

REVIEW PAPER

The urban innovation system modeling: using Meta- synthesis method

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ABSTRACT

BACKGROUND AND OBJECTIVES: According to the path of economic growth theories, especially the introduction of endogenous growth theories to address the shortcomings of extrinsic theories, the economic systems in order to achieve long-term economic growth goals need to drive stimuli and improve endogenous components that originate, crystallize, and evolve within these systems. Some endogenous growth models have stated that one country could be more successful than another if it devoted more resources to innovation. So today, the study of how to create innovation in various economic systems has become a challenging issue in the world's economic circles.

METHODS: Using the Meta- synthesis method, 19645 sources were collected between 1997 and March 2020 related to the urban innovation system, and after 7 steps and classification of resources, finally, 10 sources were selected and based on the coding method, the ten mentioned sources were coded. The estimated kappa coefficient indicates the reliability of the selected codes.

FINDINGS: The paradigm model of the urban innovation system was extracted based on the performed codes. This model can be used as a pivotal model in future studies.

CONCLUSION: An innovation system that can be implemented and applied in urban geography overcomes many urban, regional, and even national problems. Since this study examines the theory of Urban Innovation System, it can be expected that the results of this study can bring a positive step to determine the specifications and measures needed to create, sustain, and expand urban innovation systems.

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INTRODUCTION

Innovation in Endogenous Economic Growth Theories

In this strict competition era, all actors in economics must focus on their strengths for continuous growth, which would presumably lead to economic development (Soyer et al., 2020). Therefore, some economists have tried to explain knowledge, innovation, and new technologies as endogenous growth factors by providing endogenous growth patterns. In this regard, the separation of human capital from other production factors in the form of coded knowledge is one of the important issues that shows research and development activities are more important than before. In some other studies, differentiation between human capital, knowledge, and technology leads to long-term growth affecting the per capita production. In the early 1980s, Romer (1986) and Lucas (1988) stimulated the interest of macroeconomists in economic growth by emphasizing the economics of thought and human capital after Solow studies (1956) and focusing on the accumulation of physical capital. Using new advances in incomplete competition theory, Romer (1990) introduced the technology economy to macroeconomists (Oketch, 2006). Following these theoretical advances, empirical studies began by some economists, such as Barro (1990), to quantify and test growth theories. According to Solow model (1956), the technology is assumed to be exogenous, which goes forward regardless of other issues. But in the mid-1980s, Romer (1986) established the link between economic growth and the economics thought, and the pattern of endogenous growth was taken seriously at the economic level (Pala, 2019). The endogenous growth pattern seeks to explain technology as an endogenous factor influencing production and economic growth. These models introduced the effect of technology through different ways and factors such as human capital, improving production quality, and expanding various products in the growth model. The endogenous growth pattern presented by Lucas has been expanded by introducing the human capital factor in the neoclassical growth model. In their model of improving production quality, Aghion and Howitt (1992; 2005) and Aghion et al., (1998) explained the use of new technologies that would allow producers to leave the scene with old technology using the Schumpeter perspective (1934). Grossman, and Helpman (1993) introduced

endogenous growth patterns with the advent of new technology, which they said led to research and development. This in turn leads to the production of knowledge and innovation that could ultimately pave the way for economic growth (Fagerberg et al., 2010). On the other hand, there is the view that with increasing economic growth, more facilities and financial resources will be provided to entrepreneurs, and this in turn can expand innovations. In fact, there may be a circular flow between innovation and economic growth. Innovation increases economic growth, and economic growth itself can lead to increased innovation (Galindo and Mendez, 2014).

Innovation

“From a terminological point of view, innovation means the process of acquiring a creative idea and turning it into a useful product, service, or operating method. In other words, innovation is a thought, idea, or application in a product, service, or method” (Henderson and Clark, 1990). In fact, innovation is the development and implementation of new processes or procedures that are inherently different from what they are. The position of innovation is a well-known position in economics and especially in the theories of economic growth. A significant part of economic growth is explained by the factor of innovation. In traditional economics, the relative economic power of countries and regions was explained by factors such as the existence of diverse amounts of natural resources and the abundance of cheap labor (Pyka and Prettner, 2017). Over the past decades, economic, regional management, and economic geography scholars have gained more evidence that increasing productivity is the key factor to achieving high levels of income, employment, and productivity growth that could be achieved by the innovation (Dziallas and Blinda, 2019). This finding led to extensive research efforts to understand how innovation works and how innovators and policymakers can increase innovation. On the one hand, stimulating the innovation capacity of enterprises and industries is an opportunity to improve living standards, and on the other hand, ignoring innovation will lead not only to economic recession, but also to economic collapse. As Schumpeter (1934) warned as “the father of innovation studies”, innovation is a double-edged sword. Innovators are creating a temporary monopoly on new products that allow them to

have high profits and employment over a period of time. But at the same time, existing products and techniques are obsolete due to new innovations, and this leads to the destruction of the forward movement of the creative process, which can lead from wealth to poverty in a very short time. Thus, "innovation is the engine of economic development, and for its growth and development, the necessary infrastructure must be created and strengthened in different countries, especially in developing countries" (Imon, 2006). As noted, although most entrepreneurs and policymakers are now aware of the importance of innovation, many researchers are still trying to better understand the innovation mechanism production and its supportive policies (OECD, 2008). Therefore, innovation is considered as one of the most basic requirements for the path of economic growth and development, which requires the maximum use of existing capacities, the creation of new capabilities and the conversion of potential capacities to actual capacities with emphasis on all types of capital, especially human and social capital that provide suitable conditions for the movement of the cycle of innovative activities (Perry, 2011).

The importance of innovation

In fact, the key to economic growth is human capital and emphasizes the role of innovation as an input factor of production. Numerous studies have attempted to explain innovation by combining models of economic growth, most of which agree that increasing the quantity and quality of innovative activities increases a country's economic growth rate. Among them, the studies of Fagerberg and Verspagen (2002); Metcalfe (2002); Demirel and Mazzucato (2007); Hasan and Tucci (2010); Sener and Saridogan (2011); Bartiuk (2014), Dmitriev *et al.*, (2016); Ashford and Hall (2018); Berneir and Plouffe (2019); Hu and Jaffe (2007) can be mentioned. However, some of these studies suggest that innovations can only improve a country's economic growth if the necessary conditions are provided for their implementation in the country (Lebel, 2008; Chen and Puttitanun, 2005). Innovation, as the engine of economic growth and national welfare, takes place within an innovation system that includes the activities and interactions of a set of members, including firms, individuals, universities, government-sponsored researchers and non-governmental organizations, and the socio-

economic environment (Pece *et al.*, 2015). For this reason, designing an innovation system is very important to provide a favorable atmosphere in which economic agents innovate and create technology (Rauhut and Hatti, 2017). The most important aspects of urbanization are industrial capacities, trade and handicrafts, interaction with the surrounding agricultural areas, a community that accepts and includes immigrants, an efficient and effective judicial system, schools and studies, and physical location with access to a good transportation system. It is possible to trade with other cities and countries. Therefore, only cities can provide the necessary environment to increase revenue and power (Lee *et al.*, 2017; McQueen, 2008; Oleinik and Zakharova, 2019). Cities are vessels of creativity and have always been the cycles of movement, concentration and direction of human creative energy. Most of the literature that has been written about innovative cities has not only focused on the role of innovation in urban growth and formation, but also emphasizes that by removing restrictions and barriers (physical, social, cultural, etc.) from cities, Innovation will become the driving force of economic growth and development of cities, regions and countries (Chen *et al.*, 2020; Caratelli *et al.*, 2019). Economic growth requires the accumulation and utilization of different types of capital, especially human capital and skilled labor. Cities are one of the most important population points, which are the factors affecting economic growth due to the existence of numerous educational and research centers and the accumulation of skilled labor (Bakhri and Fauzi, 2019; Zhang *et al.*, 2019; Zait, 2017; Chen and Choi, 2004; Carillo, 2004; Edvinsson, 2006).

The Importance of Cities

Throughout history, cities have played an important role in the social and economic development of countries. Cities are effective and efficient elements for the growth of the national economy, as well as the production of resources needed for public and private investment in infrastructure, education, and health, improving living conditions and reducing poverty (Marceau, 2014; Wei *et al.*, 2020). The capacities and capabilities of creativity and problem solving in cities are unique, as most cities are described as the cradle of creativity and as an innovative environment (Brezzi and Veneri, 2015). Cities are the boiling springs of

new ideas and innovative experiments and the center of the opportunities and threats flow (Athey *et al.*, 2007). Therefore, it is expected that the establishment of an appropriate UIS, given the specific conditions in each city, will make it possible to turn challenges into opportunities.

Cities: The Geography of Innovation

Based on the previous discussion, it can be concluded that the place of production and birth of innovative ideas should be a rich environment in all types of capital (Lever, 2002; Schragger, 2007). Cities are potentially innovative in terms of community and the accumulation of physical, financial, human and social capital (Song and Kim, 2020). In fact, cities are a gift of a dual nature to human societies (Maradana *et al.*, 2017). Providing favorable conditions for development in all areas will lead to the growth of urban living standards, improve productivity, and increase per capita income. Yet, on the other hand, in many developing countries, experience has shown that cities have a lot of social and economic issues. In some cases, in these countries, cities do not generate economic growth for the countries, but are an obstacle to development. Many major cities in these countries are the proven evidence for serious economic losses in urbanization. Policymakers in these countries may argue that in order to boost the national economy, it is necessary to limit urban growth, although the practicality of such policies will always be controversial (Berezin *et al.*, 2019, Aranha *et al.*, 2017). However, it can be said that the benefits of big cities outweigh their disadvantages. Even in the cities of developing countries, according to Scott (2006), in all cases, the long-term benefits of urban growth outweigh the costs. In the City Economics, O'Flaherty (2005) suggests that urban problems arise from the same factors that lead to the successful functioning of cities, such as skiing on water and expecting it not to get wet. Despite the losses and other problems caused by urban growth, big cities act like the growth machine of the national economy and, in recent years, the world economy. Large cities in the capitalist economy are places for high productivity and efficiency (Pinto Ferreira *et al.*, 2015). They have achieved astonishing growth through the growth of trade, industrialization, modernization, and now globalization. The importance of cities in national development as well as in global development has

been emphasized in many academic works. Life without cities will be very poor, not only for urban dwellers, but also for all those goods and services that are produced in cities, as well as people with high income. Because they have migrated to cities to achieve a higher life quality. Cities have always been at the forefront of national wealth creation (Chung, 2008). Very difficult experiments become commonplace through cities. Cities are the mother of innovations and inventions, and valuable interactions are made possible by the presence of a thoughtful mass and diversity. Cities are densely populated environments where people adapt, and their ability to leap toward progress is tested. Cities over the centuries have grown slowly to fulfill this role (Savitch and Kantor, 2002).

Urban Innovation System (UIS)

Cities cannot function separately and independently, but each city is part of an interconnected complex network of cities. This intertwined network in the context of globalization, as part of the global human subsystem and urban space (Navarro Yanez, 2013; Herrera- Medina *et al.*, 2013). Meanwhile, the increasing spatial expansion of cities, constructions, increasing the cars, creating permanent urban traffic and environmental pollution, etc. create this undeniable necessity in the third millennium, that is the creation of a UIS to make a permanent suitable communication with urban problems and solving them in a timely position (Taylor *et al.*, 2014; Chamchong and Boossabong, 2020). UIS deals with unique social aspects that exist in the urban environment by upwards or downwards. "An innovation system on such a small scale is considered not only because of economic factors, but also because of all the range of social challenges. Therefore, the present time is a 'critical time' to lay the groundwork for future success" (Markatou and Alexandrou, 2015). Fig. 1 shows the characteristics that appear to have the greatest effect on the performance of a UIS.

- ✓ Actors: UIS requires a specific combination of actors depending on the step of development and profile of the system.
- ✓ Networks: In addition to the composition of the actors and their individual characteristics, the innovation capacity of a UIS also depends on the interactions and connections between the actors.

Different types of networks can be distinguished from formal, institutional, and commercial networks to informal and populist networks.

- ✓ Platforms: Many networks appear automatically when playing between actors. Successful UIS have platforms that host networking and care for permanent innovation and network reconstruction (Francin, 2015).
- ✓ Space environment: This includes the city location and access where the innovation system is located, as well as the range and quality of amenities that make this place attractive for skilled workers, entrepreneurs, and businesses (Florida, 2005).
- ✓ Institutional environment: This regulates the rules of the game, and defines business cultures and attitudes towards cooperation and entrepreneurship, and therefore has a great impact on the innovation process.
- ✓ Externalities: The path of development and innovation capacity is a UIS influenced by external factors such as the market and technological opportunities that arise at different times during the system development process (Van Winden et al., 2014).

UNCTAD (2018) in its report shows the relationship between the performance of innovation, enterprises, government, civil society and universities. Each of these components and their functions leads to the creation of human capital, market demand and conditions, finance and the entrepreneurial ecosystem, policy and regulatory framework, technology infrastructure, governance and institutional issues, and the connection to innovation. International political cooperation, natural resources,

poverty, migration and other social challenges, as well as emerging technologies, influence the performance of innovation. Jukneviene (2019) examines the relationship between innovation and institutional structures and stated that innovation capacity in any country is subject to political decisions in that country. The current study has been carried out in Kermanshah in 2020.

MATERIALS AND METHODS

Survey design and data collection

Grounded Theory (GT)

Grounded theory refers to discovering a theory in social science research based on systematic data collection to reach a step of the subject matter understanding that enables us to compare the theory we have built with real data with existing theories. Grounded theory aims to identify and understand people's experiences of events in a particular context. In this method, using data, a theory is developed that explains a process or phenomenon (Glaser et al., 1968). When we need a theory to explain a process, achieving it requires the use of a strategy that involves constructing a theory. Especially when existing theories are not able to explain such a process well, with the help of grounded theory, it is possible to formulate a theory about the occurrence of this process, the problem or the observed individuals. Grounded theory is an inductive exploratory research method that allows researchers in a variety of subject areas to develop their own theory rather than relying on the existing theories. This theory is formulated systematically based on the real data. It is used in cases where our knowledge is limited in intended fields.

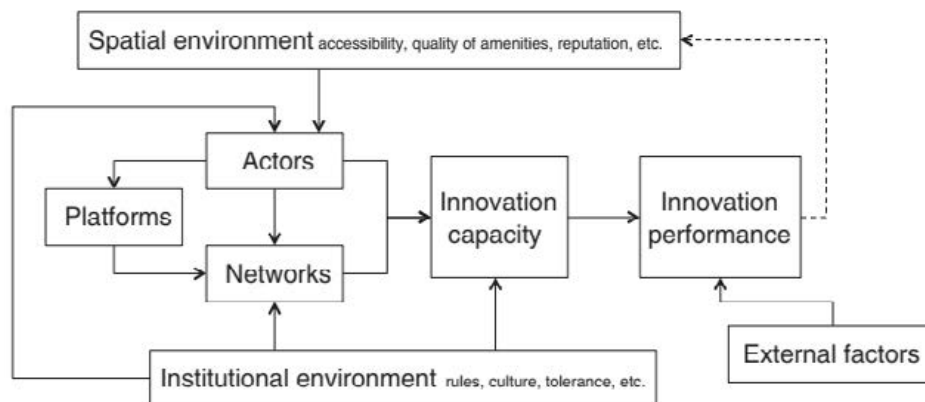


Fig.1: Performance and innovation capacity in the UIS (Van Winden et al., 2014)

Therefore, this paper has a qualitative method, and collects and analyzes data from the grounded theory (Bazargan, 2010). Given that no research has been conducted so far on the UIS that focuses exclusively on step-by-step elements and their stratification, this study, using the grounded theory method and similar studies, first establishes a general framework of UIS and, then, by using systematic study of texts (meta-synthesis method) and related tools in that field.

Grounded Theory and Coding Method

There has been some discussion in the literature about what characteristics a grounded theory study must have to be legitimately referred to as 'grounded theory' (Morse et al, 2009). The fundamental components of a grounded theory study are set out in Table 1. These components may appear in different combinations in the qualitative studies; a grounded theory study should have all of these.

Systematic Study of Texts

Meta-synthesis is a qualitative research method that provides an interpretive combination of qualitative findings, so that the result of the combination is more than the total findings of the resources used (Mays and Pope, 2000). The ultimate goal is to develop a theory, summarize, and generalize it at a high level to

provide more access to qualitative findings for their practical application (Sandelowski et al., 2008). This resource is most useful in meta-synthesis studies. The steps in this method include setting up the research question, systematic literature search, searching and selecting appropriate texts, extracting paper details, analyzing and combining qualitative findings, quality control, and presenting findings (Xu, 2008). In order to determine transcendental validity, the Critical Appraisal Skills Programme (CASP) vital assessment tool provides a comprehensive list of questions that can be used to determine the validity, applicability, and appropriateness of the study (Glynn, 2006). The remainder of this paper is organized as follows. The next section provides the results including the results of meta-analysis, the grounded theory, and the end section concludes the paper.

RESULTS AND DISCUSSION

Meta-synthesis

Step 1: Setting up the research question

The first step is to determine "what" to study. In this paper, the main question in order to conceptualize this structure is that what the components of the UIS are.

Step 2: Systematic literature search

Table 1. Fundamental components of a Grounded Theory study

Component	Stage	Description
Openness	Throughout the study	Grounded theory methodology emphasizes inductive analysis. Induction moves from the particular to the general: it develops new theories or hypotheses from many observations. This means that grounded theory studies tend to take a very open approach to the process being studied. The emphasis of a grounded theory study may evolve as it becomes apparent to the researchers what is important to the study participants.
Analyzing immediately	Analysis and data collection	In a grounded theory study, the researchers do not wait until the data are collected before commencing analysis. In a grounded theory study, analysis must commence as soon as possible, and continue in parallel with data collection.
Coding and comparing	Analysis	Data analysis relies on coding - a process of breaking data down into much smaller components and labelling those components - and comparing - comparing data with data, case with case, event with event, code with code, to understand and explain variation in the data. Codes are eventually combined and related to one another - at this stage they are more abstract, and are referred to as categories or concepts.
Memo-writing (sometimes also drawing diagrams)	Analysis	The analyst writes many memos throughout the project. Memos can be about events, cases, categories, or relationships between categories. Memos are used to stimulate and record the analysts' developing thinking, including the comparisons made.
Production of a substantive theory	Analysis and interpretation	The results of a grounded theory study are expressed as a substantive theory, that is, as a set of concepts that are related to one another in a cohesive whole. As in most science, this theory is considered to be fallible, dependent on context and never completely final.

(Sbaraini et al., 2011)

Table 2: The key terms of UIS

	Word
1	Innovation system
2	Innovation function
3	Urban innovation
4	UIS
5	Sectorial innovation system
6	Regional innovation system
7	National innovation system

Various terms were used from 1997 to March 2020 to search for papers to answer the question at Scopus, Science Direct, and Springer. These terms can be seen in Table 1:

In the first step, the introduced databases were searched using the key terms of Table 2, and all papers were collected based on the relationship between the papers and their titles. 19,645 sources were found, among which 6,192 were book chapters and 13,453 were papers. In addition, 17 sources were Persian and the rest were English.

Step 3: Searching and selecting appropriate texts

In this step, the sources found in the previous step

are browsed step by step according to acceptance or non-acceptance of articles. Acceptance criteria include articles published in journals and books in Persian and English on the subject of the innovation systems and, in particular, the UIS from 1997 to March 2020 by qualitative or qualitative-quantitative research methods. At this step, the articles are carefully reviewed in several steps to determine which ones are appropriate for the research questions. Therefore, during these steps, articles that do not relate to the questions are omitted to ultimately detect the most relevant articles to extract the accurate answers to the questions. The review process includes skimming the articles' titles, abstracts, and content which are reviewed at each step according to the acceptance criteria. In this study, the steps of the review process are as follows:

1- The field of work of the obtained findings was examined, and some of the findings were left out due to the lack of a systematic scientific structure. At this step, 889 abstracts (excluding articles), 1,707 lexical explanations, 287 newsletters, 921 book reviews, 231 conference introductions, 813 authors, 670 debates, and 3,256 other unrelated items were discarded. And

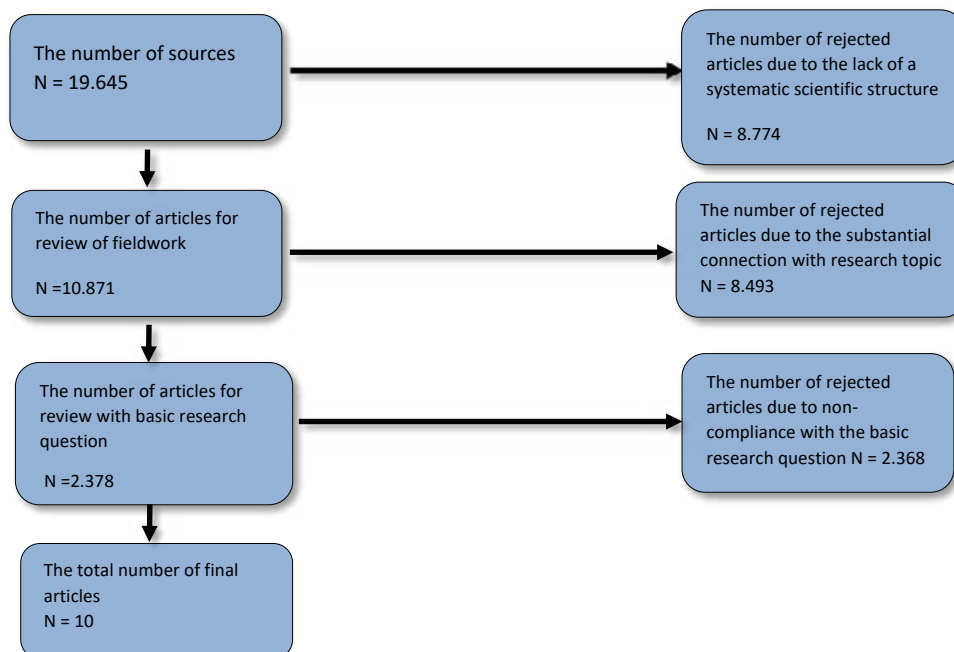


Fig. 2: A diagram of the meta-synthesis steps for the main research question

10,871 sources entered the second phase for further investigation.

2- According to the main research question regarding the UIS, articles in non-related fields were removed. Thus, 8,493 cases were removed, and 2,378 cases remained.

3- Among each two articles with the same authors and duplicate findings, one was omitted, and the more complete article remained. In addition, the abstracts of all articles were studied, and 2,368 articles whose findings were unrelated to the main research question were deleted. Eventually, ten sources remained to go to the next step.

4- The remaining articles were reviewed in terms of content quality. Quality was measured with criteria such as research objectives, method logic, research design, sampling method, data collection, reflectivity or relationship between researcher and participants, ethical considerations, accuracy of data analysis, clear expression of findings, and value research. When using this tool, articles were read, and a score of one to five was assigned to each article for having the above features. Based on CASP's 5-point scale, we introduce the following scoring system, and categorize articles based on their

quality. Very high (4-5), high (3-4), medium (2-3), poor (1-2), very poor (0-1). In this study, 10 articles and books were accepted in the evaluation process, among which four articles received average scores, 3 articles received high scores, and 3 articles received very high scores (Singh, 2013).

Step 4: extracting article details

Throughout the meta-synthesis, we continuously review the selected and finalized sources several times in order to obtain separate in-content findings, in which the original studies are performed. In the present study, resource details are categorized as follows: the reference for each article is recorded (author's name or surname, the year the article was published), the main factors influencing or constituting the UIS that the source refers to it, and key methodological details such as: the research purpose, methods, procedures, and measuring tools (Leary and Walker, 2018).

Step 5: analyzing and combining qualitative findings

The meta-synthesis method aims to create an integrated new interpretation of the findings. Meta-synthesis method has been adopted to clarify

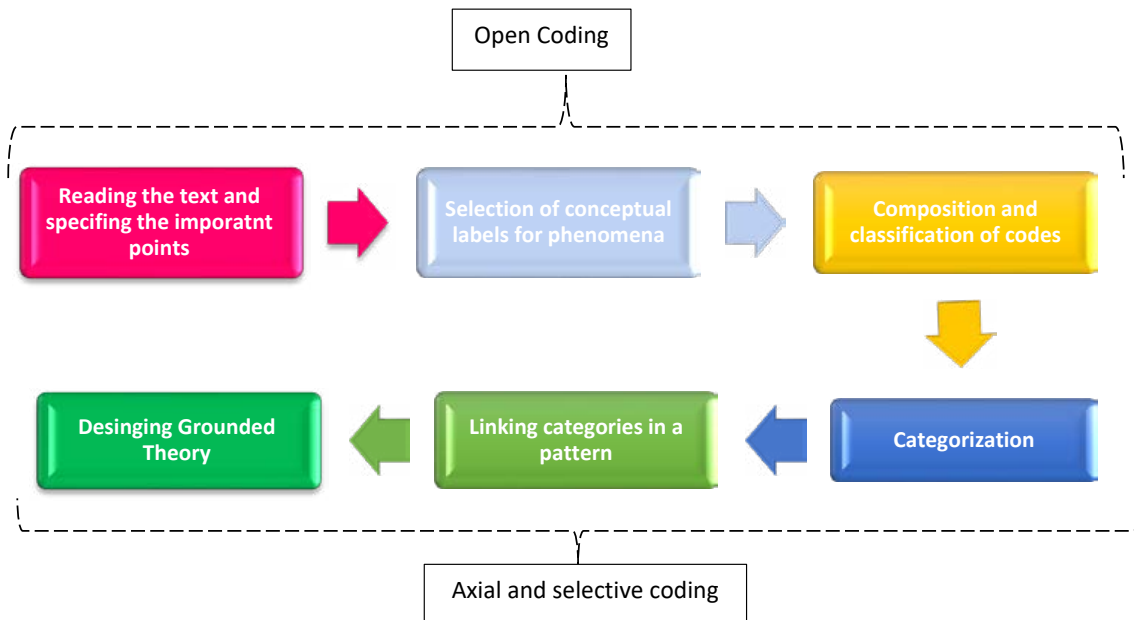


Fig. 3: The analysis process

the concepts, patterns, and results in refining existing modes of knowledge and the emergence of operational models and theories. During the analysis, topics are explored that have emerged among the existing studies, which is called “thematic study” (Smit *et al.*, 2020). After identifying the topics, a thematic classification is formed, and similar and relevant classifications are placed in a topic that best describes it. Fundamental topics are presented to create explanations, models, and theories or hypotheses (Sandelowski *et al.*, 2008). In the present study, first all of the factors extracted from the sources are considered as code, and then by considering the meaning of each of these codes, they are categorized in a similar concept (dimension) in order to form research concepts. We need coding tools to categorize concepts and categories and to theorize. For this purpose, three methods of open, axial and selective coding are used. Beginning with line-by-line open coding of data and comparing incidents to each other in the data, the researcher codes the data in every way possible and asks a set of questions of the data: ‘What is this data a study of?’, ‘What category does this incident indicate?’, ‘What is actually happening in the data?’, ‘What is the main concern being faced by the participants?’, and ‘What accounts for the continual resolving of this concern?’ (Glaser, 2005; Siau and Long, 2005). These questions sustain the researcher’s theoretical sensitivity, transcend descriptive details, and encourage a focus on patterns among incidents that yield codes. Line-by-line coding forces the researcher to verify and saturate categories, minimizes missing an important category, and ensures relevance by generating codes with emergent fit to the substantive area under study. The result is a rich, dense theory with the feeling that nothing has been left out. The first step of coding is using the open coding method, to modeling the urban innovation system according to the conditions and requirements of the model (Abili *et al.*, 2021).

The steps of open coding are:

A- Analysis and coding: At this stage, the researcher must pay attention to the coding of all events. Many codes may be extracted from a single text; but when the data is reviewed regularly, the final codes are specified.

B- Discovering categories: In this stage, concepts are classified based on their relationship to similar topics, which is called categorization.

C- Description of categories according to their characteristics: In order to clarify the categories.

Axial coding is the second stage of analysis in grounded theorizing. The purpose of this step is to determine the relationship between the categories created in the open coding step. In axial coding, the researcher identifies a central or axial phenomenon, describes the causal conditions, identifies the intervening and context conditions, and determines the consequences and outcomes of strategies for this phenomenon (Khan and Krishnan, 2021; Adler and Lalonde, 2019).

Selective coding is the most important stage of theorizing in which the researcher expresses the relationship between categories and modifies the categories that need to be improved and revised. In fact, the researcher tries to build a new theory by establishing connections between categories and based on these relationships (Holton, 2010).

The steps of the coding method according to Fig. 3 for the 10 selected articles have been followed by the meta- synthesis method, which can be seen in Table 4.

Step 6: quality control

In the meta-synthesis, the following procedures are considered to maintain quality:

1. Throughout the research, an attempt is made to provide clear and concise explanations for the available options for the realization of the necessary steps;
2. All facilities are used to access the acquired sources;

Table 3: Kappa coefficient estimation Symmetric measures

		Value	Asymptotic standardized Error ^a	Approximate T ^b	Approximate significance
Measure of agreement	Kappa	0.730	0.175	4.274	0.000
N of valid cases		10			

a) Not assuming the null hypothesis.
 b) Using the asymptotic standard error assuming the null hypothesis.

Table 4: Components for the realization of UIS

Category	Concepts	Codes
Innovation	Technology	Technological innovation (Chai – Lee, 2017; Putra and Knaap, 2018; Nguyen and Moehrle, 2019; Van Winden et al., 2014), sustainable city (Chai–Lee, 2017), smart city (Chai–Lee, 2017; Marakatou and Alexandrou, 2015), institutional innovation (Chai–Lee, 2017), research institutes (Warnke et al., 2016), innovation supply (Johnson, 2008), innovative competition (Johnson, 2008), creative class (Johnson, 2008), open innovation (Genuchten et al., 2019), sustainable urban life (Genuchten et al., 2019), community-based innovation (Genuchten et al., 2019), government-based innovation (Genuchten et al., 2019), Public interest in innovation (Genuchten et al., 2019), Patent (Nguyen and Moehrle, 2019; Van Winden et al., 2014), startup city (Marakatou and Alexandrou, 2015), urban planning (Marakatou and Alexandrou, 2015), research and development activities (Van Winden et al., 2014), tacit knowledge (Van Winden et al., 2014), offshore (Van Winden et al., 2014), scientific publications (Van Winden et al., 2014), innovation hub (Van Winden et al., 2014)
	Patent	
Economic	Research	Economic growth and development programs (Chai – Lee, 2017; Johnson, 2008), public goods (Chai–Lee, 2017), consumption patterns (Chai–Lee, 2017), production productivity (Chai–Lee, 2017), final demand (Warnke et al., 2016), intermediate demand (Warnke et al., 2016), high-tech products (Warnke et al., 2016; Van Winden et al., 2014), SME (Small and Medium-sized Enterprises) (Warnke et al., 2016), banking and venture capital funds (Warnke et al., 2016; Van Winden et al., 2014), taxation systems (Warnke et al., 2016), business tendency (Warnke et al., 2016), production factors mobility (Warnke et al., 2016), mother industry (Warnke et al., 2016; Van Winden et al., 2014), web information exchange (Caragliu and Del Bo, 2018; Putra and Knaap, 2018), urban transport (Caragliu and Del Bo, 2018), e-government (Caragliu and Del Bo, 2018; Putra and Knaap, 2018), virtual markets (Putra and Knaap, 2018), urban employment (Ratanawaraha, 2012), per capita urban income (Ratanawaraha, 2012), urban trade (Ratanawaraha, 2012; Van Winden et al., 2014), financial investment (Ratanawaraha, 2012; Marakatou and Alexandrou, 2015; Van Winden et al., 2014), intellectual capital (Ratanawaraha, 2012), industrial networks and clusters (Ratanawaraha, 2012; Van Winden et al., 2014), competitive advantage (Van Winden et al., 2014), economic reforms caused by the crisis (Van Winden et al., 2014), history of economic growth and development (Van Winden et al., 2014), business space (Van Winden et al., 2014)
	Knowledge	
	Production	
	Income	
	Competition	
Social	Market	Innovative culture (Chai–Lee, 2017; Putra and Knaap, 2018; Genuchten et al., 2019; Van Winden et al., 2014; Marakatou and Alexandrou, 2015), health system (Chai – Lee, 2017; Ratanawaraha, 2012), education programs (Chai–Lee, 2017; Putra and Knaap, 2018; Genuchten et al., 2019; Van Winden et al., 2014; Marakatou and Alexandrou, 2015; Johnson, 2008; Warnke et al., 2016), standards and norms (Warnke et al., 2016), social and human capital (Caragliu and Del Bo, 2018; Van Winden et al., 2014; Johnson, 2008), art activities (Putra and Knaap, 2018), urban physical space (Ratanawaraha, 2012), urban entertainment (Ratanawaraha, 2012), knowledge tools (Ratanawaraha, 2012), informal institutions (Ratanawaraha, 2012; Van Winden et al., 2014), demography (Johnson, 2008; Van Winden et al., 2014; Marakatou and Alexandrou, 2015), cultural diversity (Genuchten et al., 2019; Johnson, 2008; Van Winden et al., 2014), social tolerance (Johnson, 2008; Van Winden et al., 2014), urban brand (Marakatou and Alexandrou, 2015; Van Winden et al., 2014), life style (Van Winden et al., 2014)
	Culture	
	Education Systems	
	Institutions	
Environmental	Norms	Waste management (Chai – Lee, 2017; Nguyen and Moehrle, 2019), energy management (Chai – Lee, 2017; Ratanawaraha, 2012), urban green space (Caragliu and Del Bob, 2018), water quality (Ratanawaraha, 2012; Nguyen and Moehrle, 2019), food security (Ratanawaraha, 2012), urban order (Johnson, 2008), urban viability (Genuchten et al., 2019; Nguyen and Moehrle, 2019), climate change (Nguyen and Moehrle, 2019), geographical location (Marakatou and Alexandrou, 2015; Van Winden et al., 2014), accessibility (Van Winden et al., 2014)
	Physical Urban Space	
Political	Livability	Public participation (Chai–Lee, 2017), government policy (Chai–Lee, 2017; Marakatou and Alexandrou, 2015), allocation of resources (Chai–Lee, 2017), governance (Warnke et al., 2016; Caragliu and Del Bo, 2018), political capital (Ratanawaraha, 2012; Van Winden et al., 2014; Johnson, 2008), legal system – rule of law – judicial system – military equipment (Van Winden et al., 2014)
	Governance	

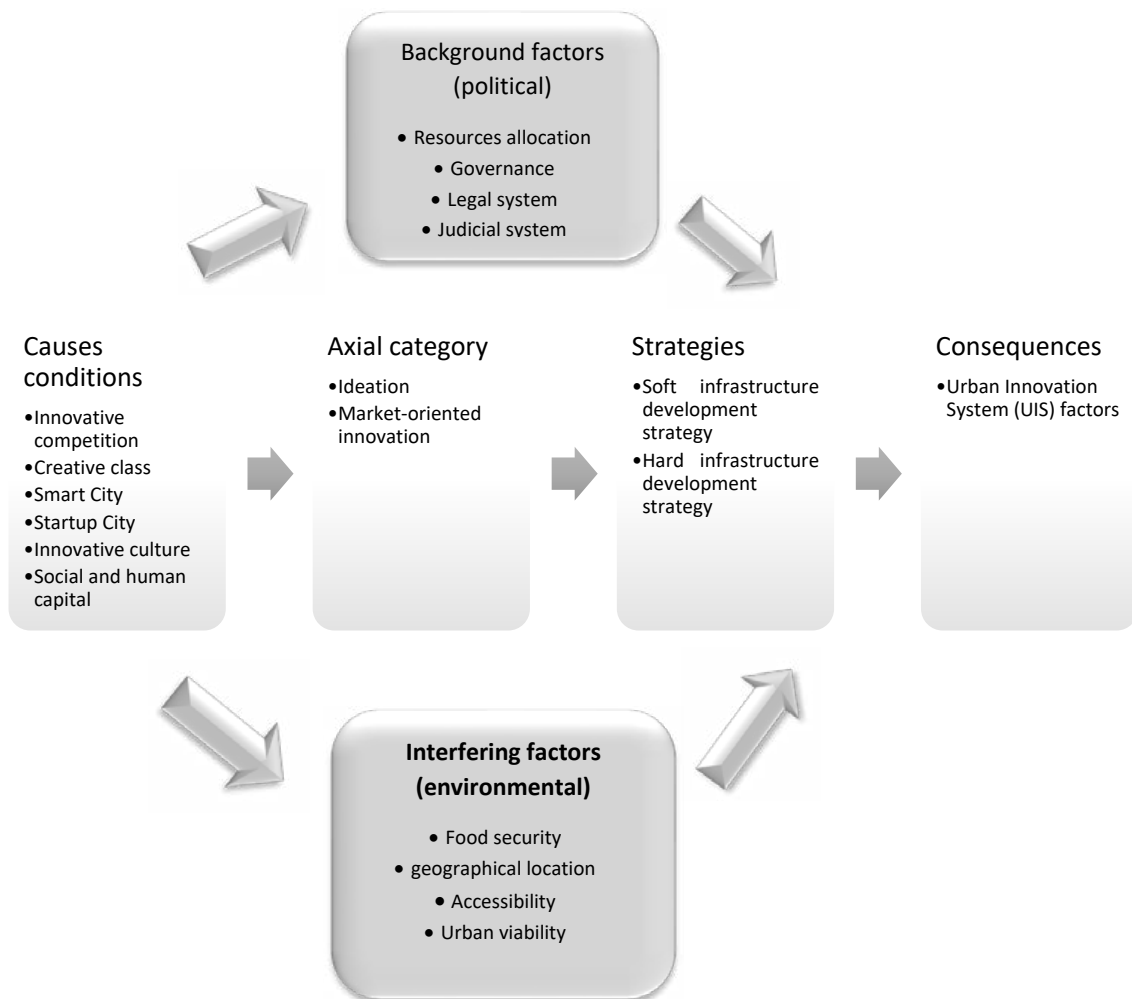


Fig. 4: The paradigm model of UIS

3. To combine the main studies, CASP tool is used to evaluate the meta-studies performed. Kappa coefficient has also been used in this study to maintain the quality of the study (Sattar *et al.*, 2021).

The Kappa coefficient is used to determine reliability. Kappa coefficient is a statistic that is used to measure inter – rater reliability (and also intrarater reliability) for qualitative (categorical) items (McHugh, 2012). It is generally thought to be a more robust measure than simple percent agreement calculation, as Kappa coefficient takes into account the possibility of the agreement occurring by chance. Researchers have suggested that it is conceptually simpler to evaluate disagreement between items

(Sim and Wright, 2005). In this study, a total of five codes were extracted. The extracted codes were provided to one of the experts for review and possible additional feedback. The results of the coding show that the Kapa coefficient calculated by SPSS software was 0.730, which is higher than the acceptable value (0.6) (Gwet, 2014; Zhang and Xiao, 2020). Since the numerical value obtained for the Kappa index is less than 0.05, the assumption of the independence of the extraction codes is rejected and the dependence of the extraction codes is confirmed. Therefore, it can be claimed that the codes of the tools used to extract the codes were sufficiently reliable (Mohagher *et al.*, 2011).

Step 7: findings present

In this study, the constituent components for the UIS were questioned and what was extracted from the text of the selected sources was considered as the code. In general, five codes (innovation, economic, social, environmental, and political) were defined, each of which has two general aspects in terms of soft infrastructure and hard infrastructure (Fingeld-Connett, 2010). In each code, the concepts that are used as examples in each of the classified sources were also identified.

Paradigm Model of UIS

According to the studies, in general, five sets of variables can be identified in the UIS: innovation, economic, social, political, and environmental variables. Each of these code instances has two main dimensions called soft infrastructure and hard infrastructure, both of which are mutually effective and interactive. In addition, the variables identified in the above five sets have interrelationships. Therefore, the paradigmatic model of UIS is a dynamic system of four economic, social, political, and environmental concepts, which ultimately leads to the production of a combined index of innovation concepts in the field of urban geography. Based on the classification, a set of codes and concepts have emerged that are interrelated. So to discover how to interact those codes and concepts, we need to receive the opinions of UIS experts, which are discussed in the second section. Fig. 3 shows the paradigmatic model of UIS.

CONCLUSION

Cities, due to their extraordinary potentials in idea generation, the beginning of new activities in all fields, are always the center of the first sparks of change in the fields of art, economy, culture, society, etc., and the most important changes is innovations. Thus, cities are the birthplace of innovation and the continuous flow of the innovation production cycle. The today world is in transition from the industrial age to the creative age. In addition to meeting basic needs, modern man seeks to meet other needs such as the need for imagination, mastery, vitality, innovation and curiosity. Innovation is a fundamental principle for being human and a vital resource for the individual, society and the life of economics. Innovative and vibrant societies with

human potential, foster individual growth, shine in cultural and technological advances, generate jobs and wealth, and embrace the diversity of lifestyles and cultures. It can be said that today, innovation has become a very important element in urban marketing policies around the world. The emergence of this issue in the simplest possible form constitutes a distinct stage in the development of capitalism, according to which the main force of the economy is no longer technological and organizational tools, but man. Therefore, understanding the complex systems in cities increases a large part of our current knowledge about the urban geographical area, and the urban innovation system is one of these systems. Designing an urban innovation system model, as a research priority, has little history among academic and research studies, so to model an urban innovation system, cannot use a fundamental theory like other humanities studies that revolved around the fundamental theory and generalized new topics. Therefore, there is a need to develop a new theory and theorizing. For this purpose, one of the methods used to explain new theories is grounded theory. The purpose of this study is to provide a paradigmatic model of the urban innovation system that can be developed and generalized in the future as a basic theory in urban innovation systems. To construct a grounded theory, all studies that have a slight resemblance to the subject under study should be carefully studied so that not all aspects of urban innovation system modeling are overlooked. It should be noted that so far no study has been conducted to model the urban innovation system using the grounded theory method. The method of the study is to use the Meta-Synthesis method in order to construct a paradigmatic model in the context of grounded theory. To enumerate the elements of the paradigm model, one of the common methods is to use the coding method, especially the open coding method. The estimated kappa coefficient indicates the reliability of the selected codes. This study reviews and compiles a set of valid studies on the paradigmatic factors in the formation of the urban innovation system. Using the Meta-synthesis method, 19645 sources were collected between 1997 and March 2020 related to the urban innovation system, and after 7 steps and classification of resources, finally, 10 sources were selected and based on the coding method,

the ten mentioned sources were coded. Based on the time allotted for the project, the results are uniquely novel. Finally, the paradigm model of the urban innovation system was extracted based on the performed codes. This model can be used as a pivotal model in future studies.

AUTHOR CONTRIBUTIONS

H. Samari performed the literature review, model design, analyzed and interpreted the data, prepared the manuscript text, and manuscript edition. S. Delangizan performed the literature review and compiled the data. K. Soheili helped in the literature review and manuscript preparation.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

ABBREVIATIONS

CASP	Critical Appraisal Skills Programme
OECD	Organization for Economic Cooperation and Development
SME	Small and Medium-sized Enterprises

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