic energy-efficiency retrofits broadly since this clouds the competition between proponents of the leaps and steps logics.

6. Concluding remarks

In this paper, an in-depth analysis was presented of two distinct energy-efficiency retrofit approaches prominent in the Netherlands. The first approach entails stacking individual energy-efficiency measures for particular houses, whereas the second approach revolves around holistic renovation plans for particular types of houses. It was shown how these renovation approaches are reflections of two distinctive institutional logics (the Steps logic and the Leaps logic), and how these lead to differing viewpoints on problems and solutions on the road to scale-up of energy-efficiency retrofits. Incorporating an analysis of institutional logics in research on technological change processes has potential merits and could be explored further.

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

References

[1] P.H. Thornton, W. Ocasio, M. Lounsbury, The Institutional Logics Perspective: A New Approach to Culture, Structure, and Process, Oxford University Press, Oxford, 2012, https://doi.org/10.3917/mana.155.0583.

[2] P.H. Thornton, W. Ocasio, Institutional logics, in: R. Greenwood, C. Oliver, K. Sahlin, R. Suddaby (Eds.), The SAGE Handbook of Organizational Institutionalism, Sage, London, England, 2008, pp. 99–129.

[3] P.H. Thornton, W. Ocasio, Institutional logics and the historical contingency of power in organizations: executive succession in the higher education publishing industry, 1958–1990, Am. J. Sociol. 105 (3) (1999) 801–843, https://doi.org/10.1086/210361.

[4] L. Fuenfschilling, B. Truffer, The structuration of socio-technical regimes—Conceptual foundations from institutional theory, Res. Policy 43 (4) (2014) 772–791, https://doi.org/10.1016/j.respol.2013.10.010.

[5] T. Reay, C. Jones, Qualitatively capturing institutional logics, Strateg. Org. 14 (4) (2016) 441–454, https://doi.org/10.1177/1476127015589981.

[6] P.H. Thornton, The rise of the corporation in a craft industry: conflict and conformity in institutional logics, Acad. Manag. J. 45 (1) (2002) 81–101, https://doi.org/10.2307/3069286.

[7] CBS Statline [Centraal Bureau voor de Statistiek], Voorraad woningen; eigendom, type verhuurder, bewoning, regio, 2018.

[8] M. Economidou, B. Atanasiu, C. Despret, J. Maio, I. Nolte, O. Rapf, Europe's Buildings Under the Microscope. A Country-by-Country Review of the Energy Performance of Buildings, Buildings Performance Institute Europe (BPIE), Brussels, Belgium, 2011.

[9] Rijksdienst voor Ondernemend Nederland [RVO], Voorbeeldwoningen 2011: Bestaande bouw, Author, The Hague, Netherlands, 2011 Retrieved from https://www.rvo.nl/sites/default/files/bijlagen/4.%20Brochure%20Voorbeeldwoningen%202011%20bestaande%20bouw.pdf.

[10] A.D. Bhappu, The Japanese family: an institutional logic for Japanese corporate networks and Japanese management, Acad. Manage. Rev. 25 (2) (2000) 409–515, https://doi.org/10.2307/259021.

[11] R. Friedland, R. Alford, Bringing society back in: symbols, practices, and institutional contradictions, in: W.W. Powell, P.J. DiMaggio (Eds.), The New Institutionalism in Organizational Analysis, University of Chicago Press, Chicago, IL, 1991, pp. 232–263.

[12] M. Schlaile, S. Urmetzer, V. Blok, A. Andersen, J. Timmermans, M. Mueller, J. Fagerberg, A. Pyka, Innovation systems for transformations towards sustainability? Taking the normative dimension seriously, Sustainability 9 (12) (2017) 2253, https://doi.org/10.3390/su9122253.

[13] C.R. Bening, N.U. Blum, T.S. Schmidt, The need to increase the policy relevance of the functional approach to Technological Innovation Systems (TIS), Environment. Innovat. Societal Trans. 16 (2015) 73–75, https://doi.org/10.1016/j.eist.2015.07.007.

[14] B.K. Sovacool, What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda, Energy Res. Soc. Sci. 1 (2014) 1–29, https://doi.org/10.1016/j.erss.2014.02.003.

[15] A. Strauss, J. Corbin, Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory, Sage, Thousand Oaks, CA, 1998.

[16] K. Charmaz, Constructing Grounded Theory: A Practical Guide through Qualitative Research, Sage, London, England, 2006.

[17] Sociaal-Economische Raad, Energieakkoord voor duurzame groei, (2013).

[18] Taskforce Bouwagenda, De Bouwagenda: Bouwen aan de kwaliteit van leven, Author; Delft, Netherlands, 2017.

[19] M. David, Moving beyond the heuristic of creative destruction: targeting exnovation with policy mixes for energy transitions, Energy Res. Soc. Sci. 33 (2017) 138–146, https://doi.org/10.1016/j.erss.2017.09.023.

[20] P. Johnstone, A. Stirling, B. Sovacool, Policy mixes for incumbency: exploring the destructive recreation of renewable energy, shale gas 'fracking,'and nuclear power in the United Kingdom, Energy Res. Soc. Sci. 33 (2017) 147–162, https://doi.org/10.1016/j.erss.2017.09.005.

[21] F. Kern, P. Kivimaa, M. Martiskainen, Policy packaging or policy patching? Energy Res. Soc. Sci. 23 (2017) 11–25, https://doi.org/10.1016/j.erss.2016.11.002.

[22] P. Kivimaa, F. Kern, Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions, Res. Policy 45 (1) (2016) 205–217, https://doi.org/10.1016/j.respol.2015.09.008.

[23] K. Reichardt, S.O. Negro, K.S. Rogge, M.P. Hekkert, Analyzing interdepecies between policy mixes and technological innovation systems: the case of offshore wind in Germany, Technol. Forecast. Soc. Change 106 (2016) 11–21, https://doi.org/10.1016/j.techfore.2016.01.029.

[24] K.S. Rogge, F. Kern, M. Howlett, Conceptual and empirical advances in analysing policy mixes for energy transitions, Energy Res. Soc. Sci. 33 (2017) 1–10, https://doi.org/10.1016/j.erss.2017.09.025.

[25] J. Rosenow, F. Kern, K. Rogge, The need for comprehensive and well targeted instrument mixes to stimulate energy transitions: the case of energy efficiency policy, Energy Res. Soc. Sci. 33 (2017) 95–104, https://doi.org/10.1016/j.erss.2017.09.013.

[26] P. Kivimaa, H.L. Kangas, D. Lazarevic, Client-oriented evaluation of 'creative destruction'in policy mixes: finnish policies on building energy efficiency transition, Energy Res. Soc. Sci. 33 (2017) 115–127, https://doi.org/10.1016/j.erss.2017.09.002.

[27] B.K. Sovacool, J. Axsen, S. Sorrell, Promoting novelty, rigor, and style in energy social science: towards codes of practice for appropriate methods and research design, Energy Res. Soc. Sci. 45 (2018) 12–42, https://doi.org/10.1016/j.erss.2018.07.007.

[28] F.W. Geels, Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, Res. Policy 31 (8–9) (2002) 1257–1274 doi: https://doi.org/10.1016/S0048-7333(02)00062-8.

[29] B.A. Lundvall, National Innovation System: Towards a Theory of Innovation and Interactive Learning, Pinter, London, England, 1992.

[30] F. Malerba, Sectoral systems of innovation and production, Res. Policy 31 (2) (2002) 247–264, https://doi.org/10.1016/S0048-7333(01)00139-1.

[31] P. Cooke, M.G. Uranga, G. Etxebarria, Regional innovation systems: institutional and organisational dimensions, Res. Policy 26 (4–5) (1997) 475–491, https://doi.org/10.1016/s0048-7333(97)00025-5.

[32] B. Carlsson, R. Stankiewicz, On the nature, function and composition of technological systems, J. Evolution. Econ. 1 (2) (1991) 93–118, https://doi.org/10.1007/BF01224915.

[33] 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 (4) (2009) 584–594, https://doi.org/10.1080/09537325.2016.1220515.

[34] T. Jacobsson, S. Jacobsson, Conceptual confusion - an analysis of the meaning of concepts in technological innovation systems and sociological functionalism, Technol. Anal. Strateg. Manage. 26 (7) (2014) 811–823, https://doi.org/10.1080/09537325.2014.900171.

[35] I. Miremadi, Y. Saboohi, S. Jacobsson, Assessing the performance of energy innovation systems: towards an established set of indicators, Energy Res. Soc. Sci. 40 (2018) 159–176, https://doi.org/10.1016/j.erss.2018.01.002.

[36] A.J. Wieczorek, M.P. Hekkert, Systemic instruments for systemic innovation problems: a framework for policy makers and innovation scholars, Sci. Public Policy 39 (1) (2012) 74–87, https://doi.org/10.1093/scipol/scr008.
[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 (4) (2007) 413–432, https://doi.org/10.1016/j.techfore.2006.03.002.
[38] B. Carlsson, S. Jacobsson, M. Holmen, A. Rickne, Innovation systems: analytical and methodological issues, Res. Policy 31 (2) (2002) 233–245, https://doi.org/10.1016/s0048-7333(01)00138-x.
[39] J. Markard, B. Truffer, Technological innovation systems and the multi-level perspective: towards an integrated framework, Res. Policy 37 (4) (2008) 596–615, https://doi.org/10.1016/j.respol.2008.01.004.
[40] M. Smink, S.O. Negro, E. Niesten, M.P. Hekkert, How mismatching institutional logics hinder niche–regime interaction and how boundary spanners intervene, Technol. Forecast. Soc. Change 100 (2015) 225–237, https://doi.org/10.1016/j.techfore.2015.07.004.
[41] R. Greenwood, R. Suddaby, Institutional entrepreneurship in mature fields: the big five accounting firms, Acad. Manag. J. 49 (1) (2006) 27–48 Retrieved from: http://www.jstor.org/stable/20159744.
[42] Max Weber, Economy and Society: An Outline of Interpretive Sociology, in: G. Roth, C. Wittich (Eds.), University of California Press, Berkeley, 19221978.
[43] Dutch Ministry of Finance, *Belangrijkste wijzigingen belastingen 2016*, 2016. Retrieved from: https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/circulaires/2015/12/23/belangrijkste-wijzigingen-belastingen-2016/belangrijkste-wijzigingen-belastingen-2016.pdf.
[44] K. Araújo, The emerging field of energy transitions: progress, challenges, and opportunities, Energy Res. Soc. Sci. 1 (2014) 112–121, https://doi.org/10.1016/j.erss.2014.03.002.
[45] A. Cherp, V. Vinichenko, J. Jewell, E. Brutschin, B. Sovacool, Integrating techno-economic, socio-technical and political perspectives on national energy transitions: a meta-theoretical framework, Energy Res. Soc. Sci. 37 (2018) 175–190, https://doi.org/10.1016/j.erss.2017.09.015.
[46] 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 (3) (2008) 407–429, https://doi.org/10.1016/j.respol.2007.12.003.
[47] R. Klein Woolthuis, M. Lankhuizen, V. Gilsing, A system failure framework for innovation policy design, Technovation 25 (6) (2005) 609–619, https://doi.org/10.1016/j.technovation.2003.11.002.
[48] K.M. Weber, H. Rohracher, Legitimizing research, technology and innovation policies for transformative change: combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework, Res. Policy 41 (6) (2012) 1037–1047, https://doi.org/10.1016/j.respol.2011.10.015.
[49] A. Kieft, R. Harmsen, M.P. Hekkert, Interactions between systemic problems in innovation systems: the case of energy-efficient houses in the Netherlands, Environment. Innovat. Societal Trans. 24 (2017) 32–44, https://doi.org/10.1016/j.eist.2016.10.001.