Unraveling the Mechanisms of Land-Use Lock-in in Iran's Urban Planning System within the Theoretical Framework of Path Dependence

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Abstract
Urban development plans, as one of the principal pillars of Iran's urban planning system, plan the future development of cities over periods exceeding a decade through two key instruments: land-use maps and planning regulations. However, despite more than three decades of research demonstrating that the realization of planned land uses has remained partial and imbalanced, this planning pattern has persisted. This applied study employs a qualitative approach and a descriptive method to answer, in two steps, why this pattern has persisted and what mechanisms have stabilized it. In the first step, the realization rates of planned land uses and the causes of their non-realization, were extracted from selected studies. These causes were subsequently categorized through qualitative content analysis within the theoretical framework of path dependence. The findings indicate substantial overlap among these causes regardless of time and location. While the causes identified in earlier periods were predominantly technical in nature, those identified in more recent periods can be categorized within technical, institutional, and discursive dimensions. In the second step, the formation of the phenomenon of land-use lock-in and path dependence in land-use planning in Iran was identified and explained through system, learning, procedure, behavior, and motivation mechanisms. Finally, two strategies are proposed to break the existing path: first, transferring commissioning authority from the Ministry of Roads and Urban Development to municipalities; and second, shifting the consequences of land-use allocation on privately owned land from individual to the collective.

Keywords:
Implementation Barriers; Land-Use Lock-In; Land-Use Realization; Path Dependence; Urban Development Plans

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1.Introduction

In 1984 (1363 SH), the contract for the preparation of urban construction and development plans, the area of influence, and detailed titled Standard Contract No. 12 was formulated by the Plan and Budget Organization to define the terms of reference for comprehensive and detailed plans and accordingly, consultants, after conducting studies of the existing urban conditions, identify urban deficiencies and needs and forecast the city's population over the next one to two decades. Based on existing deficiencies, future population needs, and per capita standards, the required area for various land uses are identified and public land uses are typically allocated to vacant lands according to accessibility criteria. The primary priority for allocating public land uses is state-owned lands. If such lands are not available within the specified area, public uses are allocated to privately owned lands, often without the consent of the landowners. According to laws, the responsible agencies are mandated to acquire these lands within a maximum period of eighteen months following plan approval.

Several studies have addressed the following questions: Are the planned land uses in urban development plans realized? To what extent have they been implemented? Why have some failed to be implemented? studies by Moosavi & Rafieian (2004), Hoseinzadeh Dalir & Maleki (2007), Azizi & Arasteh (2012), Nateghi, Varesi & Rezaiian (2013), Rafie & Barakpur (2015), Noorian & Vahidi Borji (2015), Vahidi Borji, Noorian & Azizi (2017), Rezaei et al. (2018), and Goli Shirhesar, & Jaberi Moghaddam (2023) have provided answers to these questions. The results indicate the partial realization of certain planned land uses, particularly public uses.

The partial implementation of planned land uses has two consequences. The first is that the city's public needs remain unmet but the second is more significant, if planned public uses are sited on private-owned lands, the land may neither be acquired nor constructed during the plan period, which may extend over a decade. For example, according to Noorian & Vahidi Borji (2015: 66), «Designating portions of urban lands as public uses in detailed plans has led to an increase in vacant land and administrative bureaucracy in response to landowners' requests for land use change». The formation of vacant and abandoned lands is among the physical consequences of unrealized land uses, affecting the urban landscape, safety, and security, with impacts extending to all residents. However, economic losses, social dissatisfaction, and perceptions of injustice are among the individual consequences of the non-realization of planned land uses. Although previous studies have examined non-realization primarily in terms of its impacts on the public, the present study examines land-use allocation from the perspective of the costs imposed on individual landowners in pursuit of public interests. Accordingly, the research seeks to answer the following question: Why has this pattern persisted despite more than three decades having passed since the earliest studies estimated the realization of planned land uses to be only partial? This study proceeds from the premise that the persistence of this pattern stems from path dependence in Iran’s land-use planning system. It seeks to describe the phenomenon of land-use lock-in within the theoretical framework of path dependence.

2.Theoretical Framework: Lock-in and Path Dependence

Path dependence is used to analyze phenomena in which choices and decisions made in the past may constrain the range of options available in the future. Where insignificant events may, by chance, give a technology an initial advantage, and that technology may eventually corner the market, with the other technologies becoming locked out (Arthur, 1989). Although this approach has been criticized within the field of economics, it has been extended to other fields, such as politics, institutions, organizations, and so on. Path dependence is understood as a self-reinforcing process in which each step in a particular direction induces further movement in the same direction while reducing the possibility of selecting alternative paths. The persistence of this process may ultimately lead to the emergence of a stabilized state and the lock-in of a phenomenon (Pierson, 2000; Sydow et al., 2012). From this perspective, path dependence typically originates from small and sometimes contingent events; after passing through a critical juncture, the path becomes locked in, and the system’s capacity for change is constrained (Figure 1).

Lock-in [in technology] is fostered by two effects: Each trial of a technology provides experience in that technology, increasing the payoffs to that technology in subsequent trials; and each trial decreases uncertainty about its merits (Liebowitz & Margolis, 1995).

The analysis of first technological – and later institutional – path dependence started out from a critique of neoclassical economics that was grounded in evolutionary and institutional economics Whereas orthodox economics assumes the primacy of optimal solutions in terms of efficiency, the theory of path dependence pays attention to the impact of past events, often captured in the catch phrase «history matters». However, the concept of path dependence actually goes far beyond mere «past-dependence» acknowledging the importance of self-reinforcing processes (Sydow et al., 2012:

157). Increasing returns are one specific form of self-reinforcement within a wider range of positive feedback mechanisms not all of which are necessarily based on utility maximizing behavior (Sydow et al., 2005: 16).
Paul Pierson (2000: 254), citing Arthur (1994: 112), writes that four features of a technology and its social context generate increasing returns including: large set-up or fixed costs, learning effects, coordination effects, and adaptive expectations. When set-up or fixed costs are high, individuals and organizations have a strong incentive to identify and stick with a single option. With repetition, individuals learn how to use products more effectively, and their experiences are likely to spur further innovations in the product or in related activities. Coordination effects are especially significant when a technology has to be compatible with a linked infrastructure. Increased use of a technology encourages investments in the linked infrastructure, which in turn attracts still more users to the technology. Projections about future aggregate use patterns lead individuals to adapt their actions in ways that help make those expectations come true (Pierson, 2000).

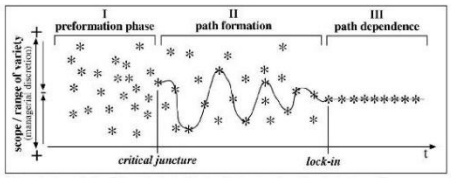

Figure 1: Constitution of a technological or institutional path The classical model

Figure 1: Constitution of a technological or institutional path The classical model (page 9)
Phase 1: Preformation phase: decision outcomes are contingent occurrences.
Critical juncture: Once these decisions have been made, dynamic self-reinforcing processes may be set into motion, which eventually lead to deterministic patterns.
Phase 2: Path formation: whilst essentially constrained, choices are still possible
Phase 3: Path dependence: one particular technology or institution has been generally adopted and Viable alternatives are no longer at hand.

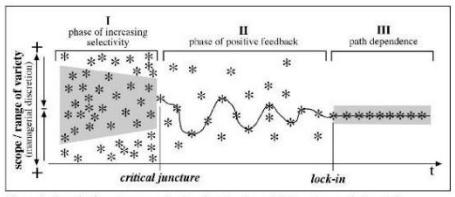

Figure 2: Constitution of an organizational path – A modified and expanded model

Figure 2: Constitution of an organizational path – A modified and expanded model (page 18)
Phase 1: not only dominated by undirected search and random selection, but also by deliberate initial decisions, investments or intended resource allocations.
Phase 2: positive feedback - it is not power per se that constitutes the path, but the positive feedback process.
Phase 3: Path dependence

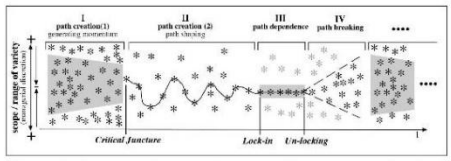

Figure 3: Breaking and creating organizational paths: Alternative route in face of path dependency

Figure 3: Breaking and creating organizational paths: Alternative route in face of path dependency (page 32)
Phase 1: path creation (1) - different types of path constitution may exist; random emergence and deliberate creation.
Phase 2: path creation (2) – path shaping - access to the necessary resources, understand the rules of the game, organize collective action effectively, and gain legitimacy for their collective action.
Phase 3: Path dependence
Phase 4: Path breaking

Figure 1. Path Dependence: The Classical Model, A modified Model, and Path Breaking (Sydow et al., 2005)

Seven interacting origins or drivers of path dependence have been identified including: system, learning, procedure, behavior, motivation, uncertainty, and external environment. (Table 1). Path dependence results from intra-system interactions among individuals, organizations, and various stakeholders, and is reinforced through learning processes and the accumulation of experience over time. In addition, decision-making routines and procedures, behavioral patterns, cognitive biases, individual or collective goals and motivations, as well as conditions of uncertainty and external environmental factors, can each contribute to the stabilization of a particular path and reduce possibility of deviation from it. Accordingly, path dependence should be understood as the outcome of the gradual accumulation of choices and institutional interactions over time rather than the result of a single discrete decision (Hamalainen & Lahtinen, 2016).

Table 1. origins and drivers of path dependence (Hamalainen & Lahtinen, 2016)

Origin or driver	Relates to	Brief explanation
System	Interactions between participants of the problem solving team, related organizations, stakeholders, and the system under study.	Members of a problem solving team can convince each other of the correctness of the approach designed by the team without critical thinking or consideration of alternative approaches.
Learning	Learning during the OR process.	Increased understanding about the problem and methods used can direct the modeling and problem solving process.

Procedure	Structure and properties of the models, algorithms and problem solving procedures used.	The order in which problem solving steps are taken.
Behavior	Cognitive biases and behavioral phenomena related to individuals.	The status quo bias refers to the tendency to prefer the current solution or approach over possible new ones. The sunk cost effect refers to the phenomenon where people want to keep on committing resources to a project in which they have previously invested. This happens regardless of whether the earlier investments have been successful or not.
Motivation	Exposed and hidden goals.	Situations where people's goals affect the problem solving process. For example, when a model concurring with the initial expectations is found, then the modeler may become satisfied and stop looking for alternative models.
Uncertainty	Uncertainty about structural assumptions and correct parameter values.	If the same modeling process is repeated, it can lead to different outcomes due to changes in the external environment. A high level of uncertainty about the model assumptions increases the risk of path dependence. Even in the face of uncertainty one has to select some initial approach. The risk exists that later the modeling team or community can become fixed to only looking for refinements in the initial approach and fail to consider other approaches.
External Environment	Context and external environment.	

Some studies have conceptualized path dependence through different analytical dimensions. Low et al. (2005) identify three dimensions of path dependence: technical, institutional, and discursive. Technical path dependence, where the historical trajectory of policy is locked into a particular technical form of production or service delivery. Technical path dependence is shaped by early investment of both material and intellectual capital. Institutional path dependence, in which organizational structures and formal rules (external to the mind) influence the path of policy. Finally, discursive path dependence, refers to the case when discourse networks shape the policy path. Discursive path dependence as prior to institutional path dependence and both are at the very least reinforced by the development of technologies and the investment in both physical works and intellectual routines (Figure 2).

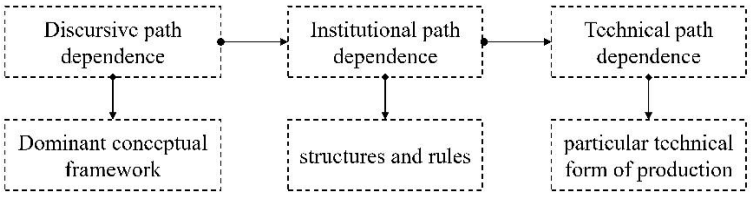

Figure 2. Representation of Discursive, Institutional, and Technical Path Dependence (Source: Authors, adapted from Low et al., 2005)

Table 2 presents the source of path dependencies and approach for path-breaking concepts. To break path dependence, four main types of «anchors» have been identified, intervention in each of which can contribute to altering the trajectory including: cognitive, emotional, social, and resource. Within each source, traps have been identified, including reflection, commitment (or identity), normative (cultural), and sunk cost.

Table 2. «Anchors» for applying path-breaking concepts (Sydow et al., 2005: 25)

	Focus	Source of path dependencies	Approach for path-breaking concepts
1	Cognitive	self-reinforcing blind spots («we don't see that we don't see»); reflection trap	organizational discourse, supplemented by information from external consultants etc., new knowledge/ perspectives
2	Emotional	self-reinforcing or escalating commitment («this commitment is our identity and the more we are	behavioral interventions, mainly on the group level

		committed the stronger is our identity…»); commitment (or identity) trap	
3	Social	self-reinforcing norms, standards, and basic assumptions («what we are doing is right because we are doing it…»); normative (or cultural) trap	systematic interventions by irritating the social system in order to break systematic routines and patterns
4	Resource	self-reinforcing resource allocation («if we gave up this investment it would be wasted…»); sunk costs trap	reallocation of resources, taking into account prevailing cognitive and normative rules

3.Methodology

This study aims to describe the phenomenon of land-use lock-in in urban development plans. To achieve this objective, in the first step, studies related to planned land uses in urban development plans in Iran were identified and collected. Studies were selected if they either explicitly reported the realization rate of planned land uses or provided sufficient data on land-use areas, including the existing land-use area at the time of plan preparation, the planned land-use area for the planning horizon, and the actual land-use area at the time of evaluation, thereby enabling the assessment of realization rates. A total of 14 studies conducted between 1992 and 2021, covering 28 cities, were reviewed. Subsequently, studies related to the causes of non-realization of planned land uses in urban development plans in Iran were identified and collected. Studies were selected if they either directly investigated the causes of land-use non-realization or examined the implementation failure of urban development plans more generally, provided that land-use realization constituted one of the evaluation criteria. A total of 12 studies published between 1992 and 2023 were reviewed. The causes underlying the non-realization of planned land uses stated in the text, findings, or recommendations of these studies were extracted without consideration of the categories or prioritization schemes suggested in each study. This was done to enable their reorganization in accordance with the analytical framework of the present study. The extracted causes were then categorized using qualitative content analysis.

Although nearly three decades have passed since the earliest studies related to the non-realization of public land uses and identifying its underlying causes, this pattern has persisted to the present day. To describe the cause of the persistence of this pattern, the second step employs the theoretical framework of lock-in and path dependence. Accordingly, the findings derived from the content analysis were compared with the identified origins of path dependence and lock-in mechanisms to assess whether the persistence of this pattern could be attributed as path-dependent. To clarify the analytical procedure and demonstrate how macro-categories were derived from conceptual codes, the process is presented in Figure 3. The validity of the study was ensured using credible scientific sources, transparency in the extraction and categorization procedures, and logical consistency between the empirical findings and the theoretical framework. Moving beyond merely assessing the realization rates of planned land uses and identifying the causes of their non-realization, this study seeks to describe the structural logic underlying the production and reproduction of this persistent path within Iran's urban planning system.

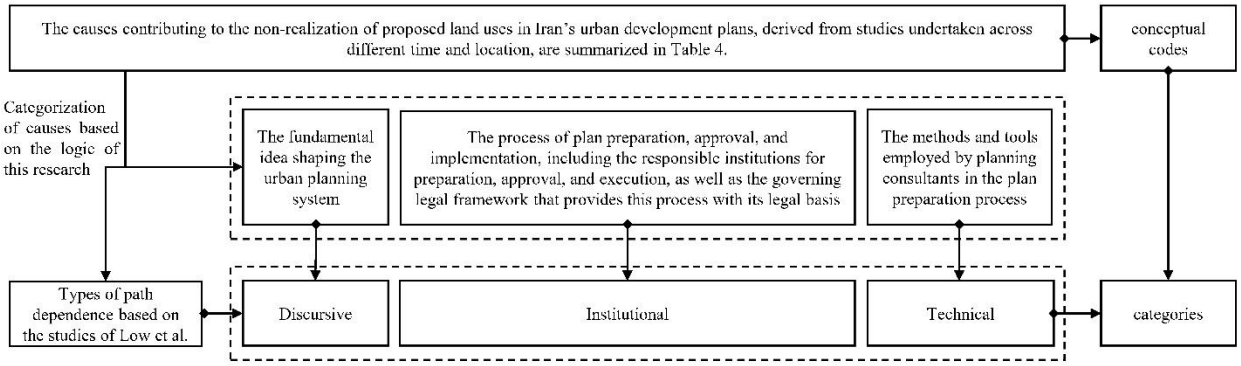

Figure 3. Representation of abstracting conceptual codes into macro-categories.

4.Discussion and Findings

Step 1: A- Examining the Realization Rates of planned Land Uses in Urban Development Plans in Iran

A review of previous studies on the realization rates of planned land uses in urban development plans indicates that only a portion of the planned land uses, particularly public land uses, has been implemented in the cities examined. These studies show that, on average, 40% of green space and sport land uses and 58% of non-profit services were realized in accordance with the proposed standards (Mashhoodi, 2000: 16). A comparison between the average per capita planned [in the Mashhad Comprehensive Plan] for residential, educational, and health-medical land uses 45, 10.5, and 1.5 m², respectively and the actual figures [recorded in 1988], 30, 2.9, and 0.5 m², respectively reveals the limited capacity of the city to achieve the standards envisioned in the plan (Ghamami, 1993: 26). In the study titled Evaluation of Urban Comprehensive Plans in Iran (Plan Organization, 1994), the implementation outcomes of seven urban comprehensive plans were evaluated and analyzed. The overall findings indicated that, in general, «these plans have not practically succeeded in achieving their intended objectives ». The results clearly demonstrate the extent of this failure: in demographic terms, nearly 70% of the forecasts contained substantial errors. Furthermore, while 82% of the predicted per capita standards in the commercial and profit-oriented service sectors were realized, this proportion was only 53% for green space and sports and 60% for public services (Mahdizadeh et al., 2018: 441-442). Moosavi and Rafieian (2004), in an assessment of the realization rates of comprehensive and detailed plans in ten cities of East Azerbaijan Province, demonstrated that although the realization of the studies underpinning these plans was relatively successful, public land uses were not provided in a balanced manner. In particular, the variation in the realization of these land uses, compared with the plan projections, ranged from 0% to 2,300%. Findings from other studies likewise confirm these results. Hoseinzadeh Dalir and Maleki (2007), in an assessment of the planned land uses in the comprehensive and detailed plans of Ilam City, indicated that green space, residential, health–medical, and sport land uses were in an unfavorable condition. In contrast, commercial, educational, cultural–religious, and urban transportation land uses were comparatively satisfactory. This situation indicates the existence of imbalance and inconsistency in the realization of the planned land-uses. Similarly, Azizi and Arasteh (2012), in evaluating the realization of land-use projections in the comprehensive plan of Lar City, demonstrated that many of the projected land-use areas and per capita standards were inaccurate due to an incorrect population forecast for the planning horizon, year 2001. Consequently, even nine years after the expiration of the plan period, part of the planned per capita land-use standards has still not been realized. Ebrahimi, Khakpoor, and Ajza Shokoohi (2014), in assessing the realization rates of selected land uses in the detailed plan of Kashmar City, indicated that higher-education land use had achieved full realization (110%), while commercial use (74%), secondary-education (64%), and green space (63.8%) exhibited partial realization. Rafie and Barakpur (2015), in an assessment of the planned land uses in the detailed plan of Lavasan City, indicated that seven years after its approval, 54% of the city's area exhibited land-use incompatibility. Noorian and Vahidi Borji (2015), in evaluating land-use planning in the detailed plan of Bojnourd City, indicated that based on the «place check» index, only 7.92% of the planned land uses had been realized, while 34.8% remained vacant and 57.28% had been changed to other uses. The «needs assessment» index indicated a realization rate of 47.61%. The discrepancy between the realization rates derived from the place check and needs assessment indexes indicates that merely designating land for a particular use does not necessarily result in the actual implementation of that use. Similarly, Goli Shirhesar and Jaberi Moghaddam (2023), in an assessment of land use in the southwestern area of Mashhad, indicated that the average realization rate of the planned land uses was 38%. Detailed information on the realization rates of selected land uses is presented in Table 3. To enable comparison across different studies and to improve the accuracy of realization calculations, the percentage of land-use realization in this study was calculated using formula presented in Figure 4.

$$\text{Land-use realization percentage} = \frac{\text{Existing area at the time of assessment - Existing area in the plan}}{\text{Proposed area for the plan horizon - Existing area in the plan}} \times 100$$

Figure 4: Formula for calculating the percentage of realization of planned land uses in urban development plans (Source: Authors)

The use of this formula, instead of the conventional «existing area at the time of assessment divided by proposed area for the plan horizon» is justified by the fact that a portion of the land uses already existed in the base year of the plan.

It should be noted that in all studies presented in Table 3, the reported percentages reflect quantitative realization at the city scale; therefore, it remains unclear whether the land uses were implemented in their originally designated locations or elsewhere within the urban area. Among these studies, Noorian and Vahidi Borji provide an important methodological distinction by differentiating between needs assessment realization and place check realization. In this framework, needs assessment realization refers to the extent to which the required amount of each land use is provided at the city level, whereas place check realization emphasizes the precise spatial implementation of land uses in accordance with the locations designated in the plan. The significant gap between these two indexes indicates that even when quantitative provision has been partially achieved, spatial conformity with planning proposals may remain limited. The non-realization of land uses in their designated locations raises fundamental questions regarding the validity of planners' decisions.

Table 3: assessment of the realization rates of planned land uses in urban development plans based on percentage (Source: Authors, based on the references listed below)

Hospitality tourism	Facilities utilities	sport	green space	health–medical	cultural–religious	educational	administrative	commercial	residential	Land uses / year	Base population	city	researchers
19.3	-3.5	13.1	97.6	43.3	67.41	73.9	52.3	41.4	33.6	1365-85	103640	Malayer	Ebrahimi-Zamani
139	149	17.3	14.5	13	62.3	12.9	20.8	52.5	61	1369-87	*39900	Lar	Azizi-Arasteh
-36	102	42.3	5.8	23.4	105.5	103.7	263	178.1	33.1	1372-82	112597	Ilam	Hoseinzadeh Dalir-Malcki
122	23.3	-4.5	9	-63	208	49	83.5	381	-	1373-83	34253	Tabriz, R6	Zangiabadi et al
-	31.1	-40	69.6	-113	98.9	-111	94.1	40.4	26.4	1374-86	18386	** Dehaghan	Nateghi et al
0	0	2.5	0	0	0	79.2	0	3.4	2.3	1375-82	11230	Ardakan	Ebrahimzadeh-Mojir Ardakani
-	84.4	17.7	31.5	53.1	45.89	58.27	64.6	-	-	1383-93	-	Bojnord	Noorian-Vahidi Borji

* The population has been estimated approximately. / ** The basis of the calculation is the guide plan.
Zero indicates that the proposed land use has not been realized. / Dashes indicate that the realization rate was not calculated

B- Examining and Analyzing the Causes Contributing to the Non-Realization of planned Land Uses in Urban Development Plans in Iran

Although examining the realization rates of planned land uses in urban development plans reveals the gap between planning and implementation, it is not sufficient for understanding the nature of the problem. The realization rates merely reflect the outcomes and do not explain the underlying reasons for the emergence and persistence of this condition. Therefore, it is necessary to investigate the causes of non-realization as well. Table 4 presents the causes identified in various studies conducted across different years and cities. In compiling these findings, no consideration was given to the prioritization of factors, or the level of emphasis placed on a specific factor in each study. Rather, only the causes explicitly stated in the text, findings, and recommendations of the reviewed studies were extracted and presented in an aggregated form to provide a general overview of the range of factors discussed in the literature. The findings reported by Sajjadi et al., Noorian and Vahidi Borji, Vahidi Borji, Noorian and Azizi, Rezaei et al., and Goli shirhesar and Jaberi Moghaddam were collected through interviews and questionnaires.

Table 4. Causes Contributing to the Non-Realization of planned Land Uses in Urban Development Plans (Source: Authors, based on the references listed below)

	Researchers	Time	location	the causes of non-realization (conceptual codes)
1	Ghamami	1993	-	The incompatibility of plans with the nature and intrinsic character of the city (inflexibility); the incompatibility of plans with societal

				conditions (non-realism); deficiencies in the existing urban management system.
2	Plan Organization	1994	Rasht, Bandar Abbas, Yazd, Shiraz, Arak, Maragheh, Zahedan	The impossibility of forecasting (particularly in the economic and social sectors); lack of consideration of funding mechanisms and the economic repercussions of the plan; neglect of the demands and the role of citizens in the formation of the city; inappropriate physical regulations; non-realism and rigid planning.
3	Mashhoodi	2000	-	Non-realism; rigidity and inflexibility; standard per capita; neglect of residents' economic capacity; lack of awareness of the city's existing and potential capacities and opportunities.
4	Moosavi & Rafieian	2004	Azarshahr, Ahar, Bonab, Tabriz, Sarab, Ajabshir, Maragheh, Marand, Miyaneh, Hadishahr	Greater feasibility of comprehensive plans compared to detailed plans; the limited effectiveness of fixing the location of public land uses in ensuring their provision; the absence of higher-level plans; lack of population forecasting based on employment; absence of approved per capita standards for land uses; the protracted nature of the preparation and approval process; adoption of certain decisions without adequate study; neglect of ownership type; lack of integrated management.
5	Hoseinzadeh Dalir & Maleki	2007	Ilam	Neglect of the relationship between urban population and the required levels of land use; neglect of social, economic, cultural, political, and geographical factors.
6	Azizi & Arasteh	2012	Lar	Inaccurate population horizon forecasting; lack of consideration of the city's core problems and needs due to the excessive volume of diagnostic studies; forecasting and siting land uses based on proposed per capita standards using an exogenous origin; the lack of participation by both local authorities and the public; ill-considered proposals resulting from the limited presence of experts in the city.
7	Ebrahimi, Khakpoor & Ajza Shokoohi	2014	Kashmar	The static nature of the plan; lack of citizen participation; absence of a systemic perspective; weakness in social and cultural perspectives; lack of integrated management; the consultants' lack of familiarity with the city; uniform content for different cities; weak role of the municipality; financial resource constraints; authoritarianism; low level of implement ability.
8	Sajjadi, Beyranvandzadeh, Radmanesh, & Vaisi	2014	Dorud-Lorestan	The protracted nature of the preparation and approval process; lack of involvement of relevant organizations; expansion of investment flows in the municipalities; insufficient attention to economic, sociological, political, and behavioral considerations; absence of existing-condition data; deficiencies in population estimation; neglect of the role of the public; Lack of obligation for government agencies; unstable municipal revenue sources; lack of preparation of a financial balance sheet; high cost of land acquisition; weakness of the council in defending the public interest; absence of comprehensive development organizations; inability of the municipality to recruit urban planners; lack of legal framework for implementation; lack of consideration for ownership; standardized terms of reference; lack of coordination between the Ministry of Roads and Urban Development and the municipality; lack of linkage with higher-level plans; weaknesses in the formulation and enforcement of regulations; sectoral fragmentation; reduction in

				government support; shortage of urban planners; absence of legal mechanisms for addressing violations.
9	Noorian & Vahidi Borji	2015	Bojnord	High land prices; lack of legal obligation and commitment of departments and organizations; strict regulations; neglect of technical requirements in site selection; insufficient municipal budgets; financial constraints in land acquisition; improper needs assessment; deficiencies in monitoring; landowners' reluctance to transfer land; suboptimal coordination between plan preparers and implementing agencies.
10	Vahidi Borji, Noorian & Azizi	2017	-	Inappropriate planning methodology; standardization; neglect of stakeholders and their multiplicity; Lack of consideration for economic, political, and social factors and key urban issues; Neglect of ownership; mismatch with organizational capacity; shortcomings of consultants; municipal financial deficit; short tenure of management; scientific deficiencies; lack of implementation commitment; inappropriate appointments; potential for rent-seeking and corruption; consolidation of implementation and monitoring authority; lack of budget allocation for monitoring; absence of social control; lack of legal basis for monitoring; contradictions and gaps in laws; Fixed siting; neglect of probabilities; providing detailed recommendations; lack of legal obligation for sectors; absence of a coordinating institution; institutionalization of a culture of rule-breaking; weak training systems; divergence in opinions; absence of the plan preparer during implementation; lack of cooperation between the government and the private sector; lack of public understanding of the plan.
11	Rezaei, Majedi, Zarabadi & Zabihi	2018	Shiraz	Inability of municipalities to acquire land; lack of willingness among agencies; deficiencies in data collection; neglect of the socio-economic conditions of different areas; large-scale land use allocation without taking into account the feasibility of land acquisition; a higher-order provision to offset deficiencies in other parts of the city; omission of land supply solutions; low managerial creativity; lack of mechanisms for the participation of both the private sector and citizens; reliance on government budgets.
12	Goli Shirhesar & Jaberi Moghaddam	2023	Southwest of Mashhad	Mismatch between the plan's logic and the ownership system; Lack of consideration for ownership; forecasting based on accessibility radius and per capita standards; absence of a Property Ownership System; ambiguity in laws; lack of deterrent laws against land hoarding; lack of legal obligation for agencies; exemption of endowment lands from Article 101; lack of transparency; neglect of the private sector; mismatch with the economic capacity of authorities; consultants' insufficient knowledge and lack of attention to feasibility; neglect of realization feasibility; inflexible regulations; insufficient budgets; diminished role of the municipality; lack of coordination between plan preparers and implementing agencies; absence of unified management; failure to prepare financial balance sheets; lack of flexibility; lack of public participation.

A review and reflection on the causes identified in previous studies indicates that, although some of these studies were conducted in specific time and location and each has organized the factors of non-realization within its own categorical framework, considerable overlap and commonality exist among the identified causes. Even cases that may initially appear to be context-specific and unique to a particular study such as the issue of endowment lands in the study by Goli Shirhesar and Jaberi Moghaddam can, at a more general level, be reframed within broader categories related to

land ownership. This conceptual convergence suggests that, despite the diversity of cases, the causes of non-realization of planned land uses follow common underlying patterns. In the present study, rather than directly adopting the categorical frameworks proposed in previous studies, only explicitly stated causes have been extracted and compiled, to enable their reorganization in accordance with the analytical framework adopted here. Accordingly, to avoid fragmentation of factors and to achieve a coherent understanding of the different dimensions of the issue, these causes have been categorized into three macro-categories consistent with the logic of this study: technical, institutional, and discursive dimensions, as illustrated in Figure 5 and presented in Table 5. In this study, the technical dimension refers to the methods and tools employed by the planning consultants in the plan preparation process; the institutional dimension refers to the process of plan preparation, approval, and implementation, including the responsible institutions for preparation, approval, and execution, as well as the governing legal framework that provides this process with its legal basis; and the discursive dimension refers to the fundamental idea shaping the urban planning system.

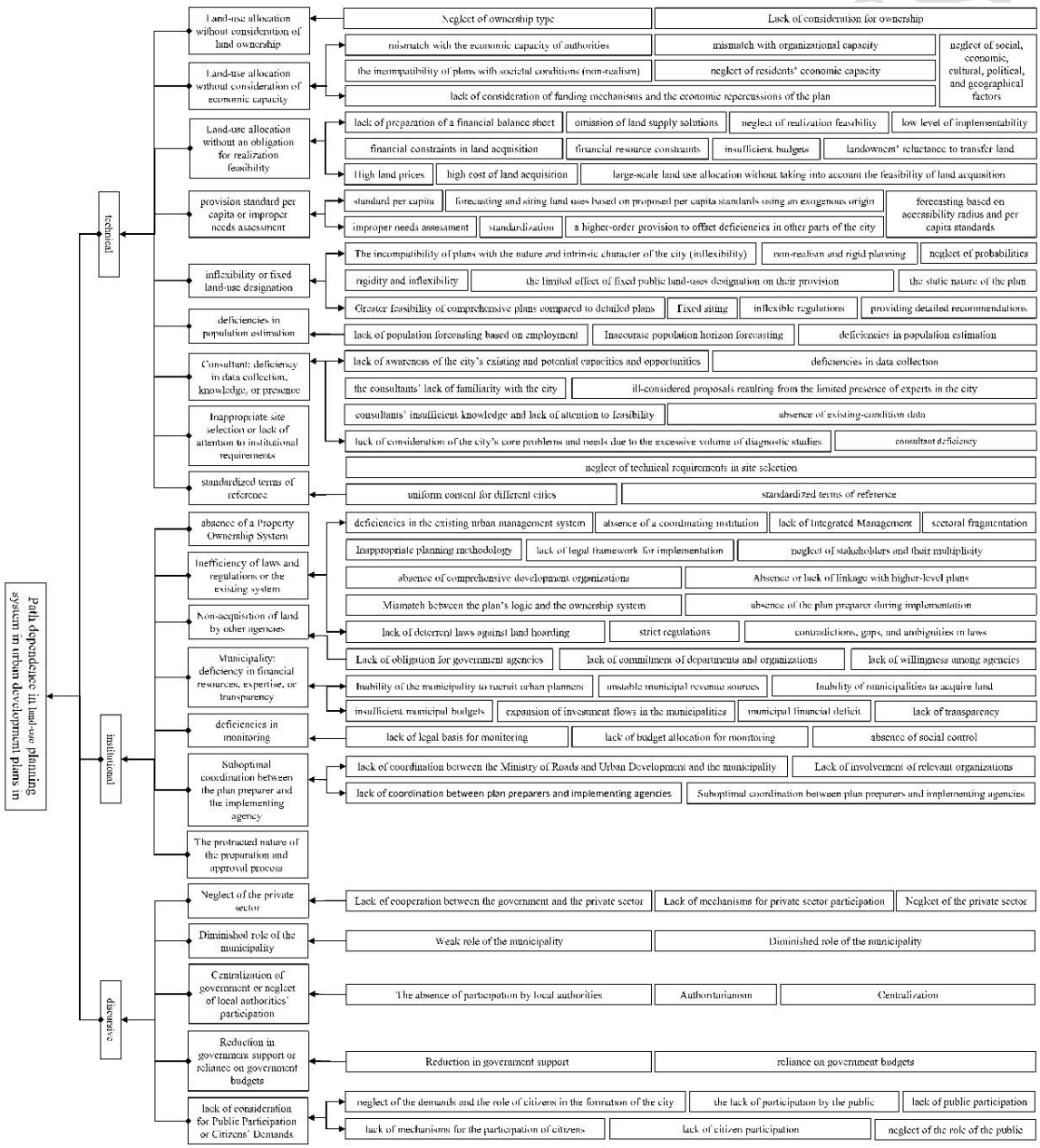

Figure 5: Representation of the process of abstracting conceptual codes into macro categories (Source: Authors).

Table 5: categorization of the causes of non-realization of planned land uses in urban development plans based on the dimensions proposed in the study by Low et al. (Source: Authors)

	Researchers / year / the causes of non-realization based on the dimensions		Ghamami	Plan Organization	Mashhoodi	Moosavi & Rafician	Hosseinzadeh Dalir & Maleki	Azizi & Arasteh	Ebrahimi et al	Sajjadi et al	Noorian & Valiidi Borji	Valiidi Borji et al	Rezaei et al	Gioli Shirbesar & Jaberi Moghaddam
			1993	1994	2000	2004	2007	2012	2014	2014	2015	2017	2018	2023
Technical (43)	Land-use allocation without consideration of land ownership	4				*				*		*		*
	Land-use allocation without consideration of economic capacity	9	*	*	*		*			*	*	*	*	*
	Land-use allocation without an obligation for realization feasibility	4							*	*			*	*
	provision standard per capita or improper needs assessment	6			*			*			*	*	*	*
	inflexibility or fixed land-use designation	7	*	*	*	*			*			*		*
	deficiencies in population estimation	3				*		*		*				
	Consultant: deficiency in data collection, knowledge, or presence	7			*			*	*	*		*	*	*
	Inappropriate site selection or lack of attention to institutional requirements	1									*			
	standardized terms of reference	2							*	*				
Institutional (24)	absence of a Property Ownership System	1												*
	Inefficiency of laws and regulations or the existing system	6	*			*				*	*	*		*
	Non-acquisition of land by other agencies	5								*	*	*	*	*
	Municipality: deficiency in financial resources, expertise, or transparency	5								*	*	*	*	*
	deficiencies in monitoring	2									*	*		
	Suboptimal coordination between the plan preparer and the implementing agency	3								*	*			*
	The protracted nature of the preparation and approval process	2				*				*				
Discursive (16)	Neglect of the private sector	3										*	*	*
	Diminished role of the municipality	2							*					*
	Centralization of government or neglect of local authorities' participation	3						*	*					*
	Reduction in government support or reliance on government budgets	2								*			*	
	lack of consideration for Public Participation or Citizens' Demands	6		*				*	*	*			*	*

Based on the data presented in Table 5, it can be argued that in earlier studies greater emphasis was placed on the technical dimension compared to the other two dimensions. However, in more recent studies, all three dimensions have been examined together. An important point is that the relationship among these three dimensions is longitudinal, meaning that changes in the discursive dimension led to subsequent changes in the institutional and technical dimensions.

Step 2: Explaining the Mechanism of Land-Use Lock-in Based on the theoretical framework of path dependence

During the third five-year development plan (1963–1967), the preparation and implementation of fourteen urban comprehensive plans were initiated. These fourteen cities included Tehran, Tabriz, Rasht, Isfahan, Karaj, Qazvin, Bandar Anzali, Chalus, Nowshahr, Sarbandar, Babol, Babolsar, Bandar Abbas, and Bandar Lengeh. The first urban comprehensive plan approved by the Supreme Council of Urban Development and Architecture belonged to Bandar Lengeh, which was implemented in 1966 (Pirzadeh et al., 2008: 41). By 2021, a total of 883 urban comprehensive construction and development plans, excluding subsequent revisions, had been approved by the Supreme Council of Urban Development and Architecture (Ministry of Road & Urban Development, 2022). Since then, comprehensive plans have become the principal framework for urban planning in cities. The Law on Renaming the Ministry of Development and Housing to the Ministry of Housing and Urban Development and Determining Its Duties, enacted in 1974, formally defined various types of plans, including urban comprehensive plans. Land-use plans (land-use

maps) and regulations constitute the two principal outputs of these plans, through which the future development of cities is projected and planned for more than a decade ahead.

The concept of land use first emerged in Western countries as a means through which governments could regulate land utilization and protect property rights. (Ziari, 2017: 2). Over time, various definitions of urban land-use planning have been proposed, including: «the spatial and physical organization of urban activities and functions based on the needs and demands of urban residents» (Ziari, 2017: 3), or «a set of purposeful activities that organizes the built environment and, to the extent possible, responds the needs and demands of urban communities in the use of land» (Pour-Mohammadi, 2017: 3).

In 1984 (1363 SH), the contract for the preparation of urban construction and development plans, the area of influence, and detailed titled Standard Contract No. 12 was issued by the Plan and Budget Organization to define the standardized terms of reference for the preparation of comprehensive and detailed urban plans, replacing the 1972 (1351 SH) contract. Under these terms of reference, Consultants following a thorough assessment of the city's existing conditions, identify urban deficiencies and needs and forecast the city's population over the next one to two decades. Based on current deficiencies, future population needs, and per capita standards, the required area for various land uses are identified and public uses are typically allocated to vacant lots based on accessibility radius. The primary priority for allocating public uses is state-owned lands. If such lands are not available within the specified area, public uses are allocated to privately owned lands, often without obtaining the consent of the landowners.

Studies conducted by the Plan and Budget Organization in the 1990s represent some of the earliest efforts to evaluate the effectiveness of urban development plans and assess the realization of planned land uses. Since that decade, various studies have examined the realization rates of land uses in urban development plans, and generally concluding that the realization of these planned land uses has been partial and imbalanced. According to the single article of the Law on the Determining the Status of Properties Located within State and Municipal Development Plans: «all ministries, institutions, organizations, state-owned or state-affiliated companies, municipalities, and institutions whose inclusion under the law requires explicit mention by name are obliged, in public or development plans whose implementation has been approved and announced by the minister or the highest executive authority, in accordance with the relevant rules, and which are located on lands and properties lawfully and religiously owned by individuals (natural or legal persons), within the boundaries of cities and towns and their protected zones, to complete the final transaction, transfer of official deeds, and the payment of the price or compensation or equivalent consideration in accordance with relevant laws within a maximum period of eighteen months, following the official announcement of the project».

Despite this law, these lands, as also shown in Table 3, may remain unacquired until the planning horizon. On the other hand, landowners are not able to change the land use to residential use; and if there is an intention to develop the property for uses other than residential, a lengthy land-use conversion process must be undertaken, which may ultimately not result in approval. As stipulated in Clause 2 of Article 49 of the Bylaw on the Procedures for the Review and Approval of Local, District, Regional, and National Construction and Development Plans and Urban Planning and Architecture Regulations (amended in 2005, originally issued in 1999), concerning the review of detailed plan amendments, «in cases where the change relates to public land uses, suitable replacement land in terms of area and location, in coordination with the comprehensive plan, must be proposed». In such circumstances, the land remains excluded from development which in this study is conceptualized as the «land-use lock-in phenomenon». In other words, the land can neither be constructed nor acquired, thereby becoming a frozen asset for the owner, with significant economic, social, and physical consequences.

Various studies have identified different causes for the non-realization of a substantial proportion of planned public uses, which are discussed in Tables 4 and 5. Many of the factors compiled in these tables are included in Standard Contract No. 12, which consultants are obliged to comply with; otherwise, the plan cannot obtain approval (Table 6).

Table 6: Alignment of the causes of non-realization of planned land uses identified in previous studies with Standard Contract No. 12 and other applicable rules (Source: Authors).

	the causes of non-realization	Standard Contract No. 12 and other applicable rules
Tech	Land-use allocation without consideration of land ownership	8-6-3: Land Ownership Status in the City, Classified by Private and Public Ownership Types (Municipality, Endowment, Land Organization, and Other Public Organizations).

Land-use allocation without consideration of economic capacity	4-3- Review and Recognition: Economic characteristics of the city. 5-3- Review and Recognition: Financial, credit, technical, and administrative capacities of the municipality and other organizations influencing urban development.
Land-use allocation without an obligation for realization feasibility	4-1-5- A general projection of the financial requirements for plan implementation and proposed interventions, considering the budgetary limits and capacities of the respective implementing agencies.
provision standard per capita or improper needs assessment	Note 1 of the Resolution on Refining the Definitions and Concepts of Urban Land Uses and Determining Their Per Capita Standards: the per capita standards set out in this resolution shall be applicable to cities that do not possess any specific characteristics in terms of function, role, or climatic conditions. In cases where, during the preparation of a plan and based on its associated studies, the consulting firm responsible for plan preparation identifies the necessity to modify the approved per capita standards for any given city, such modifications may be considered and approved by the plan approval authority, provided that adequate technical justification and necessary documentation are presented.
Consultant: deficiency in data collection, knowledge, or presence	4- The consulting firm responsible for plan preparation shall, in addition to establishing a well-equipped local office, maintain close coordination and cooperation with the municipality and other organizations responsible for urban development. It shall undertake studies and provide solutions to the ongoing urban development issues and problems of the city, and train municipal technical staff in order to familiarize them with the proposed plans and programs. This should be done in such a way that, in the future, the municipality and other relevant organizations are, as far as possible, able to independently continue planning activities and implement development projects.
Inappropriate site selection or lack of attention to institutional requirements	4- All assessments and proposals at the various stages of planning and design should be carried out in conjunction with obtaining the views of organizations and authorities responsible for urban development, and through direct cooperation with them. This ensures that the proposals and plans are prepared and formulated in accordance with existing realities and implementation capacities.
standardized terms of reference	Article 2: The Employer shall have the right, at any time and within reasonable and proportionate limits, to modify the scope of services under the contract, and to reduce or increase certain services. In such cases, the contract duration, and the fee payable to the consultant shall be adjusted proportionally, in accordance with the corresponding increase or decrease in the scope of work.

Although the phenomenon of land-use lock-in has been identified in many cities and its underlying causes have been categorized, the present study seeks to address another aspect of the main research question: why, despite more than three decades having passed since the earliest studies, which estimated only a partial realization of planned land uses and led to land-use lock-in, the same process has continued to persist. This issue is examined through the theoretical framework of «path dependence».

According to Clause 2 of Article 3 of the Law on Renaming the Ministry of Development and Housing to the Ministry of Housing and Urban Development and Determining Its Duties, the preparation of comprehensive plans for each city, in accordance with approved rules and standards, is the responsibility of the Ministry of Housing and Urban Development [Roads and Urban Development]. According to Clause 3 of Article 2 of the Law Establishing the Supreme Council of Urban Development and Architecture of Iran, the final review and approval of urban comprehensive plans and their amendments, outside the detailed plans, fall within the authority of the Supreme Council of Urban Development and Architecture. According to Article 5, review and approval of detailed urban plans and their amendments in each province have been delegated to the commission established under this article. After approval, the plans are communicated to the implementing authority, namely the municipalities. Figure 6 illustrates the structure for the preparation, approval, and implementation of urban construction and development plans, as well as their respective members.

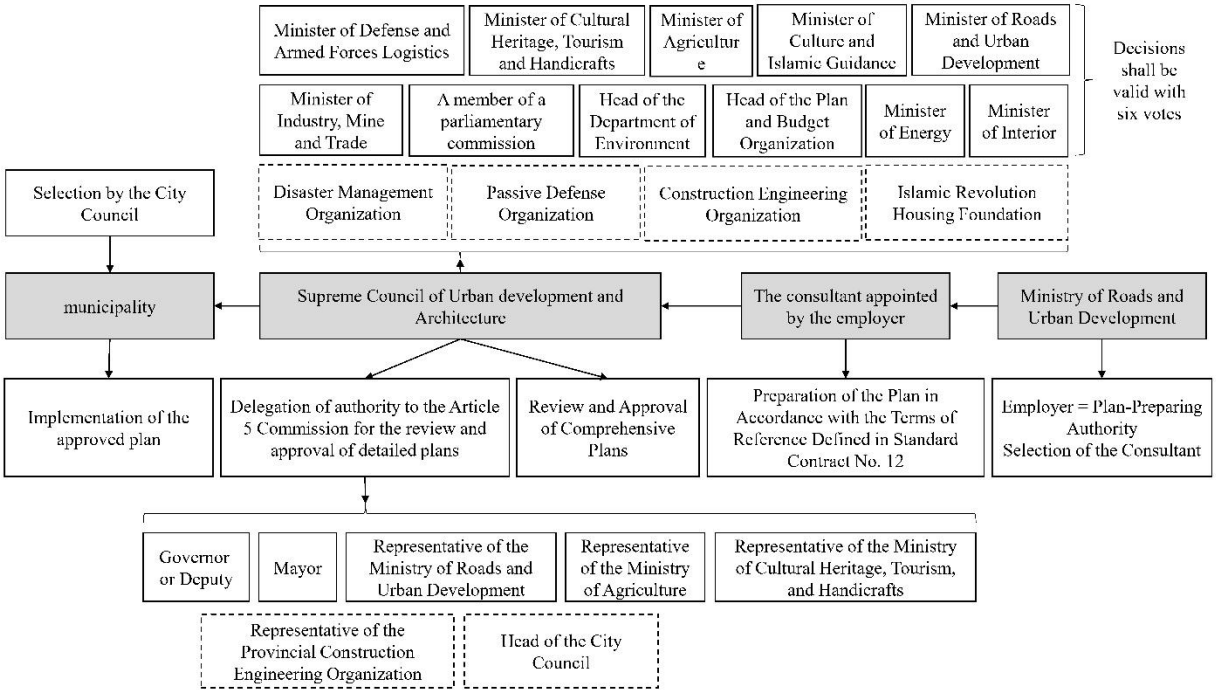

Figure 6: Representation of the structure of the preparation, approval, and implementation of urban development plans (Source: Authors)

City councils are elected through direct popular vote, and according to Article 80 of the Law on the Formation, Duties, and Elections of Islamic Councils of the Country and the Selection of Mayors, they appoint the mayor for a four-year term. In Note 1 of Article 3 of the Law Establishing the Supreme Council of Urban Development and Architecture of Iran, it is stated that «in the review of urban comprehensive plans and their revisions, the views of the governor, county council, city council, mayor, and qualified experts shall be obtained and taken into consideration».

Clause 2 of Appendix 2 of Standard Contract No. 12 states that «coordination with decentralization policies and consideration of the role of local organizations and councils in decision-making processes related to development activities at the city, county, and provincial levels», or «the necessity of independence and self-sufficiency of municipalities and local institutions in planning and implementing urban development programs» or in Clause 4 « The consulting firm responsible for plan preparation shall, in addition to establishing a well-equipped local office, maintain close coordination and cooperation with the municipality and other organizations responsible for urban development … all assessments and proposals at the various stages of planning and design should be carried out in conjunction with obtaining the views of organizations and authorities responsible for urban development, and through direct cooperation with them» and in Clause 3 of Appendix 3, «financial, credit, technical, and administrative capacities of the municipality and other organizations influencing urban development» have been taken into consideration.

Accordingly, in the process of plan preparation by the consultant and its approval by the Supreme Council of Urban Development and Architecture, the views of city councils and municipalities are obtained; however, there is no obligation to incorporate them or in the detailed plan commission, the mayor holds only one vote, while the city council has no voting rights. In contrast, city councils and mayors receive the most substantial feedback from citizens regarding the advantages and disadvantages of the prepared plans. Although such feedback is accumulated within these two institutions, there is no mandatory requirement for its utilization in decision-making processes.

The Ministry of Roads and Urban Development (as the client), the consultant (as the plan preparer), and the Supreme Council of Urban Development and Architecture (as the approving authority) are, in comparison with city councils and municipalities, less exposed to feedback regarding the outcomes of the plans in general, and specifically regarding the non-realization of public land uses, which is the focus of this study. As a result, they may become trapped in reflection trap and, due to the absence of feedback reception, this path may become self-reinforcing through positive feedback and thus persist over time. The origin of this path dependence, based on the identified origins (Table 1), is

system origin; That is, members of the problem-solving team may convince one another of the validity of the design approach adopted by the team.

The first comprehensive plan was approved in 1966 (1345 SH), consisting of two main components: review and recognition of the city's existing condition, and planning and guiding its future development based on the findings of the comprehensive plan studies (Behzadfar, 2015). In 1972 (1351 SH), Standard Contract No. 12 of the Plan and Budget Organization was issued, and in 1984 (1363 SH), it was revised under the title contract for the preparation of urban construction and development plans, the area of influence, and detailed. Appendix 3 includes regional review, review of the urban influence area, urban review and recognition, analysis and synthesis of reviews, and preparation urban development plans and programs and the area of influence. In 2010 (1389 SH), the Supreme Council of Urban Development and Architecture approved the resolution titled «Refining the Definitions and Concepts of Urban Land Uses and Determining Their Per Capita Standards».

The above-mentioned items are part of research conducted on the process of preparing comprehensive plans and land-use planning. «Learning effects» refer to the idea that "Over the course of time, firms learn better ways of producing the same goods and at lower cost" (Low et al., 2005: 394), which may lead to path dependence with a **learning origin**, resulting in a locked-in path while alternative pathways are set aside. The time and resources that have been invested so far in plan preparation and related studies may also generate a sunk cost trap. «The sunk cost effect refers to the phenomenon where people want to keep on committing resources to a project in which they have previously invested. This happens regardless of whether the earlier investments have been successful or not» (Hamalainen & Lahtinen, 2016: 17), which can contribute to path dependence through a **behavior origin**. These costs include prepared plans, conducted research, academic training in universities, consultants' experience, and books that have been translated or authored to date and …. Continued commitment to the project may also reinforce a commitment or identity trap.

Urban development plans are prepared under the authority of the Ministry of Roads and Urban Development, which, as the employer, employs consulting engineers under Standard Contract No. 12 for engineering services. Based on the terms of reference, consultants are obligated to provide the specified services, and according to Appendix 7 of the contract, their remuneration is determined based on the population and area of the city. The prepared plans are then approved by the Supreme Council of Urban development and Architecture. In accordance with the terms of reference, consultants first conduct a survey of the existing conditions, then forecast the horizon-year population, and subsequently estimate the required land area for each land use by assessing existing deficits. The preparation and approval of these plans thus follow a predefined procedure from the outset, which may lead to path dependence with a **procedure origin** and lead to a **normative trap** where, given that up to 2021 a total of 883 urban plans have been prepared, the implicit assumption becomes that «what has been done must be correct because it is already being done». Since the employer is a single centralized authority for all plans and consultants are paid according to a predetermined budget, competition for offering alternative approaches is diminished, which may create path dependence with the **motivation origin**. Furthermore, when the proposed plan conforms to initial expectations, groups may become satisfied with it and discontinue the search for alternative models.

Since land-use planning is a component of urban development plans, to break path dependence in urban development plans in general and land-use planning in particular, the following recommendations are proposed:

1. To enhance the participation of citizens and local institutions, and to improve satisfaction and creativity in cities, responsibility for commissioning urban development plans should be transferred from the Ministry of Roads and Urban Development to municipalities. Under this arrangement, the costs of plan preparation could either be financed through municipal revenues or covered by central government funding in return for the delivery of planning services.
2. Municipalities should establish a planning council composed of relevant experts. In this way, instead of a strong centralized Ministry of Roads and Urban Development, stronger municipalities would be formed.
3. Given the substantial resources that have already been invested in the preparation of urban development plans, and to prevent sunk costs trap from obstructing institutional change, it is proposed that previously prepared comprehensive plans be retained as a valuable repository and used as «base plans» with any subsequent modifications subject to approval by the municipal planning council and then the city council.
4. In the current process, land-use allocation in urban development plans is undertaken by public institutions in the name of public interest; however, the consequences may directly affect private property rights. Therefore, to break the existing path, once the owner of a property designated for public use submits an application to the municipality for development permission, the responsible public authorities should compensate the owner for the resulting losses and damages. Otherwise, the owner should be entitled to access all the benefits available to other citizens (Figure 7).

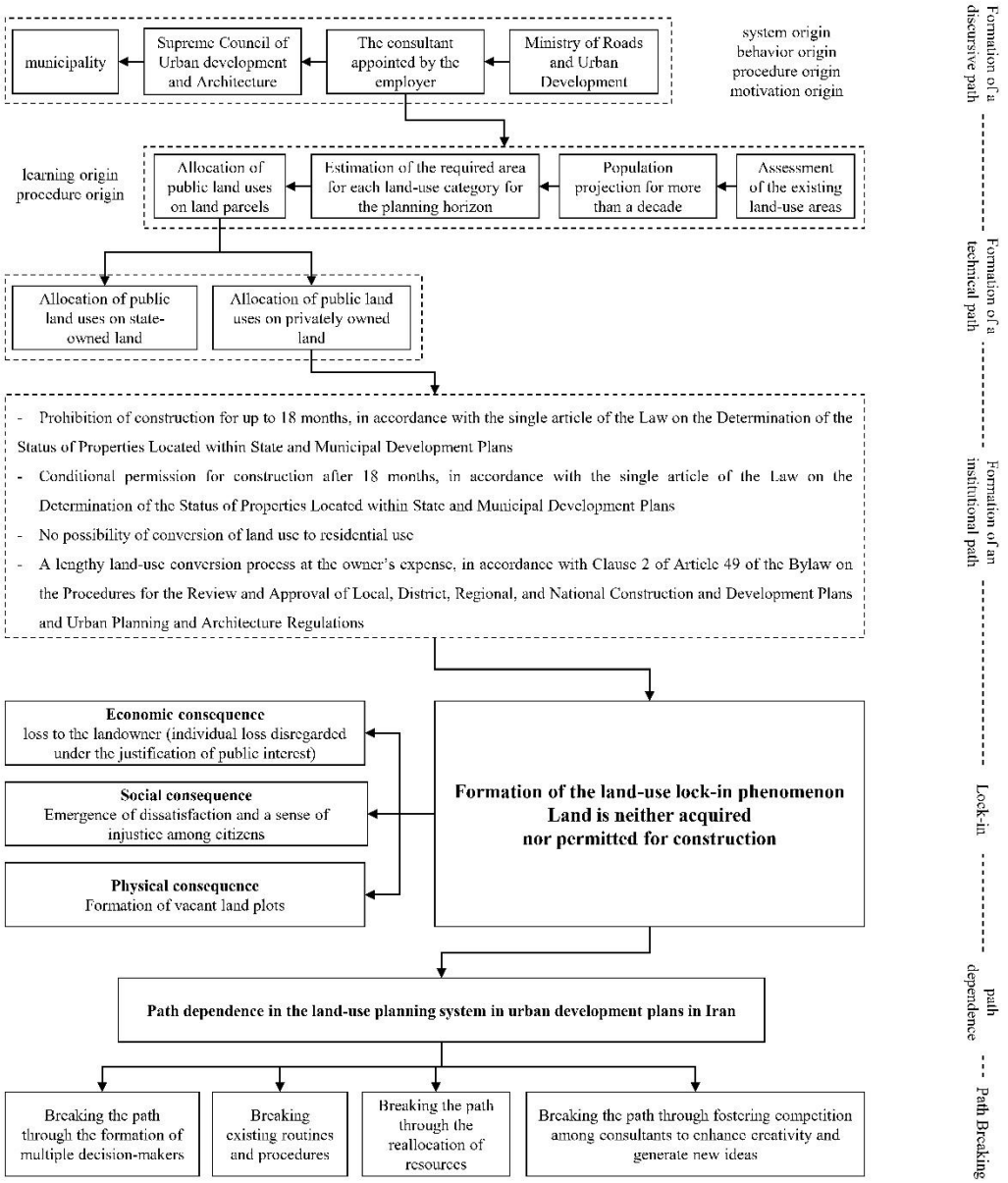

Figure 7: Representation of the formation of lock-in and path dependence phenomena in land-use planning in Iran (Source: Authors)

5.Conclusion

Land-use planning in Iran is implemented through the preparation of urban construction and development plans for urban areas. Urban construction and development plans in Iran are long-term plans that project and plan the future of cities over more than a decade by defining land-use maps and construction regulations. The proposed land-use map fixes the spatial allocation and extent of each land use for the planning horizon. A review of the existing literature indicates that the realization rate of planned land uses in urban development plans is partial and imbalanced; meaning that the realization rate of a particular land use may exceed 100 percent or even be zero. The non-realization of planned land uses has two major consequences. First, public needs anticipated in the plans remain unmet but the second is more significant, when planned public uses are allocated to privately owned lands, such land may neither be acquired nor constructed during the plan period, which often exceeds a decade resulting in a phenomenon termed «land-use lock-in». The allocation of land uses on privately owned land is carried out in pursuit of public interest for all city residents; however, its economic costs are borne by individuals, leading to dissatisfaction and perceptions of injustice.

Beyond its impacts on individual property owners, it may also produce collective consequences through the increase in vacant and abandoned land and the insecurity associated with such conditions.

A review of the literature on the causes of non-realization of planned land uses further indicates that these causes, regardless of time and location, are largely overlapping. They are not merely the result of implementation failures; rather, they reflect a recurring structural pattern. Accordingly, this persistence is described within the «path dependence framework» When, among several possible alternatives, a particular solution is selected to address a problem, it may become locked-in over time, marginalizing alternative paths, and leading to a dependence on a path. This path is subsequently sustained through self-reinforcing positive feedback mechanisms.

In this study, the causes of non-realization identified in previous research were first classified into three dimensions of path dependence: technical, institutional, and discursive. The relationship among these three dimensions is longitudinal, meaning that a change in the discursive dimension will also lead to changes in the institutional and technical dimensions. Based on the conducted analysis, it was found that earlier studies on the causes of the non-realization of land uses placed greater emphasis on the technical dimension than on the institutional and discursive dimensions, whereas more recent studies have addressed all three dimensions. Subsequently, path dependence is described through its system, learning, procedure, behavior, and motivation origins as follows:

- The lack of citizen feedback regarding the advantages and disadvantages of proposed urban development and construction plans may lead the problem-solving team to become convinced of the validity of the chosen path.
- The approval of terms of reference, standard per capita, and other related provisions facilitate path learning among members of the problem-solving team.
- The time and resources invested in urban development plans over the past six decades such as academic training, research activities, consultants, translated books, and other related resources reinforce the persistence of the existing path.
- The preparation and approval of urban construction and development plans based on predefined terms of reference have established a standardized procedure. Given that consultants' remuneration is also determined based on these terms, competition and creativity within the process are not sufficiently fostered.

Breaking the existing path is proposed through two main strategies: first, transferring the commissioning authority from the Ministry of Roads and Urban Development to municipalities; and second, shifting the consequences of land-use allocation on privately owned land from individual to the collective. (Figures 8 and 9).

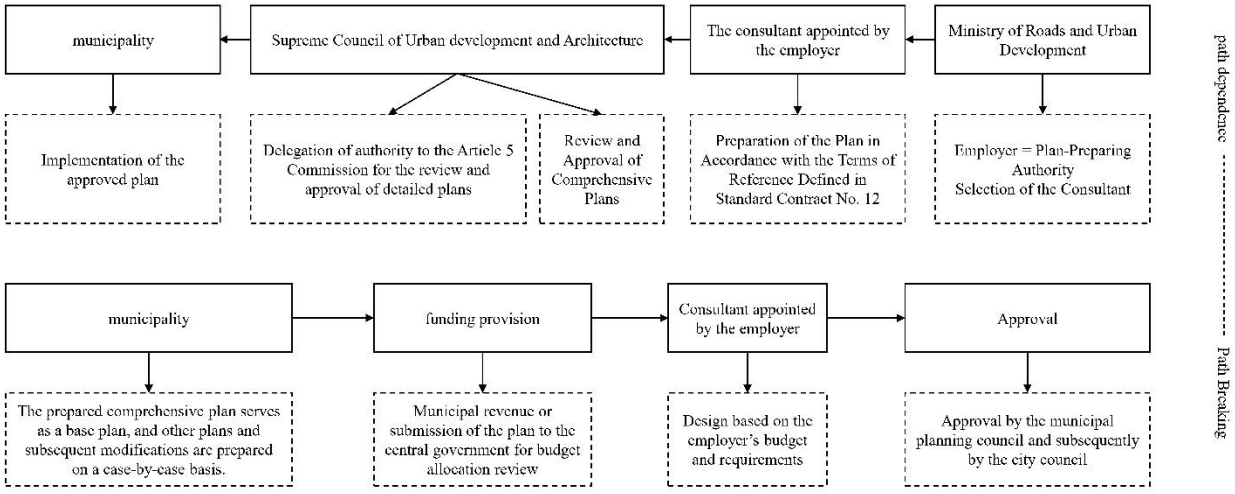

Figure 8: Institutional mechanism for breaking path dependence (Source: Authors)

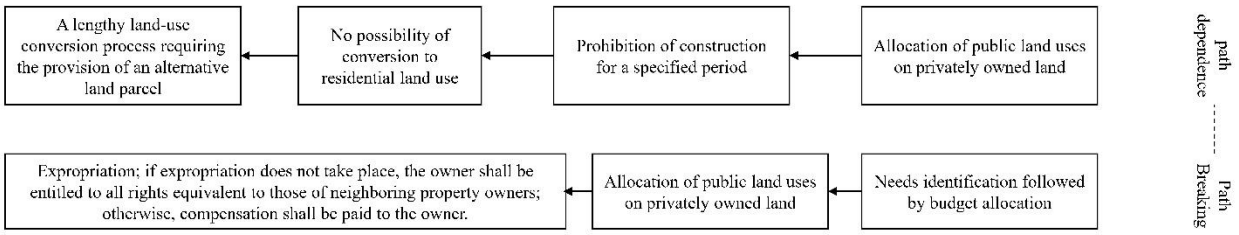

Figure 9: Transition from path dependence toward breaking the path (Source: Authors)

Authors' Contributions
The authors contributed equally to the development of this article.

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Conflict of Interest
The authors declare no conflict of interest.

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