



International Migration Governance and Smart Urbanization: A Game Theory Analysis with Reference to Nash Equilibrium

Akıllı Kentleşmede Uluslararası Göç Yönetişiminin Etkisi: Oyun Teorisi Bağlamında İncelenmesi (Nash Dengesi)

Mehmet ÖLMEZ¹ , Bülent BAYRAK²

ABSTRACT

Throughout history, migration has been one of the most important factors affecting and shaping the lives of countries and societies driven by economic, political and social reasons as well as by destructive factors such as international and civil wars. In this context, migration governance is defined as “a system of institutions, legal frameworks, mechanisms and practices to regulate migration and protect migrants”. Smart urbanization, on the other hand, refers to the development of living spaces that incorporate advanced technology and generate less harmful waste, with the goal of establishing a sustainable urban life and leaving livable cities to future generations. Game theory is a discipline that examines the strategies of actors, such as individuals, institutions, and states such as individuals, institutions, and states, who must make decisions under given constraints data, aiming to maximizing gains and minimizing losses losses in scenarios involving conflict and cooperation. This study analyzes the relationship between smart urbanization policies and international migration governance within the framework of game theory. The aim of the study is to examine the impact of international migration governance on smart urbanization policies in the context of game theoretic strategies. Within this framework, the study covers the attitudes of two important actors of international migration governance, Turkey and the EU, towards migration and migration policies. A two-player game matrix was constructed, and the equilibrium point of the game was calculated using the maxmin and minmax methods. Based on the results, it was concluded that Türkiye should adapt the temporary admission strategy despite the EU's preference for smart urbanization strategy. The analysis based on the data related to international migration governance, revealed that there is no Nash Equilibrium. In this context, the approach to be adopted is a mixed strategy approach. This will provide a more sustainable and flexible cooperation environment for both migration governance and urbanization policies.

Keywords: *Smart Urban Environment, Migration Management, Decision Making Strategies.*

Öz

Göç olgusu tarih boyunca ekonomik, siyasi ve toplumsal kaynaklı nedenler yanında uluslararası ve iç savaş gibi yıkıcı etkenlerden dolayı ülkelerin ve toplumların yaşamını etkileyen ve şekillendiren önemli faktörlerden biri olmuştur. Bu bağlamda göç yönetimi, “göçü düzenlemeye ve göçmenleri korumaya yönelik kurum, yasal çerçeve, mekanizma ve uygulamalardan oluşan sistem” olarak tanımlanmaktadır. Akıllı kentleşme ise gelecek nesillere yaşanabilir kentler bırakma anlayışı içerisinde sürdürülebilir bir kent yaşamını yerleştirmek amacıyla, teknolojinin çok, zararlı atıkların az olduğu bir yaşam alanını ifade etmektedir. Oyun teorisi, bireyler, kurumlar ve devletler arasındaki çatışma ve iş birliği gibi konuları mevcut veriler ve kısıtlar içerisinde karar verme ve tercihte bulunma durumunda olan aktörlerin kazançlarını maksimize ve kayıplarını minimize etme stratejilerini inceleyen bir disiplindir. Çalışmada akıllı kentleşme politikaları ile uluslararası göç yönetimi arasındaki ilişkinin ne yönde olacağı oyun teorisi çerçevesinde analiz edilmiştir. Çalışmanın amacı, uluslararası göç yönetişiminin akıllı kentleşme politikalarına etkisinin oyun teorisi stratejileri bağlamında incelenmesidir. Bu amaç çerçevesinde çalışma, uluslararası göç yönetişiminin iki önemli aktörü olan Türkiye ve AB'nin göç ve göçmen politikaları karşısındaki tutumlarını kapsamaktadır. İki kişili oyun matrisi oluşturularak kurulan oyunun denge noktası maxmin ve minmax yöntemiyle hesaplanmış ve elde edilen sonuçlara göre AB'nin akıllı kentleşme stratejisine karşın Türkiye'nin geçici kabul stratejisini seçmesi gerektiği sonucuna ulaşılmıştır. Uluslararası göç yönetişimi ile ilgili verilerden hareketle yapılan analiz sonucunda Nash Dengesi oluşmamaktadır Bu bağlamda, karma strateji yaklaşımının benimsenmesi hem göç yönetişimi hem de kentleşme politikaları açısından daha sürdürülebilir ve esnek bir işbirliği ortamının sağlanabilir olacağı değerlendirilmiştir.

Anahtar Kelimeler: *Akıllı Kentsel Çevre, Göç Yönetimi, Karar Verme Stratejileri.*

¹ Corresponding Author: Malatya İnönü University, olmez23@hotmail.com, ORCID: 0000-0002-1462-1241

² Malatya Defterdarlığı, ardadoruk3588@gmail.com, ORCID: 0000-0003-1056-8866



INTRODUCTION

The concept of migration has different dimensions with local, national and global characteristics. These different dimensions of the migration process have led to the need for the theory of governance. In this context, governance refers to a pluralistic understanding of governance that provides cooperation and coordination between the state, civil society organizations and the private sector in the public administration process and shares administrative and political decision-making authority among these actors (Boyalı, 2022: 394). Migration governance is defined as “a system of institutions, legal frameworks, mechanisms and practices to regulate migration and protect migrants”. Although migration management and migration governance are seen as synonymous concepts, migration governance also means the regulation of cross-border movements at the state level. The main factor leading to the emergence of migration governance is the perception of security. This is because the perception of security is not a unilateral perception; multiple actors play an important role in the establishment or disappearance of a sense of trust. From a national perspective, it is insufficient to characterize the theory of security as an abstract and unchanging concept. Migration management consists of security-based economic and political components, giving rise to the migration governance approach (Akçapar, 2012: 573)

The phenomenon of migration has gained a global character and reached an international dimension. This situation shows that international migration governance consists of multifaceted and multicomponent actors (Sandıklı & Kaya, 2013: 72). It has become almost impossible to solve migration movements, which have gained a global character, with local and national regulations. Accordingly, migration waves that threaten the sovereignty of states can be overcome through cooperation between states. In addition to the cooperation of states in international migration governance, the contributions of international actors are also needed. Thus, a local, regional, national and international cooperation can be established through the governance process. One of the applications that can be addressed within the framework of this cooperation is smart city applications which have gained importance with the development of technology.

A smart city is a model of an innovative approach and is the transformation and ecosystem created by today's and future technologies on city life. The smart city approach includes many components such as smart transportation, smart environment, smart buildings, smart security and smart people. For example, one of the approaches emphasized in the smart city is the smart security approach. Important infrastructure requirements to ensure public safety are identified here, such as video monitoring and analysis systems for the city, detection of human behavior from images, acoustic detection and location detection, fire detection and information protection (Bülbül, 2019: 63-72; Ulubaş, 2023: 78). In smart transportation, issues such as MOBESE (Mobil Electronic System Integration), CCTV (Closed Circuit Television) systems created in urban transportation, license plate identification systems against traffic rule violations on roads and intersections, speed detection radars, and the use of geographic information systems for positioning are already known (Erkek, 2017: 61; Laufs et al., 2020: 15).

States, societies or organizations, regardless of the issue, have to make a decision based on the options in front of them while determining the path they will follow. Whether in international migration governance, smart urbanization or any other local, national or international event, they make a decision by taking into account the situation of other actors in front of them. This is where decision-making strategies and game theory come into play. Since explaining international migration governance and smart urbanization policies only on the axis of public administration will cause the study to be incomplete, there is a need to explain the scenarios that may occur regarding these policies in the context of game theory.

Although there are many books and scientific papers on the game theory concepts, international migration governance and smart urbanization, there is no known published study that combines

these concepts. This study aims to analyse the relationship between the concepts of international migration governance and smart urbanisation with the help of game theory and to produce strategies with Nash Equilibrium. For this purpose, firstly, the ideas of migration, international migration governance, smart urbanization and game theory are discussed. Then, considering the global dimension of migration, migration governance in Europe and Türkiye has been analyzed. Attitudes and policies towards the relationship and comparison between international migration governance and smart urbanization are discussed within the scope of game theory. Finally, recommendations are made in line with the scientific articles discussed in the research. In the conclusions and recommendations section of the study, the reflections of international migration governance policies on their relationship with smart urbanization are evaluated and the recommendations presented in this framework are presented based on quantitative findings with the Nash Equilibrium game theory model. In this article, recommendations and strategic situations are tried to be expressed in a mathematical form. Due to this originality, it is expected to make significant contributions to the literature. Another important gap that the study addresses is that there are no relevant studies in the field of public administration in which game theory is used as a method.

1. Conceptual Framework

In this section, firstly, the approaches of migration, international migration and international migration governance, smart urbanization and game theory will be discussed and an overview of these concepts will be given.

1.1. Concepts of Migration and Migration Governance

Migration is a comprehensive phenomenon affecting societies and states and can be defined as the permanent movement and relocation of people from one place to another. The International Organization for Migration (IOM) (2009: 22) defines migration as a permanent change of location within state borders or across international borders.

As a result of the increase in job opportunities with the industrial revolution, a migration movement started to develop from developed countries to developing countries, and this mobility has affected the whole world over time. States started to take measures against this mobility and the notion of migration governance emerged. The International Organization for Migration (2009: 36) defines migration governance as “the management of cross-border migration in an orderly and humane manner through a national system of various state institutions to manage both the entry and presence of foreigners within state borders and the protection provided to refugees and other persons in need of protection”. Migration governance is therefore the set of policies and measures pursued by states to address international migration flows. From this perspective, migration governance differs from migration management in that it is a concept that affects countries and societies in many ways, including their social, economic, physical, and spiritual structures, and is addressed not only by governments but also by civil society organizations, other states, and international organizations and institutions.

1.2. International Migration Governance

Castles and Miller (2008: 12) define the 19th and 20th centuries as the “Age of Migration”. In this period, the phenomenon of migration gained a global character with the industrial revolution and economic and political developments affected the phenomenon of migration. The multifaceted and multicomponent structure of migration movements and inter-state cooperation has created the concept of international migration governance (Sandıklı & Kaya, 2013: 72). Today, the phenomenon of migration has transformed from a local and regional structure to an international structure and has begun to be managed through policies aimed at international interaction and cooperation.

IOM (2019: 138), one of the international organizations of the framework of international migration governance, defines migration governance as a system that takes place in cooperation with different actors in forms such as voluntary, compulsory, long and short-term. International migration

governance is supported by states as well as international organizations such as the UN and independent initiatives such as the Bern Initiative and the Global Forum on International Migration and Development (Kara and Kara, 2016: 5-6). The most fundamental factor in the emergence of international migration governance is the nearly threefold increase in the number of migrants over the last half-century. According to IOM (2019), the number of migrants has increased from 85 million in 1970 to 120 million in 1990 and 280 million in 2020, representing nearly 4% of the world population.

International migration is a phenomenon that has political, economic, cultural and demographic dimensions and is addressed by a wide range of scholars including political scientists, economists, urban planners, management scientists, anthropologists, sociologists, historians and geographers. This complex structure requires governance involving public and non-governmental organizations at national and international levels. Since the actors of international migration include the migrant, the sending country, the receiving country and the transit country, the governance of migration is also multidimensional and complex. This necessitates a comprehensive governance approach in which evaluating migration only on the axis of supply and demand or needs and opportunities will be insufficient (Şemşit, 2018: 271).

1.3. Smart Urbanization

According to 2015 data, approximately 54 per cent of the world's population lives in cities, and this rate is expected to reach 66 per cent by 2050 (Urbanet, 2025). This fact has increased the importance of sustainability and served as a warning that cities need to be smarter. The fact that the concept of sustainability has given birth to the perspective of smart urbanization within the framework of the need for more population to live more easily and with less damage to the environment is also seen as a product of the development in digital technologies.

In the 21st century, the concept of “smart”, which has started to be mentioned in many aspects of life, forms the basis of providing a sustainable structure in development. The smart aspect of technology is an approach developed to ensure the sustainability of development. According to the definition in the Brundtland Report, sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

To realise this, it is important to understand that smart cities are about rethinking cities as inclusive, integrated and livable. In this context, it is argued that smart cities can reconcile growth and sustainability (Bansal et al., 2015: 554-555). By strengthening and improving facilities and networks in existing urban centers, along with good planning and enlightened governance, many cities can deliver education, health and high-quality energy services more efficiently and with fewer emissions than less densely populated areas due to the advantages of scale, proximity and lower geographic footprint. This is referred to as smart urbanization. Smart urbanization consists of levels such as using renewable energy sources, building smart grids for a smarter city, urban planning and smart growth, establishing eco-cities for environmentally friendly cities, and determining policy levels for smart urbanization (Bansal et al., 2015: 555-558).

Smart urbanization optimizes energy use and distribution by combining complex technologies such as smart grids, energy-efficient buildings and renewable energy systems. As a result, smart urbanization can effectively reduce energy poverty by using new technical solutions and optimizing resource management (Zhong et al., 2025: 2). Smart urbanization essentially refers to a multifactorial change process that enables urban habits from the past to become compatible with new technologies without harming the urban ecology (Örselli & Dinçer, 2019: 106).

1.4. Game Theory

Game theory was used in the field of economics by Augustin Cournot in 1838 in order to predict the strategies of individuals, societies and states in competitive environments. This theory is a method that mathematically examines the options developed to maximize gains and minimize losses and

enables the formation of strategies. At the same time, game theory is a method of analysis that examines the relationships between units that affect each other and is used in the decision-making process of these relationships. Although it was introduced in the 19th century, it became widespread in the 20th century and began to be applied in the field of economics (Prisner, 2014). Over the years, it has been developed by economists such as Joseph Bertrand, Francis Y. Edgeworth, Edward H. Chamberlin, Heinrich F. Von Stackelberg, Paul Sweezy, Ernst F. Zermelo, Émile Borel, John Von Neumann and John Nash in line with different perspectives within the framework of duopoly-oligopoly market theories (Şahin & Eren, 2012: 267). In 1913, the game of chess was analyzed by Zermelo and it was revealed that there is a way out regardless of the position of the pieces in the chess game. In 1944, von Neumann introduced zero-sum games as a competitive situation in which only one player wins in a game played by two players in the form of cooperative games.

In 1950, John Nash developed the theory of two-person non-cooperative games. The “Nash Equilibrium” theory won the Nobel Prize in Economics in 1994 (Kuzu & Karakaş, 2015: 126-130). Nash Equilibrium, proposed non-zero-sum games that present equilibrium situations that can be profitable for both parties without restrictions on the structure of payoffs or the number of players (Berkin et al. 2022).

A Nash Equilibrium is a set of strategies where each player's desired strategy is the optimal response to the strategies of the other players. The thought of Nash Equilibrium has many advantages in large-scale games where strategy is at the forefront (Fudenberg & Tirole, 1993: 11). Nash Equilibrium states that there is no benefit for any player to create, change or cancel his/her own strategy independently of the strategies of other players (Genç & Kadah, 2018:433-435). The equilibrium theory, developed by Nash in 1950 and awarded the Nobel Prize, states that "A strategy set for each player can be regarded as a point in the product space obtained by multiplying the strategy spaces of the players. If the strategy of a player in the n-group gives the highest expectation that can be obtained against the n - 1 strategies of the other players in the n-group, it means that this strategy is counteracting the other n-group strategies. This is called the equilibrium point in group n". Game theory, which is known as the determination of decisions, tendencies and strategies by the players of a game according to the opponent and making the moves in a balanced way and winning or exiting with the least loss, has been developed over time and has started to be used not only in the fields of mathematics and economics but also in engineering and social sciences (Kuzu & Karakaş, 2015: 130).

1.5. Literature Review

Although there are various scientific studies on international migration, international migration governance, smart urbanization and game theory in the literature review, no study was found in which international migration governance and smart urbanization issues were addressed together within the framework of game theory.

Betts (2010) argues that global migration governance involves a set of norms, rules, principles and decision-making procedures that exist over and above the level of a single nation-state and exists at three broad levels: multilateralism, embeddedness and informal networks. In his study titled International Migration and Intercultural Communication, Aksoy (2012: 303) argues that cultural differences can have positive effects by supporting different cultures trying to fuse through migration with communication governance to be developed by states, international organizations, non-governmental organizations, multinational enterprises and other stakeholders. Güllüpinar (2012: 81), in his study titled “An Evaluation on the Political Economy of Migration and International Migration Theories”, states that people have become able to migrate more easily thanks to rapid changes in transportation and communication technologies and that a “migration industry” has emerged that generates income from migration organizations through legal and illegal means.

Accordingly, those who benefit from the migration industry are able to neutralize the efforts of states aiming to control or even stop migration movements through their relations with influential interest

groups. Emphasizing that migration is a social-based phenomenon and that it is wrong for most countries to treat it as a security-oriented concept, Yılmaz (2014: 1699) stated that policies on international migration should be addressed in three dimensions: “control, international relations and migrants' adaptation”. Bansal et al. (2015:552) emphasized that the world has changed and lifestyles have been forced to change due to globalization, urbanization and technological advances. Urbanization has affected all aspects of the world economy from energy production to energy consumption. This study states that new technologies designed to limit both the environmental and negative economic impacts of this global change have the potential to transform all sectors, and that human beings need to embrace these changes and adapt to development. As a result, smart urbanization is more than planning the city, it is adapting based on evidence and analysis of the sustainable growth of cities.

Stating that the phenomenon of migration cannot be explained from a one-dimensional perspective, Kahraman and Taniyıcı (2018) proposed a multi-level governance approach to migration. In particular, it is emphasized that the managerial understanding in public institutions and organizations should change in favor of governance; the experiences of local, national and supranational actors should be utilized in migration governance; and the powers of local governments in Türkiye should be reformed when compared with the experiences of different countries. Özden and Hamurcu (2019: 454), stating that Türkiye has been the focus of migration movements throughout history, emphasized that Türkiye's being a center of attraction in terms of migration, being located in the transition region and being more developed than the countries in the region are effective. They explained that the Syrian crisis, which followed the civil wars and unrest in many Arab peninsula countries during the Arab Spring process, made it necessary for Türkiye to develop different approaches to the phenomenon of migration and explained the necessity of different policies towards migrants thanks to the migration governance to be developed and the influence and support of international actors. Newland (2020: 3, 16) noted that just at the end of 2018, the vast majority of national governments around the world agreed on a broad set of principles and commitments to manage international migration. In this study, the COVID-19 pandemic that emerged in 2020 changed the context of migration, but did not change the fact that migrants, countries of origin and destination countries all benefit from international migration. Örselli and Dinçer (2019: 106) stated that smart urbanization is an understanding that produces solutions to existing problems by using information and communication technologies and ensures the transfer of resources to future generations by using resources effectively thanks to the lifestyle it offers.

In “Evolutionary Game Theory”, Weibull (1997), who highlights the use of game theory in evolutionary and statistical population determinations, states that John M. Smith's Evolution and the Theory of Games perfected the dynamic concepts that model the evolution of different populations. In “An Introduction to Applicable Game Theory”, Gibson (1997: 127) emphasized that game theory models allow economists to study the consequences of rationality, self-interest and equilibrium in both market interactions modeled as games and non-market interactions. In the first study by Tan et al. (2015), using empirical data and game theory to analyze the decision-making process in urban development in Wuhan, a rapidly urbanizing city in central China, the urban growth of Wuhan was examined with game theory. The individual behavior modeling, which includes three types of agents: government representatives, landowner representatives, and land development representatives, is designed to model the decision-making process of different stakeholders in urban landscape formation. Samuelson (2016: 126-127), with his work on the future of game theory in economics, the field in which it is most widely used, states that game theory will continue to be the language of economics and that new areas of research in economics will both benefit from and leave their mark on game theory.

Aydoğmuş and Gürpınar (2023: 779, 783), who addressed the generation and diffusion of knowledge with game theory, explained how positive externalities can be handled under the assumption of implicit knowledge with a three-player game. Considering positive externality as a factor that arises as a result of actions and positively affects the earnings of other players, this study considers positive

externalities under tacit information as the dissemination of information produced and the benefit of players in proportion to their contributions when other players use this information. This study also examines the importance of positive externalities under tacit knowledge and the conditions under which the problem of free-riding can be overcome.

2. Purpose and Methodology of the Study

The main problem of this study is to determine the impact of international migration governance in smart urbanization and the extent of the effects it will provide to the region. Within the scope of this basic problem of the study; the purpose of this study is to examine the implementation of international migration governance of smart urbanization policies in the context of game theory strategies.

The study examines how international migration governance will affect smart urbanization strategies by considering the migration policies of the EU and Türkiye. The study draws attention to the impact of the economic and social instability created by the EU and Türkiye's international migration governance on migration events in the region. In the context of game theory, the system based on the strategic advantages to be gained by using international migration governance and the responses to be provided in smart urbanization are explained with possible game theory scenarios.

The main question of the study is “what will be the interrelationship between international migration governance policies and smart urbanization-oriented studies and the effects they will provide to the region?”.

The study includes quantitative and qualitative research methods. Qualitative research method was utilized through literature review and examination of reports of international institutions; quantitative research method was utilized through the use of mathematical and statistical strategic facts and scenarios through game theory.

3. Game Theory Strategies on International Migration Governance and Smart Urbanization

Every situation in which at least two decision makers interact and strategies are formed is a game. In this context, game theory can make preliminary predictions about the future of the situation in the light of the assumptions and strategies it can offer. Discussing and explaining international migration governance and smart urbanization policies only on the axis of public administration will cause the study to be incomplete. Therefore, there is a need to explain the future scenarios of Syrian migration governance and smart urbanization policies in the context of game theory.

3.1. Strategies for Regulating Migration Governance in the Context of Game Theory

The issue of international migration governance has been seen as a general problem of developed and developing countries for years. Considering the Syrian migration waves, losses and gains, it is possible to think of this process as a game between Türkiye and the EU. In this study, the EU player has determined some management strategies on national migration governance in order to ensure the general balance of the countries; in return, the second player Türkiye has chosen the appropriate strategy for the sustainability of smart city policies in the regional sense. As a result of this game, both players achieved some gains. With this game theory, the final value of the game was obtained by calculating the maximum value between the smallest values of the rows/columns and the minimum value between the largest values of the rows/columns (maxmin and minmax values).

In the first phase of the game, the EU's strategy, according to the information in Table 1,

- *• S_{AB1} = High density urbanization = Strategy A
- S_{AB2} = Medium density urbanization = Strategy B
- S_{AB3} = Smart urbanization = Strategy C, of Türkiye;

- S_{TR1} = Policy to limit migration= Strategy A
- S_{TR2} = Integrative policy = Strategy B
- S_{TR3} = Provisional acceptance strategy = Strategy C. to choose the appropriate one from the options.

****Table 1. Possible Strategies of EU and Türkiye Players According to Maxmin Values within the Scope of Game Theory**

		Player 2 (Türkiye)			Mins2
		A	B	C	
Player 1(AB)	A	2,-2	-3, 3	-5, 5	-5
	B	0,0	-1,1	-4,4	-4
	C	-3,3	3, -3	0, 0	-3
Mins1		-2	-3	0	-3,0

*Data and indicators were created by researchers according to the content of the study

**Reviewed figures are organized according to the original format

The maxmin value shows the minimum payoffs that the first player can achieve under the possible strategies of the second player and the minimum payoffs that the second player can achieve under the possible strategies of the first player. According to the maxmin value, the first player gains -3 units and the second player gains 0 units. As a result, the first player has a choice between strategies B and C, and the second player has a choice between strategies B and C. Theoretically, if a player has more than one strategy with equivalent payoffs, any of these strategies can be chosen. However, if the joint strategy choice (both players choosing the same strategy) preserves the overall balance of interests of the game, then the compatible strategy becomes the preferred choice. In this case, the EU and Türkiye should choose strategy C from among the two mutual strategies in order to ensure a more harmonious and balanced structure of the game and long-term gains for both sides, as well as to maintain balance in the game.

Table 2. Possible Strategies of EU and Türkiye Players According to Minmax Values within the Scope of Game Theory

		Player 2 (Türkiye)			Maxs2
		A	B	C	
Player 1(AB)	A	2,-2	-3, 3	-5,5	5
	B	0,0	-1,1	-4,4	4
	C	-3,3	3,-3	0,0	3
Maxs1		2	3	0	0,3

*Reviewed figures are organized according to the original format

In table 2, when the strategies of the second player are given, the maximum payoffs that the first player can achieve are shown, and when the strategies of the first player are given, the maximum payoffs that the second player can achieve are shown. If both players choose the minmax value, the minimum winnings from the game are 0 units for the first player and 3 units for the second player. In this case, the first player should choose strategy B and the second player should choose strategy B.

In this study, Maxmin and Minmax analyses were conducted in line with the mutual strategy preferences of the EU and Türkiye within the framework of game theory. According to the maxmin analysis, it is observed that more than one strategy provides the same maximum minimum gain for both player 1 (EU) and player 2 (Türkiye). For the EU, strategies B and C resulted in an equal gain of -3 units, while for Türkiye, strategies B and C resulted in an equal gain of 0 units. This situation is considered an equivalent strategy in game theory and in this case, there is a possibility that players may prefer both strategies. However, since strategy C was the only option that offered a common strategy choice for both players, it was chosen. In this situation where strategic alignment is possible, the choice of strategy C reduces the risk of conflict, strengthens cooperation between the parties and contributes to the stability of the game.

Therefore, choosing the mutually compatible strategy C among the strategies with “equivalent value” is considered as an approach that supports the rational and balanced structure of the game. In this case, both players prefer strategy C according to the Maxmin value. In other words, Türkiye has chosen the temporary acceptance strategy as opposed to the EU's smart urbanization strategy.

In this case, strategy C has a special meaning for the EU player. Since it is the strategy that provides the highest minimum gain, the EU player chooses strategy C, and since the Turkish player responds with strategy C, this strategy is considered to be the optimal strategy and strategy C will be the EU player's minimax strategy. This strategy corresponds to the minimum maximum value. The same process can be done for the Turkish player. When these strategies are reversed, the same results are obtained and the same is true for the Turkish player. In this equal situation, the Maxmin and Minmax analyses chosen by the two players remain valid. In this game theory, Maxmin and Minmax values are seen as the outcome value of the game.

On the other hand, the Minmax strategy is based on the lowest value among the worst maximum outcomes that the player can face against the opponent's moves. According to this approach, for the EU, the maximum value with the least loss corresponds to strategy B with 0 units, while for Türkiye, the maximum value with 3 units corresponds to strategy B. Therefore, according to the Minmax analysis, both players prefer strategy B. In other words, Türkiye responded to the EU's strategy of medium intensity urbanization with an integrative policy strategy. However, since the strategy choices intersect in different cells and the payoffs corresponding to both strategies are not equal, there is no Nash Equilibrium in this game. Likewise, there is no saddle point as the Maxmin and Minmax values correspond to different strategies. This shows that the parties cannot reach a stable and mutually optimal equilibrium point in their strategic interactions. In this context, the adoption of a mixed strategy approach may provide a more sustainable and flexible cooperation environment for both migration management and urbanization policies. Since the game does not have an equilibrium point, there is a need to identify mixed strategies to use a solution method.

In this context, among the factors affecting the migration policies and strategies of countries in international migration governance, it is recommended to implement mixed strategies towards the smart urbanization policy pursued by those countries. In this context, the accepted migrant population may require separate attention and policy determination for the local administrators of the cities where they are located. At this point, the smart applications planned by local administrators for their cities may be interrupted due to the services and expenditures that need to be provided to the migrant population. Therefore, the strategies to be followed in the governance of international migration may be decisive in meeting the mandatory needs of cities. At this point, local administrators may need to make a choice between the welfare of the local urban population and the migrant population. When the current situation is evaluated in terms of the EU and Türkiye, Türkiye's local governments are in a more problematic situation in terms of choice due to the large amount of migrant population. Both players need to combine smart urbanization and addressing the needs of the migrant population in their countries. In the mixed strategies identified by the players, public administrators and local governments need to strike a balance between smart urbanization and addressing the needs of the migrant population. It is possible for Türkiye as a player and the EU

as a player to reduce the cost of infrastructure and superstructure needs for cities by using the innovations brought by information and communication technologies (Bulut & Aslan, 2022: 139). Thus, while developing smart urbanization practices, an important step will be taken to meet the needs of the migrant population. The assumptions put forward in line with these objectives are as follows:

Assumption 1: Türkiye and the EU have to meet the needs of migrants in the context of international migration governance, while at the same time fulfilling the requirements of smart urbanization in the context of a sustainable environmental policy within the framework of the needs of the local population. By using ICTs, Türkiye and the EU will be able to use their energies to meet the essential needs of migrants, especially in cities with a high concentration of migrants, by reducing the cost element for the actual services they have to provide.

Assumption 2: In implementing migration governance, Türkiye and the EU need to take into account the registration and control of migrant populations. In this framework, information such as determining the areas where the migrant population is settled, updating the infrastructure and facility information of these areas, and ensuring that demographic and health data of migrants reflect the reality are important for the realization and effective implementation of smart urbanization. If these are realized, cities will be able to solve problems such as security and health problems caused by migrants, while taking positive steps towards the integration of migrants into society.

At the beginning of the 21st century, the migration flow caused by the Syrian civil war, which is one of the most important problems of Türkiye and the EU, can be solved or at least controlled by following different strategies in international migration governance. One of these strategies is to ensure that Syria's urban structures and economic power, which have been destroyed by the civil war, are renewed and become a center of attraction for its migrant citizens through smart urbanization steps. The actors of this game will develop strategies against each other's strategies and try to determine what kind of a path they should draw for the development of Syria. Strategy options to be determined within the scope of mixed strategy;

- * Development of Syria with EU/Türkiye support,
- * Taking steps towards smart urbanization,
- * EU/Türkiye's lack of involvement in the current situation in Syria.

Both sides know that Türkiye, one of the players in these strategies, does not have the economic and social power to improve the situation in Syria on its own. However, by holding the trump card of not intervening in Syria at all, Türkiye actually aims to keep itself in the game and to force the other player to make an effort for Syria. Thus, the potential of both players to “do most, but not everything” for Syria's recovery will be utilized.

These strategic moves in the theory aim at a point where both sides of the game are more profitable, not when one side has more to gain, but when both sides have the optimum benefit. The assumptions put forward in line with this objective are as follows:

Assumption 1: Türkiye and the EU know that the wisest and most appropriate course of action in the context of international migration governance is for Syrian migrants to return to Syria, but they also know how effective the factor of Syria's redevelopment is in achieving this.

Assumption 2: Türkiye and the EU do not want to be the sole actors in Syria's recovery. While it may seem beneficial to be the sole decisive actor in this process, the political, social and financial responsibilities taken alone may be burdensome.

Assumption 3: Türkiye and the EU are distant from a strategy of acting alone in Syria's recovery. While they may want Syria to come under their auspices in terms of political and social influence, neither Türkiye nor the EU is willing to bear the financial burden of Syria's recovery on their own. Türkiye

knows that it does not have the power to do so and the EU knows that it cannot impose such an idea on the populations of its member states. This strategy, which they would attempt on their own, would not benefit either side. The burden of migrants continuing to live in Türkiye and the EU would be far less than the burden of Türkiye or the EU going it alone. In this case, the most profitable path for both sides would be to work together to share the social and financial responsibilities for migrants to return home.

One of the most negative impacts of the Syrian civil war on Türkiye and the EU is the population growth caused by mass migration. Population growth due to migration is a situation that many countries will find difficult to accept, but it requires the development of different strategies as this increase may cause social, economic and psychological problems. In this game, players will evaluate their own decisions together with the decisions of the other player and act to take the decisions that will provide the most optimum benefit within the scope of mixed strategy. According to this;

* Keeping the Syrian migrant population in the EU/Türkiye,

* It is assumed that the strategies of distributing the Syrian migrant population to EU countries/Türkiye according to their population ratios are used.

The Syrian refugee population is not an amount that a country like Türkiye or a community of countries like the EU can accommodate on its own or eliminate within its population. However, in this game, if one of the players alone takes the entire population, it would be considered a loss for that player. Moreover, even though there is competition and a conflict of interest in the game, the players know that the total destruction of the rival player may cause more harm than good. Therefore, the strategies developed will be aimed at finding another player to share the losses incurred by the players. A fair distribution of the Syrian migrant population between the EU and Türkiye is a targeted practice in terms of governance and seems more rational in terms of the rules of game theory. The assumptions developed in this context are as follows:

Assumption 1: Although Türkiye does not have a policy that shows that it is as disturbed as other countries about the Syrian migrant population, the large migrant population creates social and economic problems in daily life. In addition to creating problems in the daily flow of urban life, the migrant population can also negatively affect the smart urbanization strategies of local government units. Therefore, even if the EU provides financial support for migrants, Türkiye should follow an appropriate strategy to reduce the migrant population in its territory, considering its demographic structure and social discomfort.

Assumption 2: Although the EU population, which is approximately 450 million by 2024 (Anadolu Agency, 2024), has the power and potential to compensate for the Syrian migrant population, which is approximately 3 million according to official data, it does not want to accommodate a religiously and culturally distant population in this way. Although it seems to be in Türkiye's favor to resettle all migrants in EU countries, the total benefit of the game is lower in strategies where only one of the players takes full responsibility.

3.2. Illustration of EU and Türkiye's Strategies towards Migrants with a Tree Diagram in the Context of Game Theory

The strategies developed for some of the policies to be pursued towards migrants are illustrated in Figure 1, Figure 2 and Figure 3 below. The strategies regarding the status of the funds transferred to Türkiye by the EU for migrants and the attitudes of the EU and Türkiye towards the rapid increase in the migrant population are shown with a tree diagram.

3.2.1. Tree Diagram of Strategies to be Followed According to the Status of EU Funds for Migrants

The influx of migrants caused by the Syrian civil war has affected many neighboring countries, especially Türkiye, and EU countries. The fact that Türkiye has taken most of this impact on itself,

within the framework of the protocols it has signed with the EU, has put an extra burden on the Turkish economy, and the EU has transferred financial resources to Türkiye in order to meet some of this burden. As stated by the President of the European Commission Ursula von der Leyen (NTV, 2024), whether the EU, which has provided around €10 billion in funding to Türkiye since 2011, will continue these funds will be influential in determining the future of migrants. Strategic decisions on the future of these funds will determine the problems or solutions that the parties will face. However, transparent information on how, where and how much funds are spent is also important to ensure the governance of migration. The strategies that the EU and Türkiye can pursue in the face of the continuation or non-continuation of the funds and the tree diagrams created accordingly are as follows.

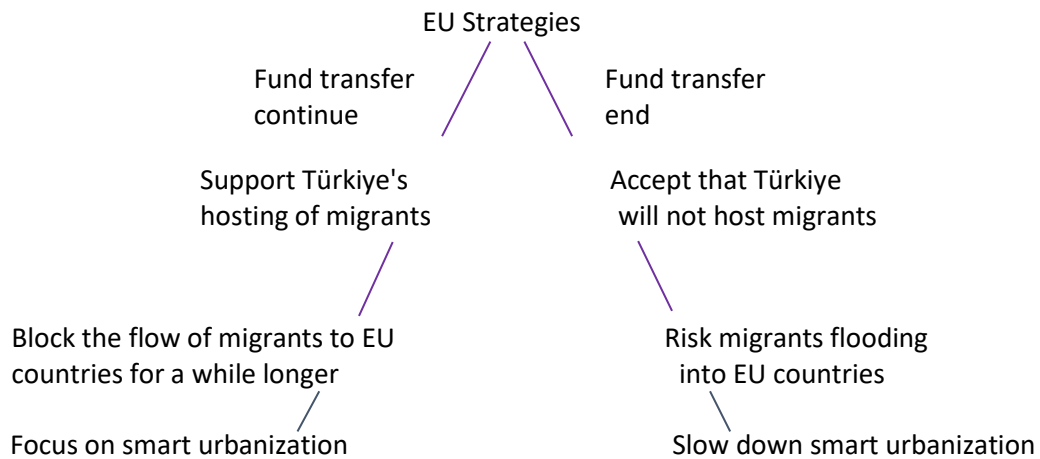
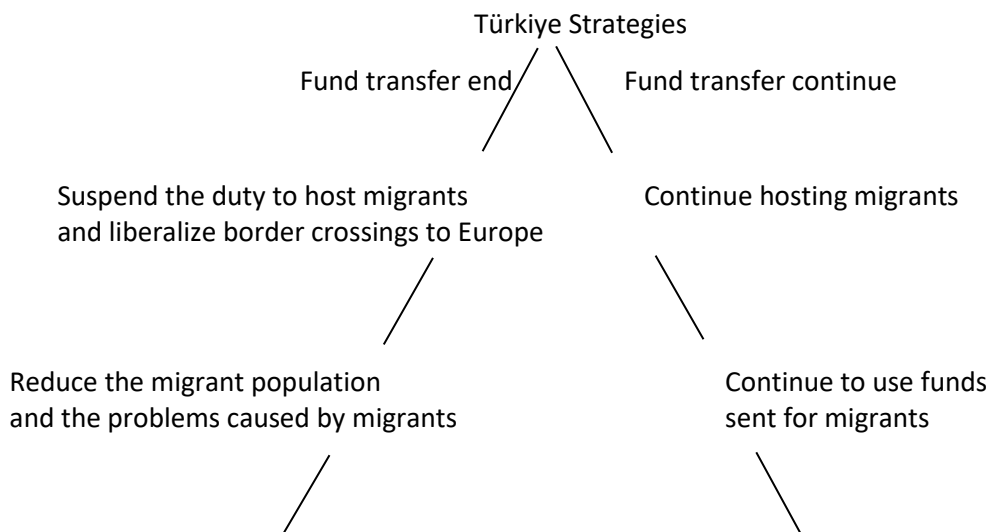


Figure 1. Tree diagram of EU strategies according to the impact of migrant funds on smart urbanization

According to the tree diagram in Figure 1, the fact that the EU will continue to transfer funds to Türkiye in exchange for Türkiye's tolerance of migrants and acting as a buffer country means that the EU will not have to deal with the migrant problem socially for some time to come. As long as Türkiye continues to receive funds, it will continue to host Syrian migrants and meet some of their needs. Even if EU officials are skeptical about where and how the funds are spent (Euronews, 2024), the EU will ignore this and continue to provide support in order to prevent the influx of migrant populations. In the opposite case, i.e. if the EU cuts funding to Türkiye, the EU would be accepting that Türkiye cannot host Syrian migrants any longer, which means that the EU would also be accepting possible migrant influxes. This could lead to a reduction in financial resources for smart urbanization and a slowing down of efforts in this field.



Focus on smart urbanization

Slow down smart urbanization

Figure 2. Tree diagram of Türkiye strategies according to the impact of migrant funds on smart urbanization

According to the tree diagram in Figure 2, in the event that the funds sent in exchange for hosting migrants are cut, Türkiye will have to develop a strategy and take the necessary steps. If the funds transferred from the EU for Syrian migrants, which Türkiye has been hosting for years despite having no obligation to do so, are stopped, Türkiye will be able to suspend its hosting duty and accelerate the exit of migrants from its borders to Europe. Thus, Türkiye would be able to reduce both the migrant population in its country and the social unrest caused by migrants. On the other hand, if the EU ceases to transfer funds to Türkiye, it may cause Türkiye to act more realistically and naturally in terms of migrants crossing its borders to European countries by revealing the fact that Türkiye will not do this job only for humanitarian, conscientious and religious reasons. Otherwise, if the EU continues to transfer funds to Türkiye, Türkiye will be able to continue hosting migrants for a certain period of time and will continue to use the funds sent. The continuation of this funding may lead to a slowdown in the efforts to be made towards smart urbanization.

3.2.2. Tree Diagram of Strategies to be Followed by the EU and Türkiye for the Increase in Migrant Population

The problems faced in international migration governance do not only consist of daily problems in the current period. In addition to the steps taken or to be taken to save the day, plans and strategies for the future should be made and followed. Although it is very important and necessary to grapple with problems under the current conditions and to develop policies that prevent or solve those problems, the impact of these solutions on the future should not be ignored. In this respect, the future impact of the immigrant population settling in a country en masse is also important. The increase in the migrant population, which has the potential to become a social problem, can be handled within the framework of game theory. It is important for Türkiye, which hosts a large majority of the Syrian migrant population, to keep this population under control in terms of its demographic and social effects. The tree diagram representation of the strategies to be followed in this regard is shown in Figure 3 below.

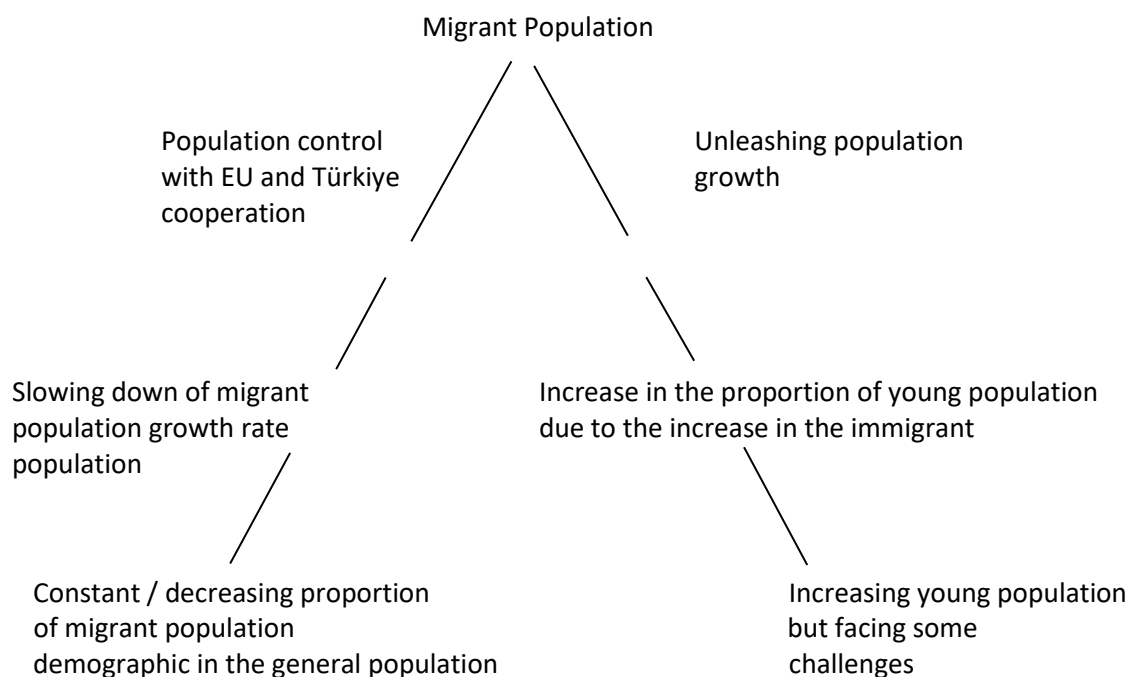


Figure 3. Tree diagram of EU and Türkiye's strategies for migrant population growth

Figure 3 shows that Turkey, with the support of the EU, has the right to control the migrant population on its territory. Türkiye, with the support of the EU, has the right to keep the migrant population under control. A strategy in this direction may lead to a stabilization or even a decrease in the proportion of the migrant population in the general population. However, in the other strategy, Türkiye has the option of choosing not to interfere with the growth of the migrant population in Türkiye. Although some of the migrants have acquired Turkish citizenship and those who were born in Türkiye have become Turkish citizens, the rapid growth of this population may result in Türkiye facing some gains and threats. Such freedom may lead to an increase in the country's young population and meet the need for young labor force, but it may also lead to negative situations such as deterioration of the demographic structure of the country, increase in informal employment, uncontrolled child labor and occupational accidents. This situation may negatively affect the studies to be carried out in the field of smart urbanization.

Conclusion and Recommendations

This study aims to understand the migration governance dynamics and smart urbanization policies and strategies of the EU and Türkiye and to contribute to the determination of strategic policies by analyzing the smart urbanization policies of the EU and Türkiye within the scope of international migration governance within the framework of game theory and Nash Equilibrium. The study explains how smart urbanization strategies could be shaped based on the positions that the EU and Turkey will take in response to the wave of migration triggered by the internal turmoil that followed the social uprisings known in the literature as the Arab Spring. Within the scope of the study, smart city applications created by examining the international migration governance policies of the EU and Türkiye with the Syrian civil unrest that started in 2011 have been investigated and a Nash Equilibrium model has been established to determine the direction for the coming years by examining these studies in the past years.

The study demonstrates that a healthy planning of migration governance in line with social needs will also affect the course of urbanization, and how the positions taken in the face of migration-related situations will affect the road map to be followed in urbanization. In other words, local governments may delay taking steps towards smart urbanization due to increasing costs, taking into account the immigrant population living with the local people. However, registration policies to be followed in order to monitor and control the immigrant population play an important role in the advancement of smart urbanization. From this perspective, it is possible to conclude that if migration governance is implemented with strict rules, smart urbanization will be positively affected, while its flexible implementation will delay smart urbanization and negatively affect it.

This study has revealed that it is difficult for Turkey to manage migration independently of the EU, but that it should adopt a position of “finding common ground rather than taking orders” in this regard. Turkey should grant local governments freedom of action in migration management and smart urbanization, prioritizing its own cities and citizens when implementing policies. Where necessary, public opinion polls should be conducted to determine the views and suggestions of local communities regarding migration governance and smart urbanization policies, and the measures to be taken and the path to be followed should be determined accordingly. Migration governance relations with the EU should be conducted on the basis of transparency and trust, in a manner that protects economic, social, and spiritual values.

In the light of the information and findings obtained as a result of the study, it is seen that countries will have difficulties in international migration governance if existing policies towards strategic sustainability in the field of international migration governance and smart urbanization become more formative. The negative effects of this situation can only be solved through cooperation between states and national NGO stakeholders. The future state of international migration governance and the measures to be taken against it should be shaped in line with the principles of sustainability.

Raising awareness of international migration governance with sustainable policies on smart urbanization is of great importance. The continuity of international migration governance policies, cooperation between countries and national NGO stakeholders and the adoption of participatory approach principles are the principles that will contribute to sustainability.

The strategies outlined in this study can be renewed in the future with the work of international researchers, supported by experts, so that the approach identified in game theory and sustainable smart urbanization can be further developed and contribute to reducing possible mistakes. In the future, games representing international migration governance could be set up not with two players, but with more players representing each country at a certain scale. This would allow for clearer and more comprehensive extended insights. In this way, the importance of determining strategies as well as whether these strategies are well managed will be realized.

Compliance with Ethical Standards

Conflict of Interests: *The authors declare that they do not have a conflict of interest with themselves and/or other third parties and institutions, or if so, how this conflict of interest arose and will be resolved, and author contribution declaration forms are added to the article process files with wet signatures.*

Ethics Committee Approval: Ethics committee approval is not required for this study.

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