Holistic Approach to Niche Formation: A Case on Transition to Nearly Zero-Energy Buildings in Türkiye

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Abstract: The long-term challenges of climate change are becoming increasingly evident. Considering the ever-increasing need for energy in parallel with population growth and the impact of greenhouse gases, the built environment is among the issues that should be addressed as a priority. As international agreements, the EU, and national legislation become institutionalized, the need to decarbonize the built environment increases. For this reason, there is a need for an understanding that enables the transition to a more sustainable society. In line with this understanding, a transition to zero-energy buildings is required. In this article, the evaluation framework is created by combining the Transition Management (TM) approach, which is a framework developed to understand long-term changes in culture, structure, and practices for sustainable development solutions, and the Strategic Niche Management (SNM) approach, which encourages technological and social change to initiate sustainable innovations at the niche level. Applications regarding energy efficiency and niche formation for the built environment in Türkiye (Gaziantep) were discussed. When the applications and theories are evaluated together, it can be seen that the applications carried out in Gaziantep regarding Nearly Zero Energy Buildings may be starter experiments. However, these projects are insufficient to create a niche, and the developments are progressing very slowly.

Keywords: built environment; energy transition; experiment; transition management; strategic niche management; multi-level perspective

1. Introduction

Climate change is a global priority due to increasing energy consumption and the destruction of natural resources. Mitigating and adapting to climate change has become a focus in various sectors and policy levels. Transitioning to a more energy-efficient built environment is a complex process that requires advanced knowledge of how policy design and measures affect change [1]. Therefore, there is a need for a transition to a more sustainable society. “Transitions can be understood as a specific type of social change, which is characterized by non-linearity, a long time frame and structural transformation” [2]. During a transition period, how a social need is met changes fundamentally. In Türkiye, there is a need for a transition from buildings that consume large amounts of energy, which cause severe damage through greenhouse gas emissions. It is considered that this process can be achieved by systemic restructuring through policies.

“Both in construction and in operation, buildings consume vast amounts of energy” [3]. Many developed countries are trying to transform their construction sectors by working on Nearly Zero-Energy Building (NZEB). NZEBs are buildings primarily powered by energy from renewable sources produced on-site or nearby, reducing energy demand [4,5]. According to the Energy Performance in Buildings Directive published by the European Union Energy Commission, by 31 December 2020, all new buildings must be designed according to NZEB conditions [6].

In Türkiye, between 2012 and 2022, when the Energy Efficiency Strategy Document was in effect, the final energy consumption in the buildings and services sector increased...
by 30.0% from 30.3 Mtoe to 39.2 Mtoe, and, depending on the population growth, the final energy consumption in buildings and services sector increased by 30.0%. It is seen that the increase in demand creates the need to build an average of 106 thousand new buildings annually [7].

During the implementation period of the NEEAP (National Energy Efficiency Action Plan) [8], which covers the period between 2017 and 2023, it was observed that the definition of NZEB in buildings was added to the legislation, and the obligation to design new buildings as NZEBs was introduced. On the other hand, central energy management units were established within the governorships to carry out energy efficiency activities more effectively; the Energy Efficiency Project in Public Buildings was launched and the number of loans to be granted for buildings with A and B class Energy Identity Document (EID) was increased, YeS-TR (Green Certificate for Buildings and Settlements) was established, and the Turkish Environment Agency was appointed as the evaluation agency [7]. Considering the international requirements and national targets, the fact that there are not enough examples of NZEB shows that this process is accelerating. For this purpose, there is a need for an energy transition in Türkiye and for this transition to be developed as a policy tool. In this context, the gains and results of locally innovative developments are precious. For this reason, the transition literature was examined because it was evaluated that a transition was needed and would contribute to the transition to NZEB.

Dutch scientists interacting with policymakers and social actors during the transition towards sustainability have developed the Transition Management (TM) governance approach. “The development of a low-emission energy supply in the Netherlands makes a good case for transition management” [9]. In the TM literature, “experimentation” refers to innovative, small-scale experiments to address persistent societal problems [2,10,11]. Another approach is related to the Strategic Niche Management (SNM) literature, which also plays a vital role in experimentation. One of the essential tools of TM is the transition experiment, while the primary tool in SNM is niche experiments.

Türkiye is in an advantageous position in terms of geothermal and solar energy due to its geological and geographical location. Many local governments in Türkiye have transnational connections and are engaged in innovative practices that can be promising experiments in this direction. This study, which contains the first outputs of an ongoing doctoral study, includes innovative practices by Gaziantep Metropolitan Municipality. For this reason, the concept of ‘experiment’ was taken as the starting point, the projects built by Gaziantep Metropolitan Municipality (GBB) as passive houses have been accepted as experiments. In this study, the parameters required for a project to be an experiment or the differences between an experiment and an innovation project will not be discussed. Van den Bosch [2] conducted a study revealing the differences between transition experiments and innovation projects. In this paper, the applications made in Türkiye were evaluated using the evaluation framework that integrates TM and SNM. In line with the research objective and questions, an evaluation framework is presented, created by developing a conceptual framework that can only be partially derived from theories on sustainability transitions, TM, and SNM (described in Section 2).

In this context, the Ecological Incentive System (EIS) included in the Climate Change Action Plan and the Ecological Design Guide prepared by the GMM are only available in the Southeastern Anatolia Region in Türkiye; Gaziantep Ecological House and Gaziantep Incubation Center Passive House were discussed. These buildings, which are single-story office buildings, are exemplary buildings that have received Passive House and EnerPhit Certificates in Türkiye and have produced successful results. Since these buildings are the first to be built according to passive-house standards in Türkiye and have received passive-house certification, building application processes are addressed within the scope of the evaluation framework.
2. Literature

If carefully designed, experiments provide essential learning opportunities to advance transition efforts. Accordingly, “sustainability transition experiments function also as an umbrella term for transformational interventions as they build on existing efforts, create new actions and add orientation to transitions” [12]. In this study, niche experiments and transition experiments were examined. While niche experiments address technological change or environmental sustainability, transition experiments are created to explore radical new paths. TM associated with transition experimentation does not seek to achieve a specific goal but uses existing dynamics, redirecting it to transition goals chosen by society [13]. The connection between experiment, SNM, TM, niche, niche-regime, and regime is shown in Figure 1.

Figure 1. The connection between theories (prepared by authors).

2.1. The Connection of Experiment–Niche–Niche-Regime–Regime

Experiments have emerged as collaborative initiatives that design, implement, and monitor experiments to support sustainability transitions [2,14,15]. Experiments are a
fruitful way to see the potential of interventions to address climate change. Academics argue that while aiming for transformation, “aligning experimentation alongside prevalent structures and paradigms is necessary in the short-term” [12]. Sustainability transition experiments focus on defined small-scale areas (manageable scale) specific to a particular place and socio-cultural context [12,16,17]. “Experiments can be defined as ‘initiatives that embody a highly novel socio-technical configuration likely to lead to substantial sustainability gains” [18].

It is emphasized that “often experiments are also expected to create more long-term outcomes, for example, initiate a process of broader socio-technical change in markets or practices” [19]. One of the theories applied in the socio-technical regime is the multi-level perspective (MLP). The transition results from non-linear interactions between three social system levels (regimes, niches, and niche-regimes). A social system can be further distinguished by these three different subsystems embedded in the landscape [2,20,21].

Weber et al. [22] distinguish experiments (projects) and niches as different levels of analysis, saying there are differences in many aspects, such as the actors involved and the process. They define an experimental project as the first step towards developing a niche, and they view a niche as an area composed of multiple experimental projects or an experimental project expanded to a dimension that brings the scale beyond the local level. Local experiments are crucial in developing niches. Niche development can be conceptualized as progressing simultaneously at the level of experiments in local practices and the global niche level of learning and rule development in the community of protagonists of the niche technology [23,24]. Van den Bosch [2] also evaluates the niche and niche-regime relationship by dividing sustainable transitions into three mechanisms (deepening, broadening, and scaling up).

2.2. Niche-Protected Space

The early literature on transitions described niches as a protected space that enables experimentation and learning [2,25,26]. Recent work has expanded the analytical core of SNM in three ways. In the recent transition literature, niche examines how a niche level emerges from local projects or experiments [2,23].

Mourik and Raven [27] argue that “through bottom-up local processes generic, location-independent rules can emerge on the global field level.”. It states that niche processes have regional and international dimensions encompassing standard rules Thus, the connection between niche, local, and global levels has been re-examined. In this regard, we understand that the niche is a protected area, and while the reason for protection has its own independent rules, it blends levels (niche, niche regime, and regime) by applying global rules.

2.3. Niche-Regime

Geels and Kemp [28] developed a multi-level perspective, and the differences between regimes and niches were attempted to be revealed. The step from niche to regime is not a single step but the result of many intermediate steps. Niches can strengthen into niche-regimes, meaning that “small-scale initiatives become viable alternatives to mainstream ways of doing” [2]. A niche-regime has characteristics between niches and regimes and represents a niche that has become strong enough to acquire a set of new features. “The most important of which is the ability to attack an incumbent regime” [2,21].

2.4. Regime

“Operating at the meso level are regimes, systems of dominant practices, regulations and interests that are shared by groups of actors” [29]. The regime can be defined as the dominant structure, culture, and practices, along with the established power and vested interests in a social system [2]. The system’s scaling is the transition experiment’s relationship to the regime [2]. Scaling up occurs in many intermediate steps; initially, small changes in specific regions can eventually lead to broader changes in the regime’s
dominant structure, culture, and practices. “Empowerment is what happens when small-scale initiatives become viable alternatives to mainstream ways of doing” [30].

2.5. SNM–Niche Experiments

SNM is a tool that supports introducing radical sustainable innovations into society [27]. SNM drives technological and social change to initiate sustainable innovations at the niche level [25,26,31]. Otherwise, Schot and Geels [31] view SNM as “an analytical framework” designed to introduce and diffuse new sustainable technologies through “societal experiments” [3].

SNM theorists have identified three processes that influence the success/failure of introducing an innovation to society: (i) shaping expectations, (ii) creating social networks, and (iii) learning processes [3,27,31,32]. Figure 2 shows these processes. SNM is a new technology policy perspective developed to enhance the more widespread diffusion of promising new technologies and “focuses on the design of demonstration projects and societal experiments” [22]. SNM focuses on programs that regulate the interaction between different experiments at the niche and local levels [23]. SNM’s connection with the regional level, experiment, and niche should be examined more deeply in this context.

Figure 2. SNM niche processes based on Schot and Geels [31], Mourik and Raven [27] and Jain et al. [3].

In the SNM literature, “Niches” are areas where radical innovations are tried, diversified, and further developed [31,33]. The normative orientation of niche experiments is the creation of market niches for broader regime shifts. Actors external to the current regime are critically important [13].

TM and SNM scholars emphasize the importance of learning from niche experiments (learning by doing); knowledge development can be seen as the primary goal of technological and market niches [34].

2.6. TM-Transition Experiments

TM is a multi-domain and multi-actor process, using sequential and participatory decision-making, and increased attention is drawn to experiments, innovation, learning, evaluation and modulation [35]. This approach is a framework developed to understand and influence long-term changes in culture, structure, and practices necessary for genuinely sustainable development solutions [36]. The Fourth Dutch National Environmental Policy Plan emerged as the TM governance mode aiming at “socio-technical change” or “system innovation” in critical societal areas such as energy [35,37].
Loorbach [38] proposed a set of principles for transition management that build on complex systems, governance, and social theories [39]. These core principles have been translated into an operational model for implementation as a transition management cycle (Figure 3). The components of the cycle are the following: (i) structure the problem in question, develop a long-term sustainability vision, and establish and organize the transition arena; (ii) develop future images, a transition agenda and derive the necessary transition paths; (iii) establish and carry out transition experiments and mobilize the resulting transition networks; and (iv) monitoring, evaluating, and learning from transition experiences and making adjustments to the vision, agenda, and coalitions based on these [38].

![Figure 3. TM cycle based on Javer Diaz Lopez et al. [40] and Loorbach [10].](image)

“TM is a multi-domain and multi-actor process that uses sequential and participatory decision-making mechanisms concerned with experiments, innovations, learning, and evaluations” [35]. It is an approach that utilizes “bottom-up” and “top-down” elements towards long-term goals at both national and local levels. Governance processes are an essential resource for actors interested in subcategories of policy and system innovation [41]. The use of TM for the transition to a sustainable energy system shows the road map of progress through experiments with local and central actors in a shorter period.

The selection of transition paths and strategic experiments, called transition experiments, aid long-term change in system innovation. TM is a governance model developed to deal with problems requiring systemic change [29,41]. Experiments aim to create a new environment to transform traditional practices [23,26,36]. However, “transition experiments are the most tangible results from an (urban) transition trajectory” [42], aiming to initiate and facilitate radical long-term transitions by challenging the status quo [38,43].

2.7. Differences between SNM and TM

While SNM focuses on (policy) actions that can help develop radical innovations in technological or market niches, TM takes a broader perspective [34]. The basic idea of transition spaces in TM is to bring together various actors, change governance, and develop collaborative relationships to facilitate transitions [44]. Niche actors have highlighted how they can shift regime-supporting regulations towards niche-supporting rules [18,44].

In SNM, niche experiments are expected to serve as “a compass for guiding future regime transitions in sustainable directions” [19,45]. Experiments initiated at the regime level connect to a body of literature on TM. TM differs from SNM by emphasizing the
importance of seeing before starting to experiment, thus making experiments more coordinated than SNM, which emphasizes experimentation and the evolutionary nature of experimentation [19,31].

While TM examines the social system by structuring the process, SNM niches examine the socio-technical regime. While SNM accepts technology as a starting point, TM takes a social problem as a starting point [46].

Loorbach [38] states that SNM adopts a more linear approach (the development of niches and the relationship of the niche with the regime), while TM is a non-linear approach, and all levels affect each other. TM emphasizes a direct connection between macro and micro. SNM does not explain how experiments should be conducted strategically, nor does it determine their relationship with higher levels. The contribution of SNM is that experiments contribute to learning. TM is a framework for structuring, organizing, and coordinating policy processes and transition areas. Due to its broad scope, it becomes unclear who should manage TM [46].

SNM focuses on managing niches in these contexts, while TM focuses on managing systems. For this reason, the parameters that evaluate niches will be combined with the TM approach that addresses how to transform the system. This study aims to create an evaluation framework that contributes to systemic transformation by systematically evaluating the experiences gained from experiments (learning by doing) and vision. In this context, what experiences can be transferred as a result of direct learning and deep learning from technologies that emerged through experiences. In this context, the integrated framework will reveal the barriers to the transfer of experiences to niche, niche regime, and regime levels.

In the literature for sustainable buildings, two studies were found: a study investigating a successful passive-house innovation network in the Flemish Region and its relationship with the success factors identified in the SNM literature for market niche development [33] and a study by Jain et al. [3] evaluating the NZEB in India with an integrated framework created with SNM and SIS (Sectoral Innovation System). In addition, Ravens et al. [47] developed a learning-based competence set based on practice for transition experiments. This set is a learning-based model. A three-tier approach was developed to design transition experiments by focusing on transition experiments and creating a practical guide. These studies have contributed significantly to this research by combining sustainable structures and transition theories.

Although the requirements related to NZEB are included in the laws, regulations, standards, and all relevant legislative arrangements for the built environment in Türkiye, it is understood that this process is progressing very slowly in practice. This slow development shows that more than the interaction between the energy efficiency policies made by the central government and the practices made by local governments in the built environment is needed. Prioritizing only international requirements in legislation design, not including the problems of local governments, and not seeing local governments as an area of opportunity are obstacles to development. In addition, it is seen that the results of innovative applications made by local governments should be reflected in the central policies. For this reason, an evaluation framework consisting of SNM and TM components was created to evaluate the interaction between local and central governments. These theories (SNM and TM), which attribute an essential role to experimentation, are not found in the national literature. In this study, for the first time, these theories and energy efficiency practices in the built environment in Türkiye will be discussed together. A holistic evaluation framework is created by utilizing the components of the theories. The practices in Gaziantep are analyzed with an evaluation framework created by integrating the elements of technology-based SNM and TM theories, which examine the social system by structuring the process. The starting point of this study is to reveal the barriers to the transfer of the experiences of innovative projects carried out by local governments in Türkiye to central policies with Holistic Niche Formation (HNF), which is formed from the components that determine the success of technologies in SNM based on niche experiments and the elements
of transition management, a governance approach. At this point, the question ‘Can the experiments (niche) conducted by local governments guide the policies made by the central government to evaluate the NZEB niche development in Türkiye?’ was attempted to be answered. This study aims to identify the barriers to institutional transformation through the evaluation framework developed in this context. As the first output of a PhD study, it is the contribution and scientific motivation of this study to include these theories in the national legislation for the first time and to evaluate the energy efficiency practices in the built environment in Türkiye within the scope of these theories and the evaluation framework created with these theories for the first time.

3. Method

In the second part, the differences between TM and SNM are provided. In this study, these two models are combined. The strength of the combined model may come from the complementarity between the approaches. The differences between TM and SNM in the second section will also provide a holistic perspective on the impact of innovative practices related to energy efficiency in the built environment in Türkiye on central policies, along with the evaluation framework that will be created by complementing these two approaches.

In this section, the frameworks established to analyze the transition process regarding NZEBs in the construction sector in Türkiye are examined. In particular, TM, SNM, and MLP approaches are analyzed. Since SNM is based on technological experiments at the niche level but does not analyze the impact of these experiments on higher levels, a complementary evaluation framework is proposed by combining it with TM. The starting point of this approach was the innovation projects carried out by local governments, which were identified as experimental areas. The GMM, one of the local governments in the PhD study, has exceeded the legislation’s requirements with its practices due to its connection with national networks.

Within the framework of combined evaluation, which is understood to contribute to sustainable innovation policies, TM and SNM approaches were conceptualized by complementing each other. The framework integrates the multi-level view of TM with the approach to measuring the success of niches in the SNM literature. An attempt has been made to combine the niche, niche-regime, and regime levels within the evaluation framework. The relationship between the niche-regime level, direct learning, and deep learning has been examined. With the evaluation framework, the niche experiments carried out by the local authorities were accepted as the starting point for a system-based transition required in Türkiye, and the effects of these applications on other upper scales were evaluated. Innovation projects in Türkiye will be assessed using a framework that integrates the success criteria in SNM and the parameters in the TM cycle. Thus, we tried to develop predictions for the contribution of experiments in the transition process to NZEB. The framework should be used for further testing in many studies. The evaluation framework, which combines the parameters of the approaches that were previously explained, is presented in the next chapter.

Bringing together the differences in objectives, policy instruments, and approaches in the SNM and TM literature, the evaluation framework in Figure 4 emerges.

3.1. Starter Experiment

The starting point in this study is niche experiments. The framework starts with the niche experiment and its components and continues with the components required for the transition experiment. While sustainable experiments strengthen green technological niches in developing countries, transition experiments are encouraged by considering social goals. Niche experiments consider three strategies: learning, alignment of expectations, and formation of actor networks, highlighting regime outsiders as “frontrunners” [13]. Since TM is not used as a governance approach in Türkiye, the practices carried out by local governments were taken as a starting point.
Experiments [12,13,48] are one approach to managing transitions in practice [25]. Experiments should aim not only at niche development but also at changing the regime from within. Köhler et al. [44] state that the governance approach associated with governance experiments has increased. Additionally, “governance experiments” can advance learning for social transitions [49] and support the accelerated diffusion of new solutions [44]. For these reasons, innovative experiments can be a starting point for creating policies.

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3.2. Shaping Expectations

New technology promises and prospects are considered necessary in niche development processes, mainly to clarify the niche’s benefits [3]. Many relevant actors and stakeholders participate in niche development processes based on shaping expectations (Raven, 2005). It is considered good if the expectations are shared in the precise expectations of increasing processes and that the expectations gradually transform into the concretization obtained from the transition experiments [50].

These expectations are expressed at three levels. The first expectations are at the technology level, are problem-oriented, and are related to the technology requirements. The second level is the meso or regime level, where expectations are at the level of a field or sector and are function-oriented. The last level is the macro level, which is “scenario”-focused, general, and comprehensive. Therefore, expectations create interactions between niche, regime, and landscape [27].
3.3. Formation of Social Networks

Developing a niche may require joining new actors and emerging social networks that provide the necessary resources [3]. Mourik and Raven [27] argue that the niche is conducive to development when social networks are significant and regular interaction exists between regime actors and actors outside the regime.

Weber et al. [22] state that the participation of these diversified actors in innovation networks must be organized from the beginning, and a network manager is required to accomplish this. Caniels and Romijn [32] state that the network manager ensures the active participation of all actors. Networking at the local project stage differs from networking at the niche stage. These differences emerge when focusing on the mechanisms to move from experiments to the niche level [22].

3.4. Direct Learning

Learning is generally “an active or interactive process of obtaining and developing new knowledge, competences, and values” [2]. If carefully designed, experiments provide essential learning opportunities to advance transition efforts [12]. Learning from experiments has been defined using many concepts in the literature. Hoogma [25] identifies five aspects that are considered important in learning about innovation/niche development: (i) technical development and infrastructure, (ii) user context (i.e., user characteristics and consumer needs), (iii) social and environmental impacts, (iv) industrial development, and (v) government policy and regulations. On the other hand, Raven et al. [47] divide an excellent learning process into broad and reflexive learning.

The aspects of (i) technical development and infrastructure and (ii) user context (i.e., user characteristics and consumer needs) defined by Hoogma [25] can be directly associated with learning. Additionally, when defining the successful learning processes determined by Raven et al. [47], in addition to techno-economic optimization, the harmony between technology and society is also included in this direct learning.

Van den Bosch [2] emphasizes that learning is of primary importance in niche experiments. Since the starting point in Holistic Niche Formation (HNF) is the niche experiments carried out in local governments, the effect of direct learning, whether direct learning turns into reflexive learning, and the reasons why it does not are essential to reveal the difficulties encountered in national legislation.

3.5. Deep Learning

For this study, deep learning is directly related to whether the actionable information from niche experiments is transformative. Learning in niches is the mutual compatibility of technology with the producer, user, and institutional structure around the technology [34,51].

Of the five aspects of learning identified by Hoogma et al. [25] for “successful niche development”, “social and environmental impacts, industrial development and government policy and regulation” can be considered as potentially relevant to deep learning. Higher-level learning is essential, especially in transition processes, because this type of learning is more reflective. Raven et al. [47] show the formation of expectations regarding the nature of the problem and possible solutions during the transition as an example of higher-level learning. For deep learning, learning goals must be determined in advance. This is important for subsequent experimental programs [2]. Deep learning is associated with increasing the scale of the experiment. Supporting individual and organizational learning is essential to iterative and rotational monitoring and evaluation of transition experiments [12]. Such experiments must be expanded and scaled up to accelerate a broader systemic transition. Kemp and Van den Bosch [52] also state that when the learning cycle is repeated in other contexts, the scale of a local project grows, and learning and, consequently, innovation becomes more robust, increasing the potential for the creation of a market niche [27]. Van den Bosch emphasizes that while learning is first-order in niche experiments, learning in transition management is both first-order and second-order [2].
3.6. Revisiting the Problem

Structuring the problem, which is one of the components of the TM cycle, has become a component of the holistic framework to determine the goals by reconsidering the problem in line with the information obtained from niche experiments. In addition, after deep learning occurs, the problem must be structured to re-determine expectations. The difference between TM-related transition experiments and niche experiments is that transition experiments are a part of the governance approach that includes strategic, tactical, and operational activities [2]. Addressing the problem again is also a strategic approach. In the SNM approach, no evaluation is made at the strategic level. In this context, “revisiting the problem” has become a component of this framework in order to evaluate niche experiments within the scope of the strategic governance approach. At this stage, obstacles will be identified in line with the components mentioned above (1, 2, 3, 4, and 5) obtained from the experiments, and the problems that need to be addressed will be determined again.

3.7. Actors

The HNF evaluation framework begins with the SNM approach. Actors in SNM and actors in TM are different. Both methods attempt to establish a managerial perspective on their transition. This ‘managerial perspective’ encompasses theoretically based and practice-oriented guidelines and recommendations targeted at specific actors. While for SNM, the central actor is, in most cases, the relevant policy maker, in TM it can be any actor (e.g., a Ministry, local government, or a company) with significant resources and the desire to advance the transition [2]. Actors are selected in transition management. These actors are brought together for transition arenas at the strategic-transition-management level.

Generally, the relevant actor groups are government, business, knowledge institutes, NGOs, and intermediaries [40]. These actors are a platform from which a vision can be achieved, and TM scholars argue that once such a vision is created, pathways can be made [34]. “Actors” in the HNF evaluation framework were designed to identify the actors in the social networks formed during the niche process and to determine how to create common goals and problems in line with the meeting of policy-making central actors. A multi-actor approach was adopted to align the niche and regime, which was determined as the starting point in this study. It is thought that the social networks formed in niches and the central actors should be defined, and this actor network should contribute to institutional regulation.

3.8. Institutional Regulation

Transition paths within the circular framework determined in transition management are included in the tactical level of transition management. Institutional processes are more associated with regime actors determining the regime’s rules [44]. Loorbach [10] stated the characteristics of transition paths as follows: Determining the changes necessary to obtain the target image, specifying which changes should be made and when, ideas on how and with whom these changes should occur, and short and mid-term goals [40]. The choice of a transition path means an option to promote specific technologies. A transition pathway could include identifying and promoting sustainable technologies, setting policy priorities for NZEB in national legislation, and short and mid-term goals. In this process, all actors (social networks and central actors) are expected to contribute to the development of pathways. Furthermore, this component is directly linked to institutional and legislative changes that can be made.

The local government selected for this study (Gaziantep) was chosen by taking into account the experiments carried out in the context of local government and trying to select an example that is or could be linked to the niche or niche-regime levels of these experiments. Kern and Bulkeley (2009) state that transnational municipal networks have developed many strategies to cope with the multi-level governance context of the EU [53]. A primary criterion was that the selected municipality should be associated with many transnational municipal networks from which it could gain experience and knowledge. In this context,
the reasons for the selection of Gaziantep can be listed as follows: Preparation of the first climate action plan in Türkiye in this municipality, the definition of eco-city components in a high-scale plan, working on the first ecological city project by this municipality, preparation of the first environmental design guide, and presentation of the Ecological Incentive System (EIS) application. This application determines whether or not the buildings will receive zoning incentives (precedent increase) by using the scoring method.

4. Results

Table 1 shows the selected examples in Gaziantep and their impacts at the niche, niche-regime, and regime levels. There has yet to be an experimental or governance program for energy-efficient buildings in Türkiye. However, it is seen that good practices made by municipalities can be implemented by the municipalities with which they interact. In this framework, it has been observed that the central government has yet to create a niche with a program other than EU projects. Municipalities with transnational connections, including Gaziantep, have tried to make a niche by selecting a specific region or building type structures. It can be said that, especially after the first Climate Change Action Plan, other municipalities have benefited from the experiences of GB. Moreover, due to the Climate Change Action Plan, an Ecological Urban Design program was prepared, and an EIS was established. The fact that this incentive system has become a policy document in local government and is carried out outside the requirements of national legislation is essential in terms of national objectives. This system is being implemented within a protected area. It is evaluated that it will be transferred to central administrations in the future and contribute to forming new niches.

Table 1. Overview of Analyzed Applications.

<table>
<thead>
<tr>
<th>Project/Application</th>
<th>Project Scope</th>
<th>Resources</th>
<th>Ownership</th>
<th>Niche/Niche-Regime/Regime</th>
</tr>
</thead>
</table>
| Climate Change Action Plan and Ecological City Design Guide | Creating an ecological incentive system and applying energy-efficient technologies. | Report secondary research (article, report, website) | -Gaziantep Municipality  
-ICLEI (International Council for Local Environmental Initiatives) (Public and international support) | Niche/Niche-regime               |
| Gaziantep Ecological Building             | The first building in Türkiye to receive PassivHaus certification.            | Report secondary research (article, report, website) | -Ipekyolu Development Agency  
-Gaziantep Municipality  
-Gaziantep University  
(Gaziantep Municipality (Public and private sector with international support) | Experiment                      |
| Gaziantep GAP Energy Efficiency and Consultancy Incubation Center | It is the only and first building in Türkiye to receive the EnerPhit certificate. | Report secondary research (article, report, website) | -GAP Region Development Administration  
-UNDP (United Nations Development Programme) (Public and private sector with international support) | Experiment                      |

The HNF assessment framework provides insights into the barriers to its contribution to system transformation and the institutional changes required.

Supporting radical, sustainable innovations and system transformation requires niche, niche-regime, and regime level actions. Therefore, the interaction between central policies and local government depends on aligning niche-, niche-regime-, and regime-level actions.

4.1. Starter Experiment

The GMM is working on many environmental projects, such as a cogeneration and biogas power plant, an environmentally friendly city hall, a LEEDS-PLATINUM candidate Greenhouse Project, and an Ecological City project, the first project in Türkiye [54]. It has also been one of the partner cities selected for the EU-GUGLE project, which aims to demonstrate the feasibility of NZEB models.

To cope with the negativities brought by climate change on a macro scale, the Gaziantep–Kilis Road and Surroundings Vision plan was approved, and the Gaziantep Eco-City Project...
was first prepared to create an ecological settlement model and to determine the general principles of the organizational scheme and zoning plans for the implementation [55]. This project aims to create a vision and a city brand aligned with ecological planning. For this reason, an environmental city design guide has been prepared. It was planned to build a museum with renewable energy resources in line with the vision components consisting of transportation, a lower-level center, housing, an environmental image, organic agriculture, and alternative lifestyle and culture, but could not be implemented. The Ecological Incentive System was created with the Ecological City Design Guide. The condition for this incentive is to implement energy-efficient technologies.

The Gaziantep Passive Building project, implemented within the Vision project’s scope, was created in 2013 to demonstrate exemplary technologies for the residences planned to be built in Ecological City Planning [56]. This project was designed and implemented to promote environmentally friendly technologies and raise awareness. Gaziantep Ecological Building, which was built according to PassivHaus (Passive House) and LEED Platinum criteria and is the first building in Türkiye to receive PassivHaus certification, is an exemplary building that minimizes carbon emissions and uses renewable energy systems [57].

The Gaziantep GAP Energy Efficiency and Consultancy Incubation Center, which has a rectangular compact form and is passive house standards, was built with the Ministry of Development fund and UNDP (United Nations Development Program) coordination to create an institution that provides consultancy for increasing renewable energy resources and energy efficiency. This building is the only and first building in Türkiye to receive the EnerPhit certificate from the Passive House Institute [58].

It was determined that the first Ecological City Design Guide prepared in Türkiye, the Incentive System created in line with this guide, and the buildings first designed and renovated as passive houses could be experiments that could take place at the center, as they are innovative practices on a national scale.

The following sections of this study include research on Gaziantep and expert opinions in their studies.

4.2. Shaping Expectations

Expectations are for harmonizing upper-scale policy requirements, national legislation, and local-scale policies. Upper-scale policies include the 11th Development Plan, Medium Term Program, Silk Road Development Agency Gaziantep, Adıyaman Kilis Regional Plan, Provincial Environmental Plan and National Climate Change Action Plan, Energy Efficiency in Buildings Law, and Energy Performance Regulation in Buildings and other relevant legislation 2020–2024 Strategic plan. It is seen that an innovative approach has been created above the rules brought by national policies with the Vision plan and related plans, which include eco-city projects. Although passive structures have been built in this direction, no other passive structures have been constructed at the national level, which shows that the niche has not been fully formed. The pace of development is very slow. In addition, the increase in the cost of ecological construction and the fact that the precedents recommended in the field of planning to make the Incentive System (IS) attractive are lower than other zoning islands has paused the process [59]. In addition, some of the expectations brought by networks with connections to international networks have been met. However, municipal election results have slowed this process [54].

4.3. Formation of Social Networks

Gaziantep has participated in three networks: Energy Cities, ICLEI, and Eurocities. Additionally, Gaziantep is associated with the EU-GUGLE (European Cities Serving as Green City Gateways Towards Leadership in Sustainable Energy) project [54]. The Silk Road Development Agency provided financial support for the Gaziantep Ecological Building, and the project was carried out with the joint efforts of Gaziantep University and the GMM [60]. R-M-P Architecture designed the Gaziantep Ecological Passive House Project and worked with Ekho Architecture and 3T Engineering as consultancy firms [58].
The building is located within the 100th Year Atatürk Log Park, which continues throughout the city and has hosted many socio-cultural activities [61]. The building, which serves as a promotion and information center, hosts conferences, workshops, and similar events with various professional groups, university students, and technical employees. It is understood that there are also collaborations with associations, foundations, universities, Gaziantep Provincial Directorate of National Education, and non-governmental organizations [62].

In the renewed workshop, activities targeting the participation of primary school students, young people, and non-profit organizations such as the TEMA Foundation and Ecological Life Association were included. It is understood that the activities of the organizations are also carried out.

Gaziantep Ecological Passive House was designed by a German–Turkish team. It has been observed that the Zero Energy and Passive House Association (SEPEV), an organization affiliated with the International Passive House Association, was established to aiming to accelerate the process regarding zero-energy buildings, contribute to the formation of the SEB building sector, and introduce passive houses with passive houses standards. The project coordinator is one of the founders of SEPEV, and he also undertook the project’s construction works and carried out the Ecological City Design Directorate of the GMM Department of Zoning and Urbanization.

4.4. Direct Learning

The third section mentions the content of “Direct Learning.” Technical development and new information about infrastructure and users may directly relate to learning. The Ecological City Design Guide implemented within the scope of the Ecological City project in the Gaziantep Ecological Building and Incubation Center, shows that during the construction phase of a passive house, the cost is high, the product market is progressing very slowly, and non-existent products are supplied from abroad, and this is both costly and expensive. It is understood that on the one hand, this prolongs the process, and on the other hand, it will take time to form professional teams [57,58]. Moreover, workshops are organized for the age group of 7–18 in the Ecological Building. The Provincial Directorate of National Education and non-governmental organizations cooperate with the events organized. Conferences, workshops, and similar events are organized with university students, various professional groups, and technical employees [62].

4.5. Deep Learning

Learning in niches is the mutual harmonization of technology with the producer, user, and institutional structure around the technology. Deep learning is associated with increasing the scale of the experiment. Gaziantep prepared the Climate Change Action Plan in 2011, which is Türkiye’s first local climate action plan and a pioneer in sustainable urban policy. In the preparation process, it benefited from the experience of its international networks. Other municipalities in Türkiye also benefited from Gaziantep’s experiences while preparing the local climate action plan. This plan was financed by the French Development Agency (AFD) and the GMM [54]. In this context, it was the first municipality to take appropriate measures regarding the National Climate Change Strategy [6]. Afterward, it was seen that many municipalities had prepared climate change action plans.

“Ecological City Design Guides” created in Gaziantep have become a policy tool for energy transition in the built environment. This guide describes an incentive system. With this application, there are zoning incentive rates according to building classes and categories, using the scoring method by which the buildings will be evaluated. The calculated eco-scores determine whether the building will receive zoning incentives. Zoning incentive rates also show what percentage increase in the rate the building will receive [6]. Transforming the system created in this context into a policy tool and granting building permits for new buildings in line with the criteria in the guide is an indication that a niche has been created for energy-efficient technologies in Gaziantep.
The fact that after the Gaziantep Incubation Center Passive House and Ecological Building, which are the first passive house examples, there are almost no examples other than buildings built with passive house building standards, which indicates that the passive house niche has not been fully formed or its scale has not grown.

Continuing the training in the ecological building contributes to the development of passive house awareness on an individual and institutional basis. However, a market niche must be created within the scope of the requirements of the national legislation that all new and existing buildings be nearly zero-energy buildings.

4.6. Revisiting the Problem

The transition process to zero-energy structures needs to be accelerated. For this reason, it is necessary to determine the obstacles to creating market niches related to “passive houses” or “nearly zero energy buildings”. In the national legislation, the Zoning Law No. 3194 and the relevant regulation (Planned Areas Zoning Regulation), which determines the design conditions of new buildings, do not clearly include statements about energy-efficient design, passive design, passive houses or zero-energy buildings, and therefore there are no obligations regarding passive design principles in buildings. In addition, increasing the incentives for the sufficient production of the materials and systems used for the “passive house” in the structures examined in Türkiye will accelerate this process in terms of cost. On the other hand, training and raising awareness of all actors involved in construction to spread passive-house awareness in the construction sector in Türkiye is another issue that will accelerate this process.

4.7. Actors

It is understood that the project was carried out with the interaction of local actors (Gaziantep Municipality, Gaziantep, Türkiye) and private sector actors (R-M-P Architecture, Ekho Architecture, and 3T Engineering, Gaziantep, Türkiye) during the design and implementation process of the Gaziantep Ecological Passive House, one of these initiating projects. The Gaziantep Incubation Center Passive House is a project carried out jointly by public actors (GAP Region Development Administration, Karaköprü, Türkiye) and private sector actors (Ekho Architecture, Gaziantep, Türkiye). It is understood that there is interaction between these two project actors, as the Gaziantep Ecological House project coordinator, the Gaziantep Incubation Center Passive House consultant, and the experts in the Ekho Architecture team came together and established SEPEV.

An NZEB event and workshop was held in 2018 with expert teams to increase energy efficiency in public buildings organized by the Ministry of Environment, Urbanization, and Climate Change with GIZ (German International Cooperation Agency, Bonn, Germany), where both projects transferred information to central policymakers. It is understood that the technical information of the Ecological Building was shared here as a sample building [59].

As a result, it is understood that the practices are technically transferred to the central actors, but these practices do not directly impact the policies made.

4.8. Institutional Structure

For the first time in Türkiye, Gaziantep prepared the Climate Change Action Plan (CCAP) and pioneered other municipalities in analyzing greenhouse gas emissions and climate change mitigation and adaptation policies with more sustainable targets and policies. In addition, an incentive system was created with the Ecological Urban Design Guide, and the positive and negative effects of this system were reported. For this reason, it is understood that the practices (land use, building typology, material selection, energy performance, automation, waste management, and environmental pollution) and the incentives given with the scoring system for energy-efficient buildings in the EIS have not been transferred to national legislation. The actors in the newly formed social networks have yet to be included in the policy-making process.
Table 2 contains the results obtained in line with the components of the holistic niche formation framework.

### Table 2. Overview of analyzed applications.

<table>
<thead>
<tr>
<th>Evaluation Criteria for NZEB Development (HNF Components)</th>
<th>Results (for NZEB Development)</th>
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<tr>
<td><strong>Starter experiment</strong>&lt;br&gt;- Niche experiments.</td>
<td>The applications are like an experiment as they are the first. The Climate Change Action Plan has contributed to the process of preparing climate change action plans of other municipalities. There is almost no other building in Türkiye included in the passive-house construction. There are litigation processes regarding the constructing area increase related to the incentive system. It has been observed that there is no niche except for the Incentive System.</td>
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<td><strong>Shaping expectations</strong>&lt;br&gt;- Do an increasing number of actors share the exact expectations?&lt;br&gt;- Are the expectations based on concrete results from experiments?&lt;br&gt;- Do the expectations include policies that need to change?</td>
<td>The Climate Change Action Plan was implemented for the first time in Türkiye, and the Ecological City Design Guide prepared in line with this plan has met some of the expectations in the first stage regarding fulfilling some requirements due to connections with international networks. Subsequently, climate action plans prepared by other municipalities were based on concrete results. However, expectations need to be aligned with all actors. Since there is no one-to-one interaction between central and local actors at this stage, expectations within the scope of national and local targets are not aligned.</td>
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<tr>
<td><strong>Social Network Formation</strong>&lt;br&gt;- Have new social networks been created?&lt;br&gt;- Was there any interaction between actors outside the regime and regime actors?&lt;br&gt;- Is there a network administrator?</td>
<td>A shared network was formed with international organizations and cities, and experiences were shared. Many informative events were organized among professional groups and students. As a result of the Gaziantep Passive House and Incubation Center passive-house projects, SEPEV was established to promote NZEBs. Interaction with actors outside the regime has only been in information exchange on a workshop or conference basis.</td>
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<td><strong>Direct learning</strong>&lt;br&gt;- What are their experiences from a technical perspective?&lt;br&gt;- Are user features learned?&lt;br&gt;- Has the technical and comfort fit been achieved?</td>
<td>Passive-house construction is a costly process. A technically experienced professional team needs to be established. Activities were organized for various age groups.</td>
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<td><strong>Deep learning</strong>&lt;br&gt;- What is the impact of the social and environmental components?&lt;br&gt;- What are the developments on a sectoral basis?&lt;br&gt;- What is the impact on government and policy regulations?</td>
<td>Using the Ecological City Design Guide as a policy tool shows that the scale of experience is growing. It is understood that the scale of passive houses has yet to grow and is limited to only two examples. It has been observed that regime actors need deep learning. It is understood that there needs to be more interaction with regime actors to establish the passive-house/NZEB market.</td>
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<td><strong>Revisiting the problem</strong>&lt;br&gt;- To identify the obstacles encountered in Components 1, 2, 3, 4, and 5.&lt;br&gt;- Redefine the problem.</td>
<td>It is observed that there is no market for passive houses or NZEB. Interaction or deep learning between the regime and niche actors is not at the desired level. It is seen that passive design principles need to be added to the national legislation (relevant regulations of the Zoning Law No. 3194), where the design conditions of new buildings are determined. In this context, legislative work can be performed to transfer the results of local experiments to central actors. Niche areas can be planned for NZEB in cooperation with the local, central, and private sectors. NZEB design principles can be included in the new building permit process.</td>
</tr>
<tr>
<td><strong>Actors</strong>&lt;br&gt;- Actors from social networks.&lt;br&gt;- Local government.&lt;br&gt;- Policymakers (Ministries).</td>
<td>It has been observed that the practices are carried out in cooperation with local actors and the private sector, and some social networks have emerged, but the ministries need to be involved in the process. The central policy process should include new networks or actors in this process.</td>
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<tr>
<td><strong>Institutional arrangement</strong>&lt;br&gt;- Determining the necessary changes.&lt;br&gt;- Recommendations on how and with whom these changes should occur.&lt;br&gt;- Necessary changes in legislation.</td>
<td>Experiments carried out by local governments with higher policies should be evaluated with regional and national actors. Incentives must be provided through policy to produce products exported from abroad in the country. It is necessary to determine the upper policies and experiment areas and the social networks and non-actor systems that will contribute to market development in those areas and to set targets for policy changes on a sectoral basis. Passive design methods for NZEB and passive houses should be added to both the national legislation and the legislation of local governments in line with the principle of simultaneity.</td>
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5. Conclusions

This study includes the first findings of doctoral research. This article began by discussing the necessity of a transition to address the energy challenges faced in the built environment in Türkiye, especially in buildings, including statements about NZEB in national policies and exploring how the transition could be accelerated by adopting them in line with international NZEB targets.

Structural changes that encourage innovation are required in the current system. This research aims to evaluate the status of local practices to accelerate the transition to the NZEB idea. For this purpose, the climate action plan, Ecological Incentive System, and passive houses, which were first implemented in Gaziantep, were examined. These practices, carried out by local governments in Türkiye, were evaluated using the created framework (HNF). This article aims to answer what the HNF framework says about NZEB niche formation in Türkiye. This article explored transition theories (SNM, TM, and MLP) and developed the HNF framework, an integrated framework to assess the status of NZEB development in Türkiye. This framework has eight theoretical components: shaping expectations, social network formation, direct learning, deep learning, problem revisiting, actors, and institutional structure. The results show that the development of the passive-house niche that will contribute to NZEB development is progressing slowly.

The different dimensions of the SNM/TM approaches were combined and a holistic framework, the HNF framework, was presented. Niche experiments involving innovation were accepted as a starting point. This framework was initially developed for Türkiye to bridge the gap between local and central government experiments. Transition researchers contributed greatly to this study [47]. The starting point for this study is the experiments conducted by local governments. The motivation for this study is to understand how the knowledge gained from these experiments in Türkiye, new networks, and expectations interact with the central government and other actors. For this reason, the framework was started with SNM components. The last element in the framework ends with the ‘actors’ and ‘institutional arrangement’ components, starting from the transition arenas and transition path components in the TM. The HNF framework evaluates local experiments by combining the components that determine the success of SNM and the cyclical components of TM (created to solve a social problem). It does so to present a holistic view of the obstacles and the interaction between local and central government.

The practices carried out in Gaziantep and examined in this study (passive house and the Climate Change Action Plan) were accepted as an experiment for Türkiye because they were realized for the first time in Türkiye. The Climate Change Action Plan prepared for the first time in Gaziantep, the Ecological Design Guide prepared by GBB, the Ecological Incentive System (ÇES) included in this guide, Gaziantep Ecological House and Gaziantep Incubation Center are innovative projects that are considered to contribute to the transition process to NZEB in Türkiye. Apart from these buildings, including the Ecological Incentive System in the building permit process of new buildings built in Gaziantep indicates that a niche has been created for ecological buildings. However, no study has been found regarding the transposition of EIS into national legislation. Although the guide is a policy tool, it has not been implemented at the niche-regime level. Likewise, the fact that there are no examples of passive houses built by local or central governments in Türkiye, other than the passive buildings examined, shows that the passive-house niche has not developed. To accelerate the process regarding NZEB, it is necessary to find solutions to the obstacles arising in this project (lack of market formation and expert technical team, high costs, import of building materials, etc.) through central policies.

The Ecological City Design Guide, prepared in line with the Climate Change Action Plan, has met some of the expectations in the first stage in terms of meeting some requirements due to its connections with international networks. Later, climate action plans prepared by other municipalities were based on concrete results. A joint network was established with international organizations and cities for the Gaziantep Passive House and Incubation Center passive-house projects, and experiences were shared. SEPEV (Zero
Energy and Passive House Association), established during these projects’ design and implementation phases, is an indicator of network development. However, this foundation’s interaction with regime actors was only in information exchange at workshops. As a result, it was observed that the experiences gained needed to be evaluated systematically with the cooperation of local government and central government. There was no effective interaction between the actors in the new networks and the regime actors, and therefore, the second stage of learning (deep learning) still needed to be completed.

Consequently, the results of innovative projects carried out by local governments that go beyond national legislation should be evaluated with local and national actors. In addition, the results of central policies should be evaluated with all relevant actors, and targets for policy change that will contribute to the necessary market development should be determined. Aligning all relevant actors’ expectations is required to achieve goals nationally. Incentives should be provided through policy for producing products exported from abroad in the country. NZEB and passive design principles for passive houses should be added to both national legislation and local governments’ legislation simultaneously.

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