The Role of University Campus Locations in the City Urban Growth: the Case of German Jordanian University in Madaba

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Abstract

Although there are many studies related to Madaba at an urban scale, there is no study for the examination of the relationship between university campus locations at the edges and the urban growth of Madaba in Jordan. This study is the first study investigating the impact of university campuses on the urban growth of Madaba, including a set of critical urban issues involved in the development of the city of Madaba. Due to the rapid urban sprawl of Madaba city, there is an increase in population flow towards the outer suburb of the city which includes the university campus and inequity in the distribution of services in these areas. This increases the urban intensification in the city suburbs and the surrounding areas without preserving and reservation of land uses and urban activities. However, urban changes appeared at the city's edges, which helped to form new urban areas close to the university campuses. These changes gave an opportunity to attract new activities due to the existence of university campuses, which affect the urban growth of the city. Therefore, this study aims to identify the role of university campuses localized at the city edges in developing city urban growth. It focused on investigating the relationship between the university campus locations and the urban growth of the cities. This research depends on the quantitative method. The quantitative method employs statistical data analysis using GIS and a questionnaire survey. The study concludes with a series of recommendations for future decision-makers to overcome the main problems facing the urban growth of the city including university campus localizing at the edges. The study shows that the land uses in the surrounding context of the university campus changed significantly, where it could be concluded that residential (48.88% to 79.16%), commercial (3.03% to 9.56%), and service (3.28% to 5.42%) increased at the expense of agricultural use (36.13% to 4.02%). According to this change, it can be noted that there is a slight increase in the built-up areas, which was 3.30% in 1990 then became 8.30% in 2020. The outcome of this study contributes to improving the decisions made by the parties involved in urban development in Jordan when developing the surrounding context of the university campus located at the city edges.

Keywords: university campus, the edges of cities, urban growth, Madaba city, geographic information systems (GIS).

Introduction

Urban growth is a concern in most developing countries, where the excessive concentration of attractive land use, diversity in employment opportunities, and land use have changed from residential to commercial in the city (Fetraniaina, Deliar, & Harto, 2016). Joo & Seo (2018) stated that the local community and the public sector should focus on developing the city through improving the suburb at the edges and surrounding areas.

The existence of universities places supports urban growth (Martins & Sawa, 2007). Universities and cities have long and intertwined Linkages in terms of urbanization (Addie, 2016). Pinheiro, et al., (2015) confirmed the relationship between universities and their urban and regional contexts development. There are beneficial relationships between cities and universities (Gordon & Richar-

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dosn, 2009; OECD, 2007; Rodin, 2005). In this context, Addie, et al., (2016) pointed out universities play a key role to affect the spatial, economic, and social structures of the cities (see also (Allen & Cochrane, 2007; Amin, 2004; Brenner, 2014; Wachsmuth, 2014; Bose, 2015; Burtscher, Harding, Scott, & Laske, 2007; Cochrane & Williams, 2013; Gaffikin & Perry, 2009; Ross, 2012; Schafran, 2015). Also, Universities are considered as one of the main reasons for shaping city development and contributing to urban growth through making new activities and attractions in the surrounding areas (Uyarra, 2010; Maurrasse, 2007; Tewdwr-Jones, Goddard, & Cowie, 2015).

It is obvious that rapid urbanization leads to that there is a strong relationship between the university campuses and the urban growth of the cities, playing a key role in city development (Allen & Cochrane, 2007; Amin, 2004; Brenner, 2014; Wachsmuth, 2014; Bose, 2015; Burtscher, Harding, Scott, & Laske, 2007; Cochrane & Williams, 2013; Gaffikin & Perry, 2009; Ross, 2012; Schafran, 2015). Urban growth was affected by university campuses through three variables: 1. locations of communities (population density and built-up areas), 2. Nature of activities (land uses, land prices, and services diversity), and 3. Social, and economic environmental impacts (employment, mobility, leisure, and consumer activities). Accordingly, this can be achieved through examining these variables for the urban growth of the city of Madaba. Therefore, the main need of this study is to examine the role of university campuses localizing at the city edges in developing urban growth of the city through examining the spatial distribution of urban areas and surrounding context effects including land uses and activities.

Dhaimat and Shawabkeh (2006) stated that there is a limited interest in urban planning and a lack of enough data for the city of Madaba. This was because the responsible parties focused their efforts to meet the general needs of the city itself, such as the sewage system and clean drinking water. On the other hand, the areas located at the edges were marginalized, therefore they led to the emergence of some problems.

At the commencement of this study, although there are many studies related to Madaba at the urban scale, there is no study for the examination of the relationships between university campus locations and the urban growth of Madaba in the Jordanian context. This study is the first study investigating the impact of university campuses on the urban growth of Madaba in the Jordanian context, including a set of critical urban issues involved in the development of the city of Madaba. Madaba city is suffering from sudden indiscriminate expansion related to several political, social, and economic factors (Dhaimat & Shawabkeh, Monitoring of Madaba City Growth by RS and GIS Technique., 2006). Due to the rapid urban sprawl of Madaba city, there is an increase in population flow towards the outer suburb of the city which includes the university campus, and inequity in the distribution of services in these areas (Greater Madaba Municipality, 2017). This increases the urban intensification of the city suburbs and the surrounding areas without preserving and reservation of land uses and activities (Fakhouri & Haddad, 2017). Therefore, urban land use changes appeared at the city's edges which started to form new urban areas close to the university campus. This affects urban land use changes in the city's suburbs which started to attract new activities due to the existence of university campuses. However, this leads to the development of the areas surrounding university campuses, this therefore affecting the urban growth of the city.

This study raised the main research question represented how could the relationship between the university campus locations and the urban growth of the cities be. However, there is no current framework or guidelines in place to help decision-makers to overcome the main problems facing urban growth of the city including university campus localizing at the edges. To fill this gap, it is necessary to test the variables affecting the urban growth of the city by localization of university campuses to determine the role of university campuses localizing at the city edges in developing urban growth of the city of Madaba. Also, it is important to explore what is the extent of university campuses' impact on the urban growth of the city.

The main aim of the study is to identify the role of university campuses localizing at the city edges in developing urban growth of the city through examining the spatial distribution of urban areas, and surrounding context effects including land uses, services and activities. It is necessary to set recommendations for growing the city, this therefore needs to be examined, investigated, and analyzed, to make control on the urban growth including equity of distribution of land uses, services, and business, commercial, administrative, and recreational activities. To achieve the main aim of this study, there should be a set of objectives, which are represented in; (1) Test the variables affecting urban growth of the city by localization of universities campuses'; (2) Investigate the extent of university campuses impact on the urban growth of the city; and (3) Propose multi-faceted recommendations for organizing the process of localization of university campus at the city edges for controlling urban growth.

According to Table 1, it is noted that the research methodologies used in previous studies, which contributed to determine the methods that were used in this research, this study uses two approaches to achieve the main objectives. Firstly, the testing-out approach examines the variables, which are identified by the literature review, to determine the implications of the university campuses' localization at the edges. Secondly, the exploratory approach is used to explore the extent of university campuses impact on the urban growth of the city through investigating the determined variables. Accordingly, this research depends on the quantitative method which employs statistical data analysis using geographical information science (GIS) and a questionnaire survey.

Table 1
The most important methodologies used in the previous existing studies. Source: The researcher

Research	Year	variables	Questionnaire	Interviews	Observation	GIS
Harvey	2005	3		●	●	
Perry & Wiewel	2005	3	●		●	
Karin	2006	1			●	●
Martins and Sawa	2007	3	●			●
Dalbey, et al.	2007	1,2	●		●	
Wachsmuth	2014	2	●	●		●
Schafran	2015	1,2				●
Addie	2016	2,3	●			
Curvelo Magdaniel	2016	3		●		●
Alzouby , Al-Shawabkeh and Dweiri	2019	1,3	●			●

Variables:
1. Locations of communities (population density and built-up areas),
2. Nature of activities (services diversity),
3. Social and economic impacts (land uses, land prices and employment, and consumer activities).

Literature Review

Joo & Seo (2018) point out that developing the city through improving the suburbs at the edges and surrounding areas needs a strong collaboration between the local community and the public sector. The quantitative and comprehensive realizations of social, environmental, and economic drivers control urban growth and therefore impact the spatial distribution of urban areas (Han, Hayashi, & Imura, 2009). This is because of the lack of such detailed information, data, maps, and archival records about urban land use (Al shawabkeh R. , Bagaeen, Al_Fugara, & Hijazi, 2019; Alshawabkeh, 2018). Due to the effect of the city's development on space, the increase in density

cannot be prevented, and the inadequacy of technical infrastructure, social facilities, and urban green areas in the city (Venkitaraman & Devadas, 2014). Consequently, it causes encroachment to surrounding agricultural areas, natural areas, and settlements (Resi, Dutal, Ariz, & Bolat, 2016; Duran & Gunek, 2007; Yilmaz, Marangoz, Sekertekin, & Oruc, 2015; Geymen, 2017). This led to the emergence of a variety and different urban forms that had a clear impact on the environment through the urban sprawl forms, which have been an attractive aspect for planners and policymakers (Frenkel & Ashkenazi, Measuring Urban Sprawl: How Can We Deal with It?, 2008; Frenkel & Orenstein, Can urban growth management work in an era of political and economic change?, 2012). In this context, there are many authors such as Tali et al., (2013) concluded that population growth has changed the land use pattern of the city. Additionally, land use change is occurring through transforming gradually the agricultural lands into built-up areas such as; industrial, commercial, and residential uses due to a lack of predicting plans for these lands and random overcrowding population (Dhaimat & Shawabkeh, Monitoring of Madaba City Growth by RS and GIS Technique., 2006).

All of these problems are pushing decision-makers and planners' attention toward thinking necessitated discussions for the city growth consequences and causes (Tali, Divya, & Murthy, 2013; Wenze, Yong, Peilei, Xinyue, & Cifan, 2012). As a result, the population increase and overpopulation help to gradually shift from agricultural use to other uses, which leads to the emergence of urban sprawl.

Wenze et al. (2013) described urban sprawl as "the encroachment of urban land onto non-urban land". Land use change requires clear guidelines reducing the risks facing converting agricultural lands to other uses (Dad, et al., 2016). Burchell et al. (1998) mentioned that the most important consequences of urban sprawl are the change in the loss of the community character and the use of land. Brook & Davila (2000) indicated stated that land use changes are correlated to economic issues, therefore, agricultural lands are being encroached upon due to coming a set of investments. The changing of land use has a negative impact on the personality of the local and rural community by changing land use where old jobs can disappear and land exploitation for new jobs, which led to convent rural lands into urban built areas that can be used in various new economic jobs (Mantra, 2003; Pradoto, 2012).

According to Gordon and Richardosn (2009), the urban sprawl of the city increases job insecurity, housing costs, income inequality, and even the increase of murder rates. These problems, therefore, are pushing people and governments to work towards a better solution for city development. This gives an opportunity to improve the current environmental and economic conditions of the suburbs at the city edges (Lim, Kim, Potter, & Bea, 2013; Al Shawabkeh, et al., 2020).

Goddard, (2009) and Rodin, (2005) stated that there is a strong relationship between cities and universities. Universities play a key role to affect the spatial, economic and social structures of cities through shaping city development and contributing to urban growth (Tewdwr-Jones, Goddard, & Cowie, 2015; Addie, 2016).

The Initiative for a Competitive Inner City (ICIC) and CEOs for Cities in 2002 stated that half of all universities are located in rural areas at the edges of cities. This leads us to the that these campuses should accommodate the urban growth of the city with ensuring the new development serves local community needs (Dalbey, et al., 2007). For the rural areas, university campuses can generate different impacts on rural areas, and therefore transform these areas into urban areas through attracting multiple activities and new groups, in addition to regenerating the nature of nearby lands (Perry & Wiewel, 2005). Addie et al., (2016) stated that there are positive and negative reflections on these areas by the construction of the university campuses.

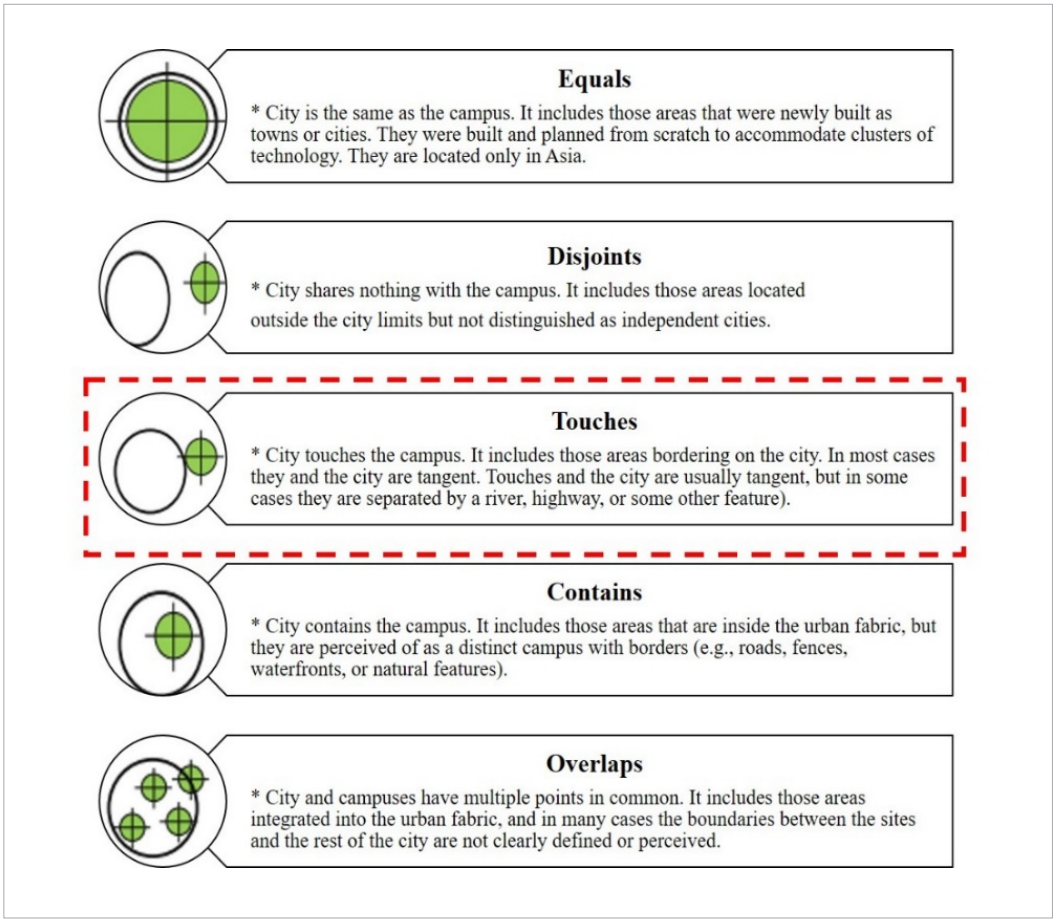
Positives; universities create great places, as well as promote positive environmental outcomes by enhancing transportation choices, fiscal responsibility through the reuse of existing infrastructure and underused properties, and economic development and job creation by supporting mixed-use and joint venture projects. Negatives; the conversion of natural lands and forests to a new office park. increased automobile trips and increased emissions because of low density. housing affordability (Martins & Sawa, 2007). The communities surrounding the rural areas are which can identify the nature of these reflections whether positive or negative (DiPasquale & Wheaton, 1996; Martins & Sawa, 2007). Accordingly, university campuses and their surrounding areas or precincts are correlated to varying degrees. Perry & Wiewel, (2005), pointed out that local communities in collaboration with public institutions play a key role in developing university campuses and growing surrounding areas, this, therefore, allows for addressing and overcoming multiple challenges that accompany urban growth related to traffic, parking, mobility, and the environment, in addition to straining the financial resources of the local community and the institutions (Dalbey, et al., 2007).

Universities play a key role in changing the surrounding lands price, because of the process of demand and supply in the market according to the proximity and accessibility of the surrounding areas of the university campus (Harvey, 2005; Martins & Sawa, 2007). This, therefore, requires strict control of the land uses in terms of the zoning of activities, the existence of residential units, and built-up areas and open spaces (Martins & Sawa, 2007). However, Martins & Sawa, (2007) asserted that university campuses have a key role in changing land uses of the surrounding areas of the university campus within the city. Land use changes affect the housing market, as a result increasing or decreasing land prices.

Many studies show that population growth trends are favoring regions with university campuses and surrounding areas over regions without them (Karin, 2006). This requires the expansion of new housing and services in these areas. This forms pressure on the urban infrastructure of these areas, and therefore increasing the development potential of current land uses by mixing uses to be a more efficient use of land (Alzouby , Al-Shawabkeh, & Dweiri, 2019). Additionally, to meet such rising market demands, many campuses are turning to the creation of new mixed-use developments off-campus in nearby areas. These projects may include retail, student, or market-rate housing, academic space, commercial/ office space, or other “back of house” university departments. All of these issues lead to the development and changing of land uses to their highest use with minimizing infrastructure costs.

Curvelo Magdaniel, (2016) called the university campuses built at the city edges “touched by the city”, which expansion reached their peripheries due to urbanization ultimately (Meusburger, Heffernan, & Suarsana, 2018). Fig. 1 describes the Campus location relative to the city and their relationship to it. Curvelo Magdaniel (2016) emphasized that cities’ campus locations are linked to a diverse set of built environments that serve both. By analyzing the characteristics in the table, the relationship of the German Jordanian University with the city of Madaba is a borderline relationship (City touches the campus), like the city and its shadow, or vice versa. Often, the presence of the university in locations within the city denies its urban integration, so the presence of the university in the suburbs of the city contributed to the occurrence of urban developments in the neighboring areas (Meusburger, Heffernan, & Suarsana, 2018). Therefore, the lack of studies on the topic of the presence of universities in the suburbs of cities in the world in general and Jordan in particular led to the necessity of shedding light on this topic as a starting point for creating integrative and unimpeded relationships between cities and universities. This study, therefore, investigated the relationship between the university campuses and the city’s urban growth through the mentioned variables above.

Fig. 1
Physical relations between the city and campuses. Source: Adapted from (Curvelo Magdanie, 2016). Modified by the researcher



The study area (Madaba)

Madaba Governorate constitutes 1.05% of the total area of the Kingdom of Jordan (as shown in Fig. 2 a,b, with a total area of 940 Km^2 and 165.000 inhabitants, while the Madaba city constitutes 450 Km^2 including 40 Km^2 of planned areas with 125.000 inhabitants (Jamhawi & Hajahjah, It-innovation and technologies transfer to heritage sites: the case of Madaba, Jordan, 2016; Dhaimat & Shawabkeh, Monitoring of Madaba City Growth by RS and GIS Technique., 2006; Greater Madaba Municipality, 2017). Specifically, the area of urban buildings in the city of Madaba reached 14 square kilometers (Dhaimat & Shawabkeh, Monitoring of Madaba City Growth by RS and GIS Technique., 2006).

In addition to its distinguished geographical location in the center, which is accessible from different directions, Madaba is distinguished by its attractive urban formations (Jamhawi & Hajahjah, It-innovation and technologies transfer to heritage sites: the case of Madaba, Jordan, 2016). This city is considered one of the historical and cultural sites in Jordan because of its ancient ruins which it is named a mosaic city (Greater Madaba Municipality, 2017). The city of Madaba has witnessed many civilizations such as the Roman, Nabataean, Byzantine, Moabite, and Islamic civilizations, where the history of its heritage can be estimated as dating back to 4500 BC (Mubaideena & Kurdi, 2017; Jamhawi, Al-Shorman, Roa'a, & Hajahjah, 2016). Currently, the city of Madaba has about 130.000 persons, it is one of the cities with a medium population density, with about 28 percent of its population living in the rural areas (Statistics, 2015; Jamhawi, Al-Shorman, Roa'a, & Hajahjah, 2016; Bzazao, 2017). Rural areas and agricultural lands in the south and southeast from 1985 to 1993 witnessed the expansion and urban growth towards them, encroaching on agricultural lands (Dhaimat & Shawabkeh, Monitoring of Madaba City Growth by RS and GIS Technique.,

2006). On the other hand, Dhaimat and Shawabkeh, (2006) pointed out that from 1993 to 2004 the expansion of urban growth towards the north and northeast direction where the German Jordanian University localized as shown in **Fig. 2 b, c**, which is characterized by a rocky nature and little towards the southwest.

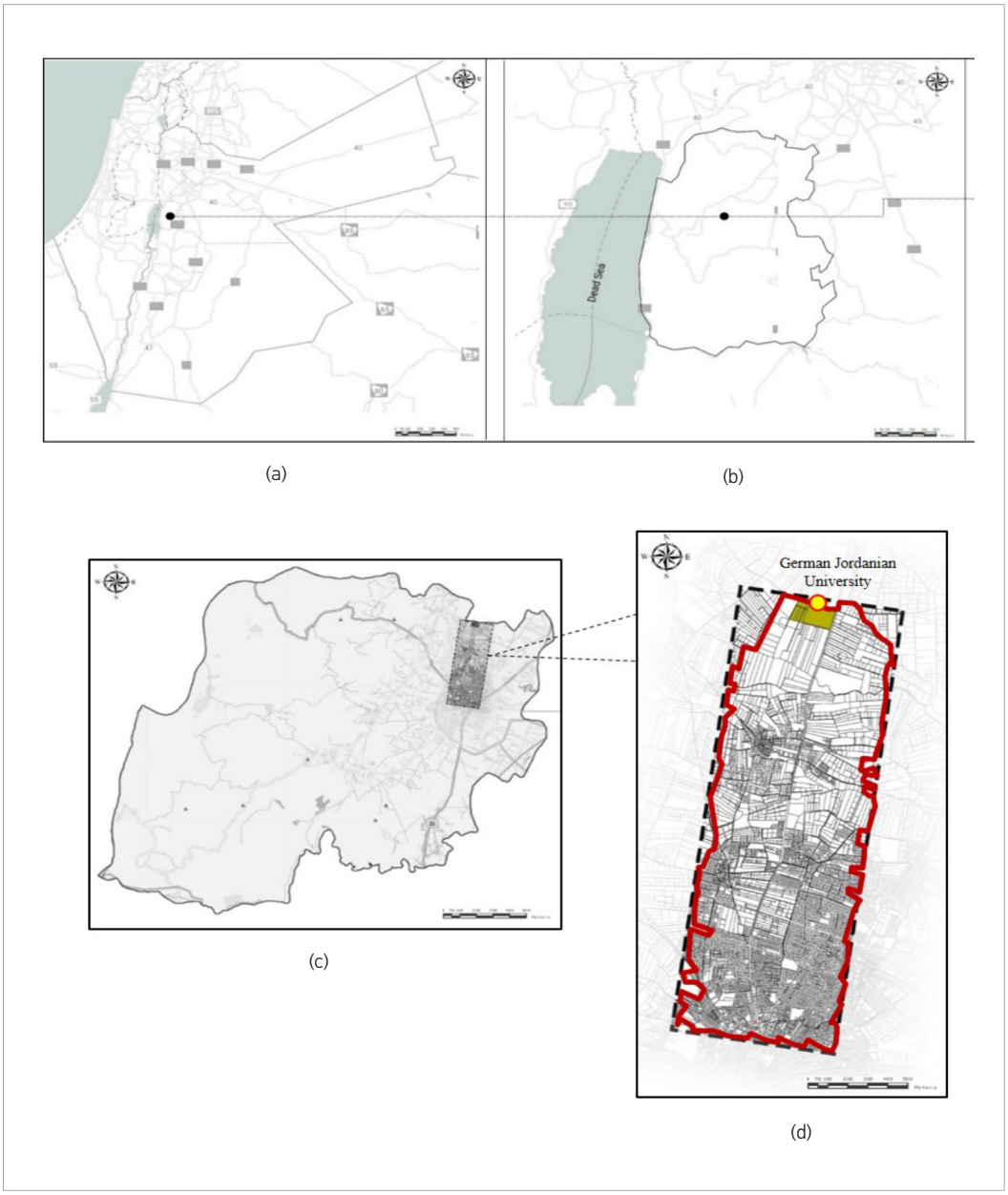


Fig. 2

(a) The Hashemite Kingdom of Jordan, (b) Madaba Governance and (c) The city of Madaba. And (d) Zoom in study area. (Source: Google base map 2021). Drawn up by the researcher 2020 using GIS14.1

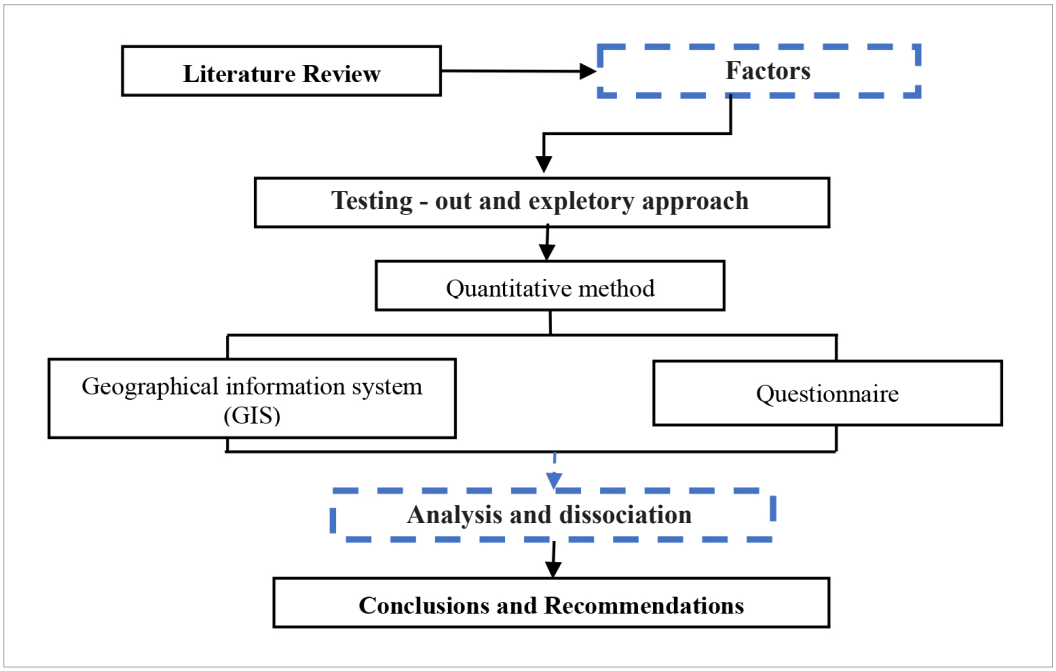
Fig. 3

The context for zoom in study area. Source: the author

Methodology

The study followed a quantitative approach to achieve the main objectives. The quantitative method employs statistical data analysis using geographical information system (GIS) and questionnaire survey as shown in Fig. 4. This research intends to determine the impact of the campus location on the surrounding urban context, by verifying the previously mentioned variables using different methodologies. Therefore, this study adopted a quantitative methodology and implemented it according to the following main addresses; (1) Using a questionnaire to examine the impact of the university's existence on the residents of the surrounding area and its visitors; (2) Using the geographic information systems program and related tools to analyze the data and examine the extent of the change caused by the presence of the university in terms of the built environment and the change in the use of land and services in the region; and (3) Consolidate the information extracted by monitoring the context.

Fig. 4
Research design. (Drawn up by the author)



Firstly, the Geographical information system (GIS) was used in this research for testing the variables as identified in the literature review to determine the implications of the university campuses localization at the edges of Madaba by mapping land use plans of the city of Madaba for the following years 1990, 2005 and 2020. This was done through making the tables and charts relating these variables data; services, land uses, population densities, land prices, and built-up areas as clarified below. The comparison process was taken place here between the analyzed data for the years 1990, 2005 and 2020. The data used in the current study mainly came from three sources: (i) Madaba municipality, (ii) Aerial photographs, and (iii) the Department of Statistics. This study followed four steps to assess the impact of the university's location on the city of Madaba: Mapping the city of Madaba at different periods, analyzing land use change, analyzing services, and analyzing the change in the density of the built environment. The 2020 plan was collected from Greater Madaba Municipality. The 1990 and 2005 plans are vertical color aerial photographs and were collected from the Royal Geographical Jordanian Centre. The data-processing methodology adopted the main steps of mapping the city of Madaba, estimating its population density, and analysis of its land uses. The date of the ArcGIS base map imaginary pertains to the year 2015. It is necessary to digitize all of the data manually to extract all maps. Therefore, before starting the analysis, all of the data were digitized. The locations of the land use plans were digitized manually. Polygons of the city too were digitized manually based on the imaginary map 2015 in GIS and the city of Madaba maps for the following years 1990, 2005 and

2020 to determine their land use areas. The built-up area layer was digitized manually based on the imaginary map 2015 in GIS and a Google map for the year 2020 to determine their built-up areas.

Secondly, in this study two types of questions are adopted: open-ended and closed questions. The survey questions were extrapolated from the literature review and GIS findings. The questionnaire consists of three sections, are; (1) This section was designed to provide a brief of the study. (2) This section was designed to offer broad information about the respondents and their backgrounds. (3) This section was designed to explore the extent of the university campus's impact on the urban growth of the city. The survey in this study includes a wide range of occupiers on the outskirts of Madaba including residents and owners of shops there, in addition to decision-makers in the municipality for taking their views on the current situation of urban growth in Madaba. The selection of the sample is the most important step to obtaining correct and accurate results. As the participants in the questionnaire survey are residents of the area surrounding the university, in addition to the owners of shops there. Also, the decision-makers in the municipality are architects and planners who are working in the Greater Madaba Municipality, due to their knowledge of the current situation of urban growth in Madaba. The diversity of the sample contributes to obtaining correct and accurate results, without bias to a particular category. On the other hand, variation at different times such as weeks, days, and hours is an effective factor in obtaining more accurate results (Chiesura, 2004). Therefore, this study conducted the questionnaire at different times over two months (November and December). The samples were distributed at the weekend with taking into account the peak and off-peak hours, and also a set of samples were distributed through weekdays in the mid-days and in the evening. This study surveyed 400 persons, who are constituting 10% of the population surrounding the university, where 310 responses were received with a response rate of 77.5%. The selection of the sample is the most important step to obtaining correct and accurate results. As the participants in the questionnaire survey are residents of the area surrounding the university, in addition to the owners of shops there. Also, the decision-makers in the municipality are architects and planners who are working in the Greater Madaba Municipality, due to their knowledge of the current situation of urban growth in Madaba. The diversity of the sample contributes to obtaining correct and accurate results, without bias to a particular category. The data collected by the questionnaire survey were analyzed and presented using figures and charts with an accurate explanation. The quantitative data extrapolated from the questionnaire survey were analyzed by calculating the frequencies and percentages for the answers. In this context, the study gathered the first two answers to each question together and the last two answers together to facilitate to the analysis of the results.

Lastly, the study also examined the relationships of the extrapolated results from the comparison process between tested variables. Therefore, the study used cognitive mapping as a subcategory of relational analysis. This mechanism tries to create a model of the overall meaning of the text such as a graphic map representing the relations between concepts. This can be done through identifying the main types of relationships, abbreviation the relations into words and then coding these words into categories, and then exploring the relationships between these variables through mapping and models.

GIS analysis

This section presents the data collected, analyzed, and discussed. The first section provides information related to the land use change and the change in the percentage of built-up areas, in addition to the number of services that have been affected by the presence of the university in relation to the city of Madaba. This is done through the basis of geographic information system GIS analysis and the extraction of different maps that show what was previously mentioned in different periods (1990-2005-2020). The benchmark of this analysis was the German Jordanian University established in 2005, where this study has taken into account 15 years after and before GJU was established. Additionally, the previously mentioned data in the study area are analyzed in a focused manner, represented in the area between the city center towards the German Jordanian University.

Fig. 5
Land use change in three periods 1990-2005 and 2020. Source: The author

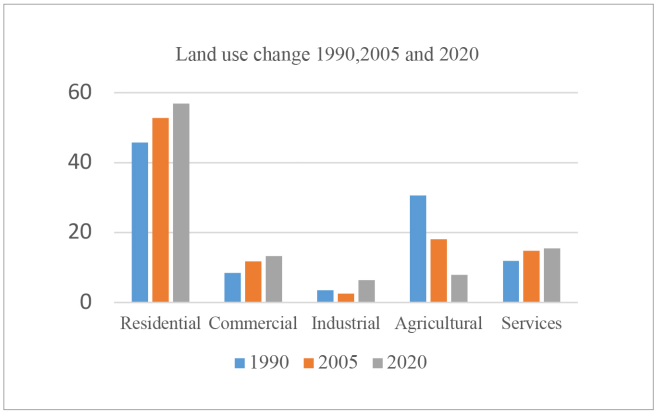


Fig. 6
Land use in Madaba city at 1990. Source: GMM, 2021: Modified by the researcher

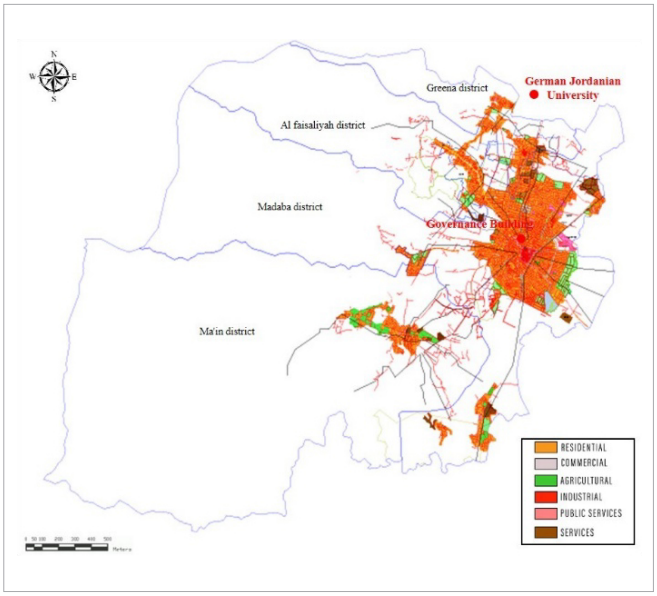
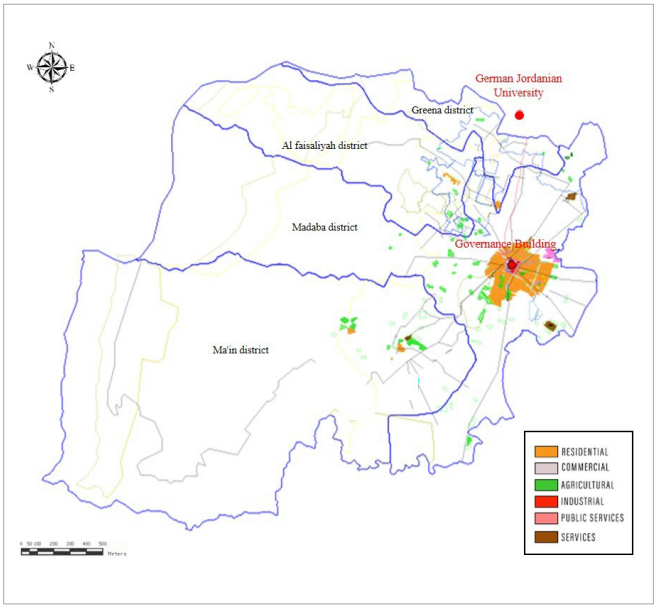


Fig. 7
Land use in Madaba city at 2005. Source: GMM, 2021: Modified by the researcher



The city of Madaba and the changes that occurred in the three periods 1990-2005-2020

Land use change in the periods 1990-2005-2020

Fig. 6 presents the distribution of land use for the city of Madaba as a whole in 1990, where residential use in the 1990s formed the highest percentage (45.69%) and the lowest percentage for industrial use (3.46%) as shown in Fig. 5. In addition, as shown in Fig. 7 and 5 displaying the areas and clarifying the land uses of the city of Madaba in 2005, residential use occupied the largest proportion of the built areas of the city with an estimated 52.82%. On the other hand, industrial use remained with the lowest rate of 2.6% of the total other uses as shown in Fig. 5. There has been an increase in general in land uses of various types, as shown in Fig. 8 and 5. The increase in residential use continued, as its percentage become 56.94%, and despite the increase in the percentage of industrial use, it remained the least of the uses, with a rate of 6.32% of All uses.

Therefore, the comparison between the land uses of the city of Madaba as shown in Fig. 5 the presence of uses that changed significantly, then decreased, and then increased again with time, such as industrial use. In addition, an increase in residential, commercial, and service uses can be continued at the city level. On the other hand, agricultural use was declining during the periods 1990, 2005 and 2020 remarkably, where the percent-

age of its change represented a clear difference. It can also be concluded that residential, commercial, service, and even industrial uses have risen at the expense of agricultural use.

Built-up areas rate change in the periods 1990-2005-2020

Although residential use obtained the highest percentage of use in the nineties of the last century, Fig. 10 shows that the built environment in the city of Madaba was not large. However, the built-up area constituted (10%) of the city-regulated areas as shown in Fig. 9. This means, that the area was not heavily inhabited. In 2005, the built environment increased, making up 19% of the area of the entire city of Madaba. Fig. 11 shows the built-up areas and shows their increase and the concentration of their orientation towards the north in a noticeable way. Fig. 11 shows a noticeable increase in the built-up areas and their distribution in an unplanned way, as the increase is remarkably directed towards the northeastern borders of the city. Fig. 12 and 9 confirmed the increase in the built-up areas, as the percentage of the built-up area reached 29% of the city-regulated areas.

As a result of the increase in the rate of land use change, especially residential use, this led to an increase in uses in general, excluding agricultural use, which was reflected in the built environment. Fig. 8 shows the expected increase in the built-up area during the three periods (1990-2005-2020) where in 2020 the built environment constituted a third of the city's area.

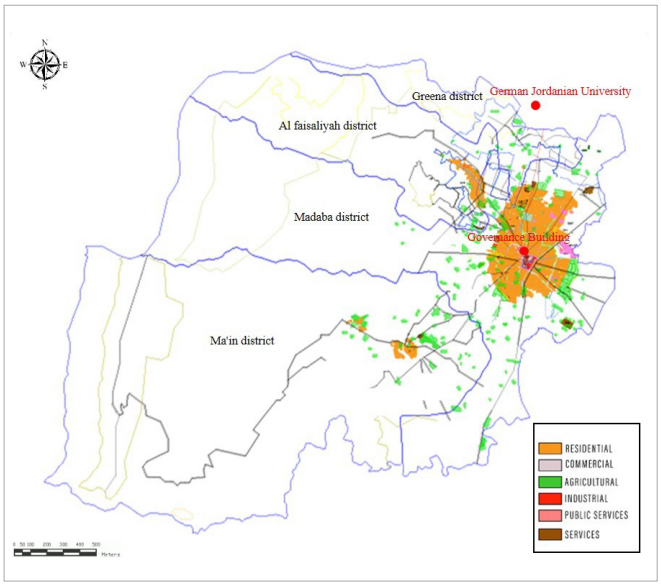


Fig. 8
Land use in Madaba city at 2020. Source: GMM, 2021: Modified by the researcher

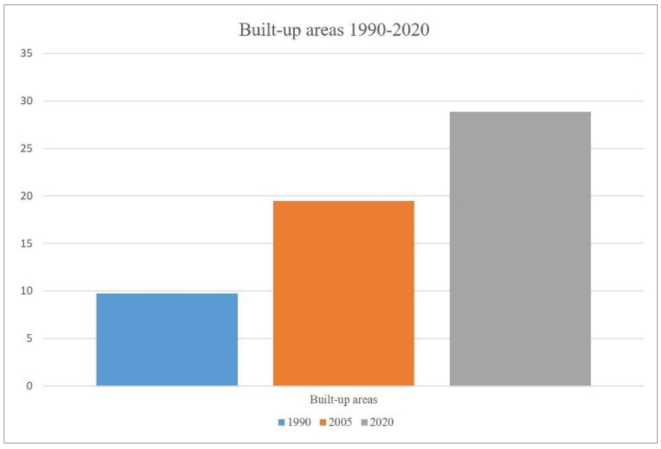


Fig. 9
Change in built-up areas in three periods 1990-2005-2020. Source: The researcher

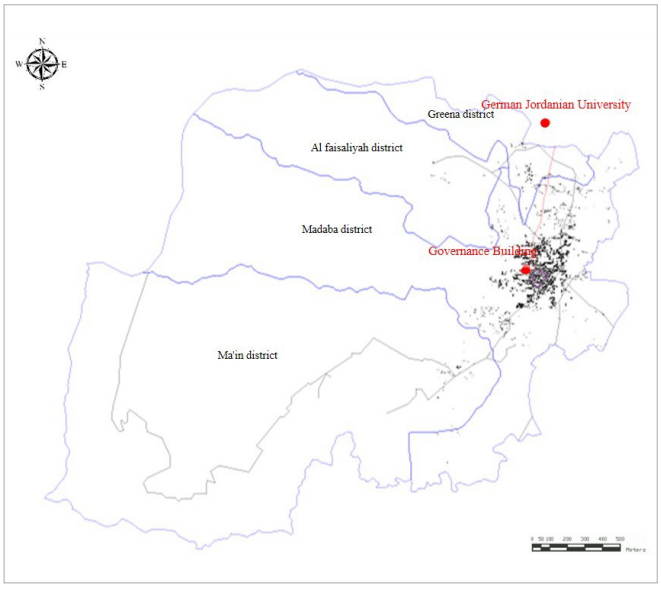


Fig. 10
Built-up area in Madaba city at 1990. Source: Google earth map, 2021: Modified by the researcher

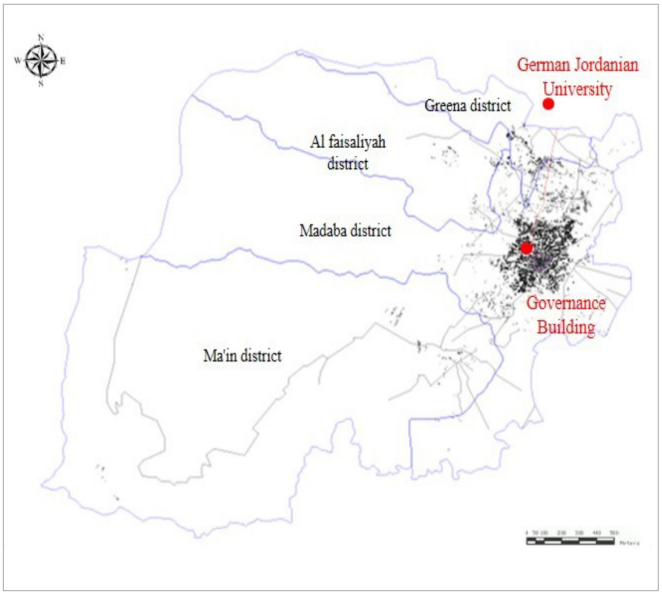


Fig. 11
Built-up area in Madaba city at 2005. Source: Google earth map, 2021: Modified by the researcher

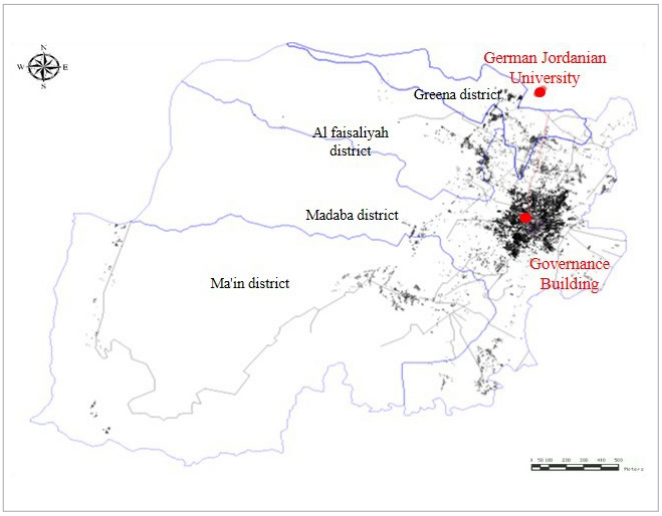


Fig. 12
Built-up area in Madaba city at 2020. Source: Google earth map, 2021: Modified by the researcher

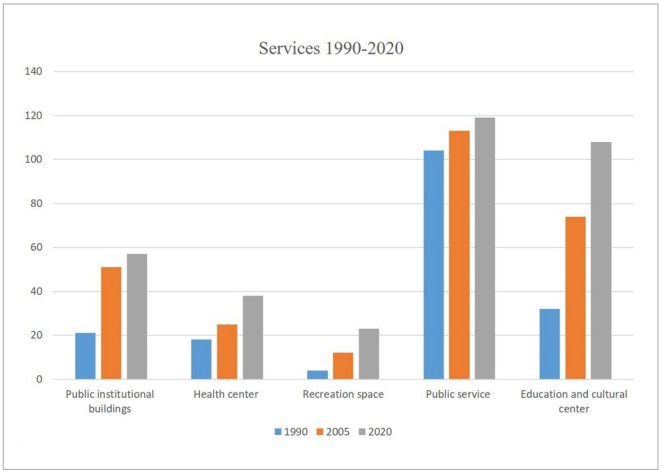


Fig. 13
The change in the number of services in the city of Madaba during three periods 1990-2005-2020. Source: The researcher

Services rate change in the periods 1990-2005-2020

In 1990, the services available in the city of Madaba diversified. As an expected result, the distribution of services was near the populated areas that often make up the city center (Fig. 14). The number of public services available in the region reached 104 as the highest number, while the recreational spaces were the least number in the region with only 4 recreational spaces as shown in Fig. 13. In 2005, based on the population and urban increases that the region witnessed, as shown by the figures and maps previously, there was also a need to refer to the number of services in the city. Fig. 14 displays the distribution of services within the urban expansion areas (built-up areas). Despite the increase in all services, the public services remained with the highest number of 113, and the recreational services with the lowest number, with a total of 12, as shown in Fig. 13. As an expected result of all the changes that took place in the city, in 2020 there has been an increase in general on all services without exception. Therefore, services spread within the built environment in order to achieve the greatest benefit to the population (Fig. 16). Public services continued to rise with the highest number of 119. On the other hand, recreational services remained, despite their increase, with the lowest number of services available with 23 units, as shown in Fig. 13.

As a result, over the three time periods (1990-2005-2020), public services remained with the largest number, and recreational services remained with the least number. In addition, it can be noted that the great change during those periods occurred with a significant increase in the number of educational services and cultural centers (Fig. 13).

Study Area (Zoom-in maps) analysis during 1990, 2005 and 2020

Land use analysis

Fig. 17 clarifies the distribution of land use from the city center of Madaba to the northeast boundary where is the German Jordanian University located there in 1990. Fig. 18 confirms what was previously mentioned, where residential use in the 1990s formed the highest percentage (48.88%) and the lowest percentage for industrial use (0%). In 2005, the city as a whole was affected by the variables of population increase, and this was reflected in the study area. Residential use continued to obtain the highest percentage and area, with a rate of 83.86%. On the other hand, industrial use remained hidden from the area remained at 0 (Fig. 17 b and 18). The increase and diversification of uses continued, with residential use maintaining the highest percentage, reaching 85.86%, while the area also continued to be free of industrial use, as it is still the same percentage and area (0) over the three different periods, as shown in the Fig.17 c and 18.

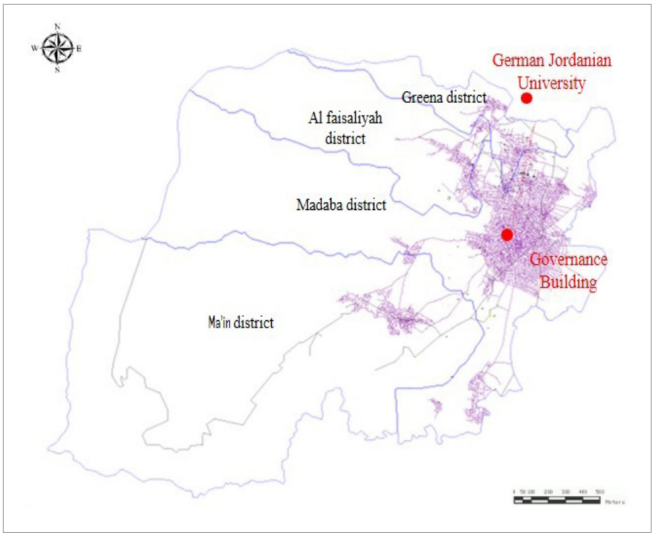


Fig. 14
Services in Madaba city at 1990s. Source: Google earth map, 2021: Modified by the researcher

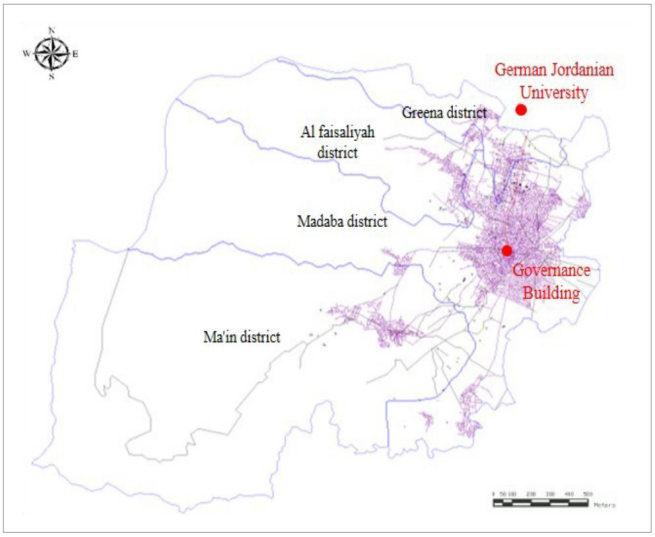


Fig. 15
Services in Madaba city at 2005. Source: Google earth map, 2021: Modified by the researcher

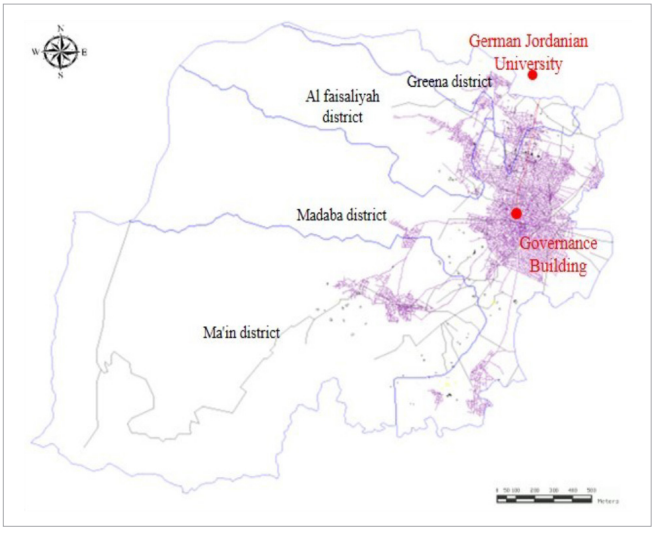


Fig. 16
Services in Madaba city at 2020. Source: Google earth map, 2021: Modified by the researcher

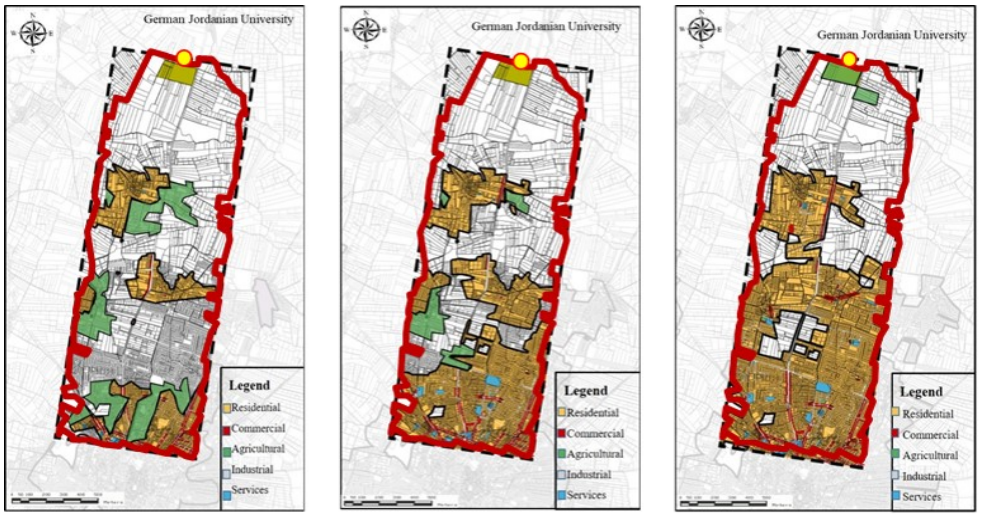


Fig. 17
Land use maps-zoom in (a) 1990, (b) 2005 and (d) 2020. Source: GMM, 2021: Modified by the researcher

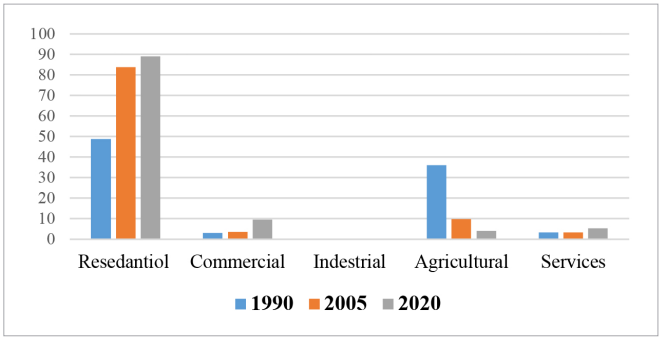


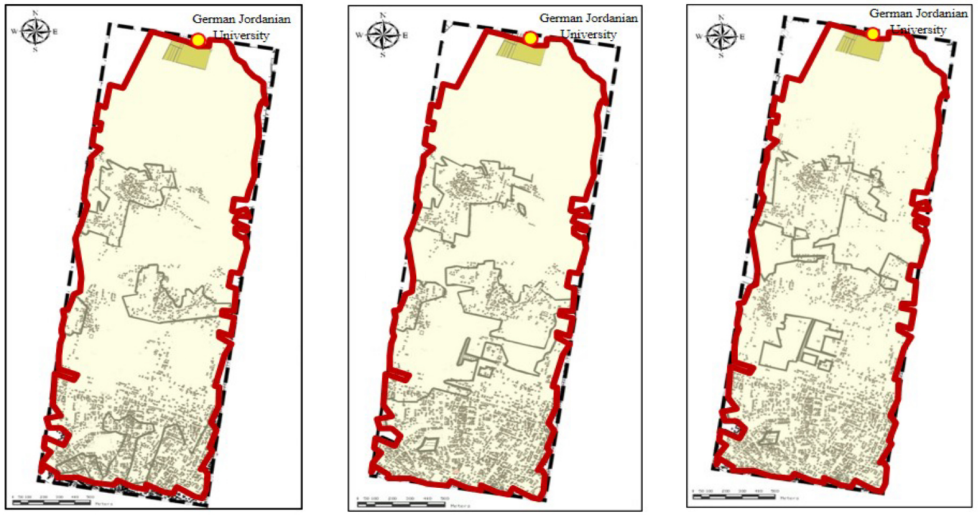
Fig. 18
Land use change graph from 1990-2005-2020. Source: The researcher

According to Fig. 18, the differences in uses appear over the three periods (1990-2005-2020), where residential use had the highest percentage over that period, while industrial use remained at its constant rate. On the other hand, the increase in residential use was at the expense of other uses such as agricultural and commercial use and services. In addition, it can be noted that the significant change in agricultural use was clearly affected by the increase in residential use, which was at its expense (Fig. 18).

Built-up environment analysis

The concentration of the population was near the city center, therefore, according to Fig. 19, the built environment is clearly visible at the lower end of the Fig. 18, which represents the middle of the city center from the north. In spite of this, it is noted that the expansion of the built-up areas, even if they are dispersed, is heading toward the north, which is for the border areas between Amman and Madaba governorates. In 2005, with the increase in population density, the built-up area increased to reach 6.5% of the area of the regulated lands (Fig. 20). According to Fig. 19 b, this increase in the built environment of the area was in the form of an expansion from the city center to the north, without prior plans or organization. Therefore, the dispersion was clear, and the built environment expanded without a systematic plan for it. It is observed that the study area was noticeably affected by the population increase, which was thus reflected in the increase in the built environment toward expansion areas at the city edges (Fig. 19). This expansion towards the northern borders of the city was emphasized, due to its proximity to the university campus and at the same time far from the urban overcrowding that occurs in the city Centre.

Over the three periods 1990, 2005 and 2020, the city of Madaba witnessed a population increase, which affected the described environment and its increase. Therefore, since the study area is part of this city, the impact was clear on it despite the low percentage of the total area occupied by built-up areas. Fig. 20 shows the gradual rise in the percentage of the built environment area,



(a) (b) (c)

Fig. 19
Built up maps-zoom in (a) 1990, (b) 2005 and (d) 2020. Source: Google earth map, 2021: Modified by the researcher

where the percentage was the highest in 2020 at 8.3% and the lowest in 1990 at 3.30%. This was consistent with the population increases and demographic changes that the region is facing.

Services Analysis

Fig. 21 a shows the distribution of services places in the study area in 1990, as their distribution was based on the built-up areas to serve the largest possible num-

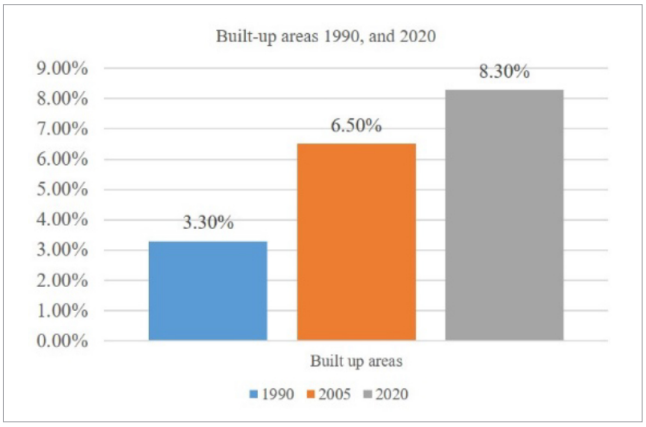
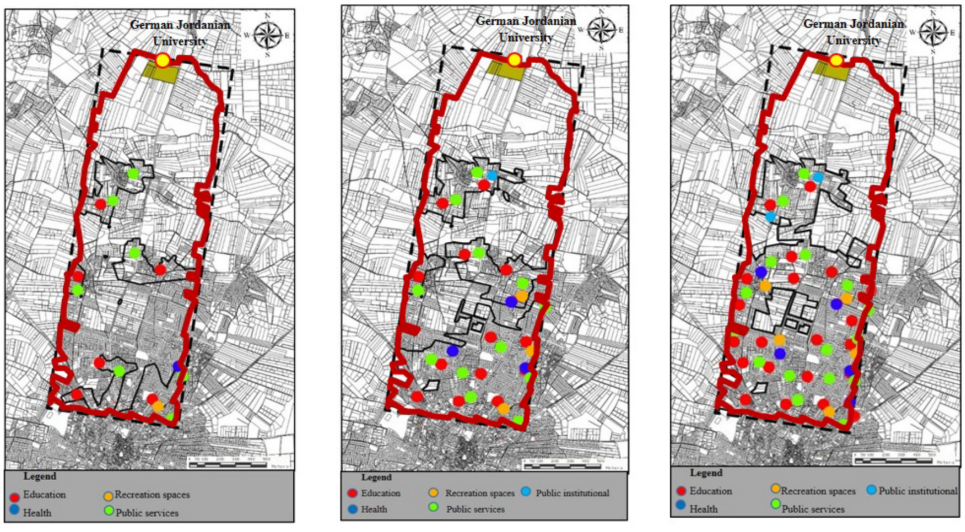


Fig. 20
Change in built-up areas in three periods 1990-2005 and 2020. Source: The researcher



(a) (b) (c)

Fig. 21
Services zoom - map in (a) 1990, (b) 2005 and (d) 2020. Source: Google earth map, 2021: Modified by the researcher

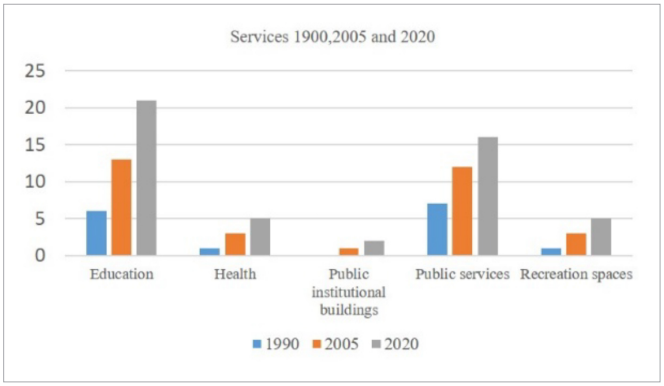


Fig. 22
The change in the services during three periods 1990-2005-2020. Source: The researcher

ber. The public services constituted the highest number, with 7 of them available, while the region lacked buildings and public institutions as shown in Fig. 22. According to Fig. 21 b which shows the study area in 2005 confirmed the development of the area and spacing of the built environment there, that is led to be was necessary to increase the number of services and their distribution within those populated areas (Fig. 22). According to Fig. 21 b and 22, the number of services available in the region has increased significantly, but here educational services achieved the highest number of available services by 13 educational units. Recently, services, in general, have increased significantly in the region, and are distributed within a wider range; this was due to the increase in the population, leading to the increase in the need for services (Fig. 21 c).

Therefore, the need for services has been influenced by changes in population density and changes in the built environment. It noticed during the three periods 1990, 2005, and 2020, there was a discrepancy in the services available in the region, where in the beginning the public services had the largest number, and then the increase was clear in the educational services that achieved the highest number of services later (Fig. 22). Also, it was noticed that the buildings of public institutions did not exist in the study area, then over time, they became present even if the least services were increased (Fig. 22).

Questionnaire survey Analysis

This section provides an analysis of the survey. The questionnaire survey presents a profile of the category participating in the survey; Which represents the residents of the areas located on the outskirts of Madaba, where the proportion of 10% as participants in the survey is appropriate because the numbers in the suburbs are known and not large, in addition to the decision-makers in the municipality of Madaba. The participants represent 10% of the population of the outskirts, where 400 people were surveyed, in addition to architects and decision-makers in the municipality. The questionnaire was hand-delivered and received, however, around 310 responses were received giving a response rate of 77.5%. As mentioned earlier, the results were manually received and analyzed from the participants to ensure that the participating group would be more useful and accurate in obtaining the desired results.

The objective of the questionnaire is confirmation of variables and to investigate variables that were extracted from the literature review and that were not investigated by the information available from map analysis by GIS, such as employment, the difference in land and real estate prices, and their impact on the surrounding area and its population. Also, some information extracted from GIS was emphasized. In addition, this chapter also verifies the results obtained from GIS by asking the surrounding population that constitutes the target group about the results obtained. Therefore, the formulation of the questionnaire questions was based on a literature review and GIS results.

The impact of the built environment, land uses, and services on the land prices

For the built environment and encroachment on the type of land use, Table 2 shows the degree of encroachment of the built environment on the nature of land use. It was clear in the analysis of the maps through the GIS program that the greatest infringement was on agricultural use, and this was confirmed by the respondents in the questionnaire. Therefore, the rate of infringement

on agricultural use was very noticeable at 98.06%, followed by public services at 93.87%, while for the encroachment of the built environment on residential use was 92.91% were commercial use affected by 91.64%. It is noticeable that the built environment did not have a very big impact on the encroachment of industrial use in the region, as 288 people (92.91% of the participants) confirmed that the encroachment of the built environment on industrial use was weak.

Degree of impact / Use	Very Large (V.L)	Large (L)	Total (V.L+L)	No effect	Weak (W)	Very weak (V.W)	Total (W+V.W)
Residential	20.97%	71.94%	92.91%	1.94%	3.87%	1.28%	5.15%
Commercial	80.97%	10.67%	91.64%	7.07%	1.29%	0%	1.29%
Agriculture	92.9%	5.16%	98.06%	1.94%	0%	0%	0%
Industrial	0%	0.96%	0.96%	6.13%	21.94%	70.97%	92.91%
Public services	62.9%	30.97%	93.87%	1.94%	2.9%	1.29%	4.19%

Table 2
The degree of the built environmental and encroachment on the land uses. Source: The researcher

As for the impact of the expansion of the built environment on land prices, the expansion of the built environment in the area has an impact on land prices there. 251 persons of participating in the questionnaire (80.97%) confirmed that land prices were significantly affected by the expansion of the built environment surrounding the university campus, while 10% of the participants considered that the impact of prices due to the expansion of the built environment was very weak as shown in Fig. 23. This may be an opportunity to question future research and studies about other variables that contributed significantly to the rise in land prices in the region, which based on the answer to this question formed the existence of the university one of them.

Additionally, the study examined the effect of changing land uses on increasing its prices, where the changing of the land use influences the increase in land prices in the region, this was confirmed by Fig. 24 of the analysis of the results of the participants in the questionnaire. Fig. 24 shows that 81.94% noted that the change was very large in land prices, while only 3 persons (0.96%) of the participants indicated that the change was weak. The vast majority of opinions, which collectively amounted to 92.91%, confirmed that the increase in prices was affected by the change in use, which was clear.

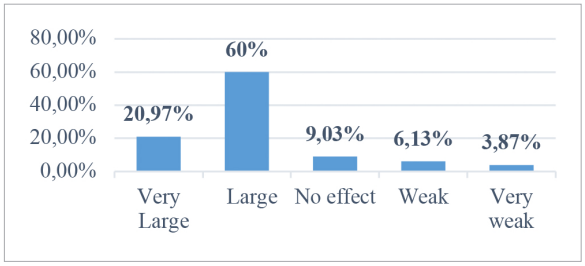


Fig. 23
The impact of the expansion of the built environment on land prices. Source: The researcher

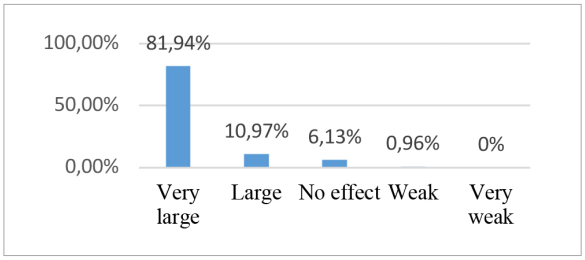


Fig. 24
The effect of changing land uses on increasing its prices. Source: The researcher

As for the effect of the distribution of services on land prices, Land prices were affected unevenly by the distribution of services within it. According to Table 3, the presence of public institutions has the largest impact of 94.19% on land prices in the region, followed by the presence of public services at 91.94%. In addition, it was noted that 273 persons (88.03%) and 64.17% of participants emphasized the significant impact of the presence of educational and health services in the region on land prices, while 81.29 % of the participants found that the availability of entertainment services had a weak impact on land prices there.

Table 3
The degree of impact of the distribution of services on land prices. Source: The researcher

Degree of impact / Services	Very Large (V.L)	Large (L)	Total (V.L+L)	No effect	Weak (W)	Very weak (V.W)	Total (W+V.W)
Educational	21.9%	66.13%	88.03%	3.87%	2.9%	5.2%	8.1%
Healthy	23.2 %	40.97%	64.17%	21.9%	9.03%	4.9%	13.93%
Public institutions	76.13%	18.06%	94.19%	2.9%	1.9%	1.01%	2.91%
Public services	80.97%	10.97%	91.94%	2.9%	3.87%	1.29%	5.16%
Recreational places	3.87%	3.87%	7.74%	10.97%	60%	21.29%	81.29%

The impact of the university's campus on the urban determinants

The determinants that were identified varied through the previous literature review, so it was necessary to specify them for the participants in the questionnaire survey to know the degree of their impact on the presence of the university. According to 97.1%, of respondents, the effect was clear and very significant in the increasing percentage of planned lands in the region, followed by an increase in the built environment in the area according to the opinion of 94.2% of the participants. In addition, the determinant of the rise in land prices in the region has a large affected according to 80.97% of participants, followed by a population increase in the area by 89.03% (Table 4).

Table 4
The impact of the university's campus on the urban determinants. Source: The researcher

Degree of impact / Determinants	Very Large (V.L)	Large (L)	Total (V.L+L)	No effect	Weak (W)	Very weak (V.W)	Total (W+V.W)
Population increase in the area	20.97%	68.06%	89.03%	6.13%	3.87%	0.97%	4.84%
Increasing the demographic diversity of the region's population	0%	1.9%	1.9%	3.87%	22.9%	71.33%	94.23%
The rise in land prices	80.97%	11.9%	92.87%	2.9%	3.87%	1.29%	5.16%
The rise in housing prices	1.9%	2.33%	4.23%	1.9%	72.9%	20.97%	93.87%
Land use change	29.03%	54.8%	83.83%	10.97%	2.9%	2.3%	5.2%
Increase public services in the area	26.77%	25.16%	51.93%	20.97%	22.9%	4.2%	27.1%
Increase the built environment in the area	61.9%	32.3%	94.2%	5.16%	0.64%	0%	0.64%
Increasing the percentage of planned lands in the region	39.03%	58.07%	97.1%	2.3%	0.6%	0%	0.6%

Also, the presence of the university in the region had a very large impact on land use change and its presence clearly and strongly, with a percentage of 83.83%, and the increase in the presence of public services in the region had a clear impact, but its presence was few, according to the opinion of 51.93% of the respondents. On the other hand, Table 4 shows that the presence of the university did not have a clear impact on increasing the demographic diversity of the region's population nor a

rise in housing prices with 94.23% as a weak percentage for demographic diversity and 93.87% as a weak percentage for the increase in housing prices according to the opinion of the participants.

According to the indicator tests identified by the survey at surrounding areas of German Jordanian University, the study identified the suitable determinants for the city based on the respondent's answers as shown in Table 4 above. 6 determinants were determined for the surrounding areas from the 8 determines identified by the literature review. Accordingly, the study identified the ranking for the determines, which can be implemented as (1) Increasing the percentage of planned lands in the region (2) Increasing the built environment in the area (3) The rise in land prices (4) Population increase in the area (5) Land use change (6) Increase public services in the area. Hence, this ranking represents the priority for implementing these determinants in the surrounding context of the university campuses, enhancing the effective implementation of these campuses at the edges of the city.

Residents' satisfaction with the university's presence in a rural area

Depending on the previous question answer, the researcher wanted to assess the extent of the university's surrounding population's satisfaction with a number of aspects that were affected by its presence, such as services, jobs, commercial investment projects, and land prices. The university had a great impact on providing the region with various services, and this is what made 97.06 % of the respondents express their strong satisfaction with its increase, followed by commercial investment projects, as 276 people (89.03 %) expressed their strong satisfaction with its increase in the region. Where it worked to improve their living conditions. In addition, 84.2% of the population participating in the survey were very satisfied with the increase in land prices in the region. On the other hand, 71.03 % of the survey respondents expressed their dissatisfaction with the jobs that the university worked on, but which did not serve the residents of the region as shown in Table 5.

Degree of satisfaction / The effect of increasing	Very satisfied (V.S)	Satisfied (S)	Total (V.S+S)	Equal	Not satisfied (N.S)	Deeply dissatisfied (D.d)	Total (N.S+D.d)
Services	91.9%	5.16%	97.06%	1.9%	1.04%	0%	1.04%
Employment	1.9%	16.1%	18%	10.97%	46.13%	24.9%	71.03%
Commercial investment projects	75.16%	13.87%	88.96%	7.1%	2.9%	0.97%	3.87%
Land price	61.3%	22.9%	84.2%	11.9%	1.95%	1.95%	3.9%

Table 5
The degree of satisfaction with the impact of the university's presence and its increase (services, jobs, commercial projects and land prices). Source: The researcher

Discussion

This section provides an analysis of the content, serving as a tool that can be used to identify the presence of certain relations, concepts within qualitative data such as figures, texts or charts through analyzing the relationships and meanings. In addition, this mechanism tries to create a model of the overall meaning of the text such as a graphic map representing the relations between concepts. This can be done through identifying the main types of relationships, abbreviation the relations into words and then coding these words into categories. Also, it presents and discusses the information and data that have been collected and obtained through reality and observing the emergence of the region due to the presence of the university. It is expressed in a relationship map to see the extent of change.

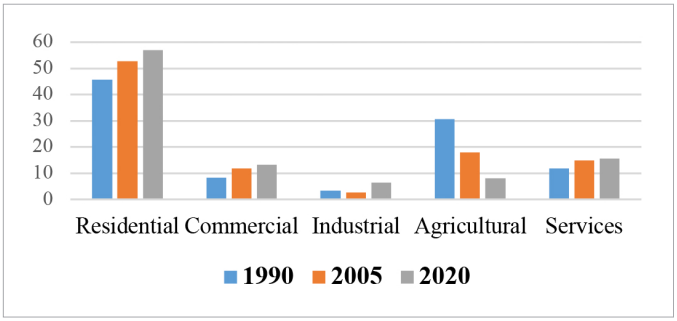


Fig. 25
Land use change in three periods 1990-2005-2020 at Madaba city. Source: The researcher

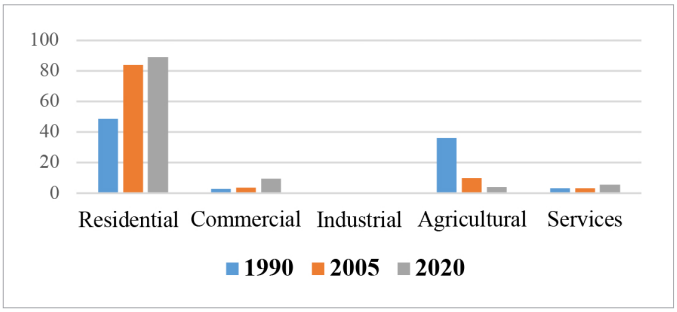


Fig. 26
Land use change in three periods 1990-2005-2020 at zoom-in district. Source: The researcher

Fig. 25 and 26 present the change in land use in three time periods 1990, 2005 and 2020. However, Fig. 25 expresses the change in the uses of the city of Madaba as a whole, while Fig. 26 focuses on the area extending from the city center to the borders of the German Jordanian University. It can be noted that the increase in the residential use of the city of Madaba has affected on zoom-in area, where the highest rates of increase for the two areas were in the residential use. Followed by an increase in commercial use, which was more noticeable in the zoom-in area, as well as services use, which increased significantly in the zoom-in area. On the other hand, agricultural use decreased noticeably in the whole city and zoom-in area clear degree over the periods, in addition to a discrepancy in the rates of industrial use, which presence in the city of Madaba was apparent, while the study area lacked such use. This was confirmed by the questionnaire, where the participants showed that the highest percentage of change over the three periods was in residential use, followed by commercial use, then services, then agricultural, and finally industrial use.

As shown in Fig. 25 and 26, the presence of the German Jordanian University in 2005 has a clear impact on land uses, whether at the level of the city as a whole or the surrounding area. Agricultural use has significantly decreased due to the presence of a university campus in the area, while residential use was increased clearly. In addition, the uses were generally affected by the presence of the German Jordanian University, where there was a clear and noticeable increase in commercial, service and industrial use (at the city level).

According to the change in land uses and their increase in general, excluding agricultural use, which was at the expense of the change, Fig. 27 and 28 show the increase in the built environments across the three periods, whether for the city of Madaba as a whole or the study area. It can be noted that the increase in the built-up areas was not very large, but it is constantly increasing, and this was confirmed by the answers to the questionnaire survey, which was found through the massive assault on the built environment on agricultural use, followed by commercial and residential use, while the impact of the infringement was very weak on industrial use, which the area was lack. On the other hand, the survey confirmed that the increase in the area of the built environment had a significant and clear impact on land prices in the region, which would bring economic benefits to the region in light of the increase in the built environment there. According to the impact of the presence of the university campus on chang-

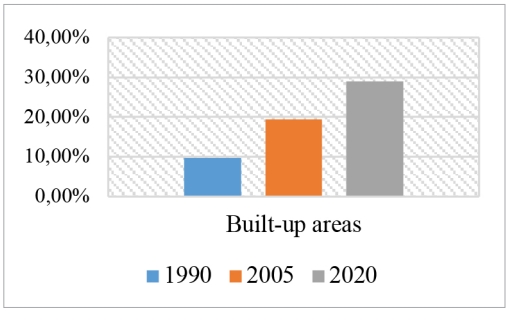


Fig. 27
Change in built-up areas in three periods 1990-2005-2020 at Madaba city. Source: The researcher

ing and increasing uses in the city and the area, there was also a clear impact on the increase in the percentage of the built environment after 2005, which formed the period of establishment of the German Jordanian University.It is noticeable from Fig. 29 and Fig. 30, which represent the change in the number of services for the city of Madaba and the study area, that the numbers are increasing, as increasing the built environment. Where it can be concluded that there is a direct relationship between them and that the greater the built environment, the greater the need for services that meet the needs of the population. Based on Fig. 29, the greatest increase in the city of Madaba was in the number of public services, followed by the number of educational services, while what is presented in Fig. 30, which represents the study area, the increase was more evident in educational services, which formed a leap in numbers, followed by public services. This was confirmed by the questionnaire survey, where the participants noticed the spread of educational services very widely in the zoom-in area, followed by public services in a large way. In addition, it was previously mentioned that the respondents in the survey confirmed that the prices of land in the region were affected by the presence of services, as the presence of public services had the greatest impact on the increase in prices in the region, which constitutes a direct relationship between the presence of services of all kinds and the increase in land prices in the region.

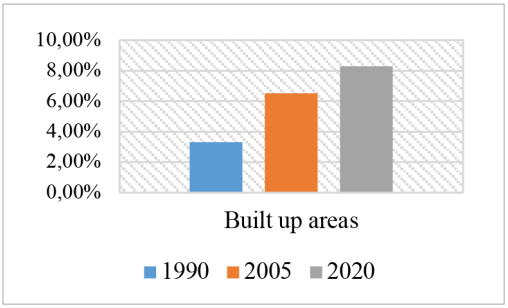


Fig. 28
Change in built-up areas in three periods 1990-2005-2020 at study area. Source: The researcher

According to Fig. 29 and 30, it is noticed that 2005 was a transitional period for the availability of services in Madaba city and the study area. The presence of universities has led to increasing in educational, health, entertainment services and public institutions in general, therefore the increase in public services for the city of Madaba was clear. On the other hand, the presence of a university campus greatly increased educational services in the surrounding area and also created services that did not exist in the surrounding area, such as the buildings of public institutions.

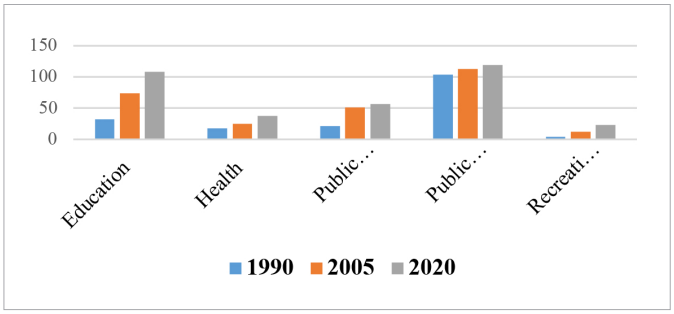


Fig. 29
The change in the number of services during three periods 1990 - 2005 - 2020 at Madaba city. Source: The researcher

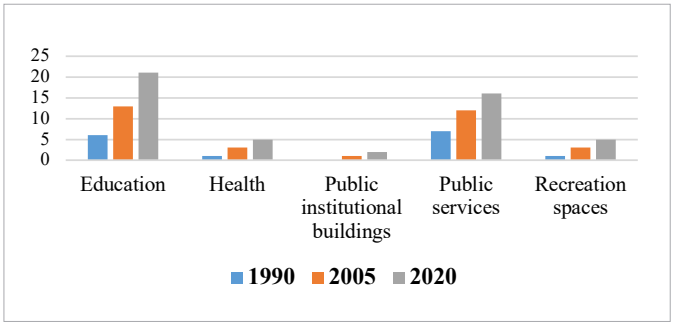


Fig. 30
The change in the number of services during three periods 1990 - 2005 - 2020 at zoom-in district. Source: The researcher

Conclusions and Recommendations

The study showed the presence of uses that changed significantly, such as increasing in residential, commercial and service uses can be continued at the city level. On the other hand, agricultural use declined during the periods 1990, 2005 and 2020 from 30.57% to 7.94% in Madaba city. It could be concluded that residential (45.96%-56.94%), commercial (8.39%-13.28%), service (11.89%-15.53%) and even industrial use (3.46%-6.32%) have risen at the expense of agricultural use (30.57%-7.49%). This was confirmed by investigating the zoom-in area surrounding the uni-

versity campus, which confirms the increase in residential use from 48.88% to 79.16%, commercial use increased from 3.03% to 9.56% and services use increased from 3.28% to 5.42% were at expense of agricultural use which decreased from 36.13% to 4.02%. On the other hand, it could be noted that the significant change in agricultural use, which was clearly affected by the increase in residential use was at its expense.

In addition, there was also an expected increase in the built-up area during the three periods (1990-2005-2020) where in 2020 the built environment constituted a third of the city's planned area. In this context, there was a gradual rise in the percentage of the built environment area surrounding the university campus (zoom-in area), where the percentage was the highest in 2020 with 8.30% and the lowest in 1990 with 3.30%. This was consistent with the population increases and demographic changes that the region is facing.

Moreover, the study pointed out the degree of encroachment of the built environment on the nature of land use. It was clear that the greatest infringement was on agricultural lands. Also, it is concluded that the expansion of the built environment in the area has an impact on land prices there. This was clear by the increasing land prices surrounding the university campus.

Additionally, the research confirmed the order of the percentage of land use from highest to lowest in the region (residential, commercial, services, agricultural and industrial). This allows knowing the categorization of the land uses surrounding the university campus and avoiding encroachment on each other.

As well as, the study identified the proximity of the main services to the built-up areas surrounding the university campus, represented in; (1) public services are the closest to the built-up areas; (2) educational services; (3) the public institutions; (4) healthy services; and (5) the recreational places. In this context, this research identified the impact of the distribution of services on the expansion of the built environment, where it was found that educational services had a significant impact on the expansion of the built areas. at the same time, this effect was not observed on the availability of recreational and health services as one of the variables that helped to expand the built areas towards them. Therefore, the presence of educational, public services and public institutions in the region was considered as one of the variables that helped direct the built environment and its expansion towards them, while the impact of the presence of services such as health and recreational services was less.

Finally, the study identified the ranking of determinants, which represented in; (1) Increasing the percentage of planned lands in the region; (2) Increasing the built environment in the area; (3) The rise in land prices; (4) Population increase in the area; (5) Land use change; (6) Increase public services in the area. Hence, this ranking represents the priority for implementing these determinants in the surrounding context of the university campuses, enhancing the effective implementation of these campuses at the edges of the city.

The study concluded with a series of multi-practical recommendations as follows:

1. Officials and developers should take into account preventing expanding all of its uses at the expense of agriculture through controlling the organization process of agricultural lands and preventing the granting of building licenses on them by activating the relevant laws and regulations.
2. The percentage of the built environment area surrounding the university campus in consistency should be controlled with the population increases and demographic changes that the region is facing.
3. Before creating the campus, decision-makers have to take into account that the change in population density and the built environment needs increasing in public and educational services strongly in comparison with other services.

4. Decision makers should consider the categorization of land uses surrounding the university campus before creating it (residential, commercial, services, agricultural and industrial) to avoid encroachment on each other.
5. Administrators and officers should take into account the degree of proximity of the main services to the built-up areas surrounding the university campus when selecting the university campus locations at the edges of the cities, represented in; (1) the public services should be the closest to the built-up areas; (2) educational services; (3) the public institutions; (4) healthy services; and (5) the recreational places.
6. The priority for implementing the determinants in the surrounding context of the university campuses should be taken through using the ranking of these determinants. (1) Increasing the percentage of planned lands in the region; (2) Increasing the built environment in the area; (3) The rise in land prices; (4) Population increase in the area; (5) Land use change; (6) Increase public services in the area.

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