

The Prefabricated Housing System And Its Impact On The Traditional Building System In Palestine (A special case in Hebron, Nablus, and Ramallah)

Wisam Shaded¹ Joan Aref²

¹Assistant professor. Palestine Polytechnic University, wisam_shaded@yahoo.com

²Instructor Master. Palestine Polytechnic University, arch.jaref@gmail.com

Abstract:

This study explores the implementation and impact of prefabricated housing systems on the traditional building practices in three distinct Palestinian cities: Hebron, Nablus, and Ramallah. As urbanization and population growth exert pressure on housing demands, the adoption of prefabricated construction methods has become a noticeable trend, potentially challenging the long-standing conventional building practices deeply rooted in Palestinian culture and history.

The research employs a mixed-methods approach, combining on-site observations, interviews with architects, engineers, and local residents, as well as an analysis of construction data and cost comparisons. The investigation focuses on understanding the drivers behind the adoption of prefabricated housing systems, assessing their architectural and cultural compatibility, and evaluating their economic and environmental implications.

Preliminary findings suggest a rising interest in prefabricated construction in the study areas, attributed to factors such as speed of construction, cost-effectiveness, and the ability to address housing shortages. However, challenges arise concerning the preservation of cultural identity, as traditional Palestinian architecture is deeply connected to historical and social narratives. The study aims to identify key areas of tension and synergy between traditional and prefabricated building systems, shedding light on the evolving architectural landscape in Palestine.

Furthermore, the research investigates the environmental impact of prefabricated construction compared to traditional methods, exploring issues such as energy

efficiency, material sourcing, and waste generation. This analysis contributes to the ongoing global discourse on sustainable building practices, particularly in regions facing unique socio-political challenges like Palestine.

The outcomes of this research aim to provide valuable insights for policymakers, urban planners, architects, and the local community. By understanding the dynamics between prefabricated and traditional building systems, stakeholders can make informed decisions that balance modernization and cultural preservation, ensuring a sustainable and resilient housing future for the Palestinian people.

1. Introduction

Prefabrication, commonly known as modular construction, off-site construction, or modern construction methods, is the process of manufacturing a structure or component in a factory under controlled conditions (Alonso-Zandari . 2016 p.348). The completed facility, which would normally have been built on-site, is then moved to the desired location. (Alonso p.348). So it includes the manufacturing and assembly of components offsite, before their final installation at a chosen location (Steinhardt 2016 p.126). Off-site, factory production of dwellings has the potential to lead to significant improvements in both the quality and speed of construction compared to traditional site-based construction. The technical benefits include increased production speed, reduced defects, and waste levels, greater production process efficiency, and improved environmental performance (Gorgolewski 2008 p.1). Prefabrication is a new issue in the areas of the Palestinian Authority, especially during the last ten years regarding residential construction. Prefabricated housing has recently appeared as a result of several reasons, including the increase in the value of the land, and the cost of construction, in addition to the lack of possibilities for the construction process. The need to search for new, cheap, and fast construction methods appeared to keep pace with the increasing demand for housing. Because of the lack of studies and research related to This type of construction method, the need to conduct a systematic, academic, and professional study on this subject, and it was necessary to conduct a study clarifying the details of this subject, especially in Palestine. In order to be more comprehensive, the study included case studies from different regions in Palestine, starting from Nablus in the north, to Hebron in the

south. In addition to the diversity of the manufacturing process of prefab and precast. Moreover, there are models that were manufactured locally and others that were imported from abroad.

There are several international Studies dealing with this topic. Among these studies that were adopted in this field is a study by Dale. A. Steinhardt and Karen Manley, in which the role of the country context in the adoption of prefabricated homes was studied and seven countries were selected, namely Australia, Japan, Sweden, Germany, the Netherlands, the United States, and the United Kingdom, and focused on collecting verifiable data to reveal the differences between the jurisdictions with high and low levels of pre-industrialization are presented as a set of four potential internal determinants arising from the context of a country's housing industry. based on a series of comparisons using verifiable data sources. These four key determinants of prefabrication uptake are annual dwelling completions—the industry's overall size and impact of significant variations in output, new housing versus renovations—the distinction between new builds and upgrades. housing ownership models—private versus state ownership and housing types—the distribution between detached and multi-residential buildings (Steinhardt & Manley 2016 .p.126-135). Previous studies such as “Prefabrication in the UK housing construction industry” have also found that prefabrication's most advantageous aspect is a reduction in potential site-based accidents and time improvements. The study included a questionnaire focused on discussing three main subjects; the level of awareness that practitioners have of prefabrication in the construction industry, the views and opinions on the application and practice of prefabrication in the construction industry, and the views and opinions regarding the future of prefabrication in the house construction industry. In addition to the analysis of three realistic case studies in the UK (Alonso-Zandari & Hashemi 2016. p.347-360). About improving sustainability Mark Gorgolewski studied the potential for prefabrication in UK housing and look at the various alternative ways that prefabricated building systems are beginning to have an impact on the way residential buildings are constructed in the UK and how is sustainability achieved through the use of prefabrication in housing and what are its benefits (Gorgolewski 2008. p.1-7).

Prefabrication may seem a new topic, especially since many countries have begun to apply it on a large scale, and others have used it in specialized fields, whether in building or construction works. But the beginning of the idea of a prefabrication house began with Le Corbusier who said, ‘It is necessary to press on towards the establishment of standards in order to face the problem of perfection.’ (Le Corbusier 1927 p.123–127; Gill p.219) And that through his book “Towards a new architecture” which was published in 1923. The dream of the factory-made house, which “became the dream house out of a catalog. The goal of developing higher and at the same time cheaper housing standards (technical, construction, and design) has given way in the prefab” (Gill p.220-221). it was a clear appearance of The Prefabricating House in 1941 under the name of “Packaged House System”, which is The General Panel System developed by Konrad Wachsmann in collaboration with Walter Gropius. And in 1942 - 1943. Wachsmann evolved a partition wall system for the prefabricated house which could be securely assembled without any mechanical connection (Gropius & Wachsmann 2021 p.1-41). Historically, this type of building appeared in Palestine through Zionist movement whose making plans for immigration to Palestine in the beginning of the twentieth century, when the agreement was made in 1933 with the manufacturer of precast housing, the Kupfer Haus Company, a number of advertisements were printed to encouraging the acquisition of ready housing so that the advertisement “traveled To Palestine and take your home with you”(Gropius & Konrad 2021 p.5), according to which the official approval, under currency controls, was granted by the Minister of Commerce on July 24 for the removal of homes by immigrants to Palestine, and the first landing of these homes coming from Germany to the port of Haifa was a fourteen large houses consist of two floors, and contains four apartments and was used for more than thirty years before it was dismantled and exploited the space for the purpose of expansion Larger (Gropius & Konrad. 2021. P 7-10) (Figure 1) shows the precast construction model.



Figure 1. Precast Construction Model in Palestine

Prefab VS Precast Modular Construction

The modular building or construction is segment or part of a building constructed off site, under controlled plant conditions, using the same materials, and designed to the same codes and standards as conventionally built facilities but in about half the time. Structurally, modular buildings are generally stronger than conventional construction because each module is engineered to independently withstand the rigors of transportation and craning onto foundations. Once together and sealed, the modules become one integrated wall, floor, and roof assembly (Mohammad 2016).

In this study, precast will be considered as a special case of prefabrication in which the design, manufacturing, and precast process takes place outside the building site or in the factory and then is transported to the site. Precast construction is defined as “a type of concrete that is mixed, cast, and cured off-site, usually at a factory using reusable molds. Precast concrete elements can be connected to create a complete structure. Wall panels, columns, beams, floors, pipes, stairwells, tunnels, and other structural components are commonly used. Many buildings today use a combination of these construction methods, with structural steelwork, in-situ concrete, and precast concrete parts being used in some cases. In terms of design, precast construction is limited. Due to the pre-determined nature of the molds, this procedure allows for a few changes. Precast items lack the size, shape, layout, and other aspects that can be adjusted in prefabricated projects. Making a component with precast construction takes longer. The parts are created in stages, with enough time for the mold to solidify completely. If the product dimensions differ from the

mold measurements, additional time will be required to get the mold to the required size” (Pressmach 2022).

The difference between the constructions in this research included the materials used and the construction processes involved in the construction installation process. In this research, the case studies in Hebron, Nablus, and Ramallah prefabricated houses were made from different materials such as thermal insulated, timber framing, aluminum, and glass or galvanized steel and sandwich panel. While the case study in Amman used precast concrete.

2. Problem statement

Currently, prefabrication houses are imported from abroad. Although the current number is not a large number, The problem is summed up in the current trend towards building a number of factories and importing materials for the manufacture of this type of non-traditional housing”, and with the continuous development and increasing demand for these types of housing, which need to study to reach an appropriate solution that preserves the cultural and aesthetic identity in Palestine without losing the originality of its heritage. This paper seeks to identify a number of points related to civilizational and cultural influences by answering the following questions:

- What are the reasons for the spread of the prefabricated residential buildings model in Palestine?
- Is the prefabricated building compatible with the local environment and the architectural structure in Palestine?
- What is the future of this type of housing in the cities of Palestine, and is it viable and developed?

The objective of the study is to seek to shed light on the phenomenon of modern prefabricated houses and their civilizational effects on the construction and cultural

structure in Palestine and make a preliminary analysis of its future and the possibility of replacing it with traditional buildings within an analytical and inductive study.

3. Methodology

This paper follows the descriptive and analytical scientific method through various means including conference papers, reports, journal articles, and books in order to carry out a detailed evaluation of the current content that is available. Primary data was also collected through the use of questionnaires. interviewing, observation, and using various photography tools, computer drawings, documentation, drawing architectural plans, and detailed drawings and studies by scanning and documenting the houses used as examples in this paper.

4. Comparative analysis of case studies

This section of the research presents case studies of prefabricated housing samples presented in a number of places in Palestine. it focuses on three areas in Palestine, representing the Palestinian north, the city of Nablus, the middle city of Ramallah, and the southern city of Hebron The reason for choosing these samples is similar to the following points:

First, these cities are considered one of the main and large cities in Palestine.

Secondly, there are old towns in these cities.

Thirdly, the construction methods and building systems adopted in these cities are traditionally based on stone.

The study cases were distinguished by the diversity of the materials used, including wood, aluminum, glass, and others from steel. Some of these samples were imported from abroad, while others were made locally. This diversity and difference created a set of options for the customer to choose what suits him according to his desires.

Case 1: models of prefabricated houses in Hebron city.




The following example is. Located in Hebron, Amjadhani architects and planning and Nasser Al-Juneidi & Sons Wood and Caramel Co, In this example, we find a number of companies that import materials and raw materials for prefabricated

homes and cooperate with engineering offices in the design, supervision, and implementation, and we find cooperation between the office of Engineer Amjad Dana and Al-Junaidi Company in the implementation of a number of residential projects in the city of Hebron, and according to the engineer Dana, the cost of this type of housing up to half the cost, with a speed of implementation of up to three weeks



Figure 2. Hebron example source 2022

Table 1

| Place and Company | construction | Interior design | image | plan |
|--|--|---|--|---|
| Hebron Amjadhan i architects and planning | Subtle finishes and materials are combined together to create an atmosphere of contextual sophistication with thermal insulated, timber framing, aluminum, and glass |  |  |  |

Case 2: models of prefabricated houses in Nablus



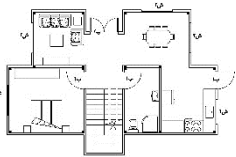
In this example, the materials were imported from a Chinese company Baofeng steel structure company, where a pre-design was done by an engineering office located in the city of Nablus, Iwan Alhandasah Office, and the manufacture of this housing was done abroad manufactured abroad in China by. and then shipped to the construction site. Before the installation and construction process, transactions had to be made to license the imported building. Figure 3



Figure 3. Inside the factory in China source https://www.baofengwarehouse.com/about-us_d1

The prefabricated house consists of two floors, the ground floor includes a kitchen, bath, dining, and living room, while the first floor contains four bedrooms and a bathroom. The total area of the project is equal to 115 m².

Table 2 example is for Iwan Alhandasah Office source author 2022

| Place and Company | construction | Interior design | image | plan |
|---|---|--|---|---|
| Nablus Iwan Alhandasah Office The country of manufacture is China | The main material used is high-strength galvanized steel and color steel composite board Wall and roof material from EPS sandwich panel |  |  |  |



The second example is taken from Al-Ilymun suburb” in the Al-Nassaria area in Nablus city, it is a complex of villas consisting of 16 housing units that are prefabricated and installed on the site. Each unit consists of a plot of approximately one dunum of land, every villa is about 75 square meters and contains two bedrooms, a kitchen, a bathroom, and a living room. The implementation process takes place in several steps, starting with the floor and ending with the final finishing work. Figure 4.



Figure 4. Steps to implement prefab houses source Diyarna Company

Construction methods details used. Firstly, the reinforced concrete slab is prepared within certain dimensions according to the scheme provided by the manufacturer. Secondly, the concrete facade system is a sandwich panel stuffed with an insulating material of polystyrene (foam), 2.5 meters high and 10 cm thick, and its width varies according to the design. Thirdly, the roofing system is 3 mm thick galvanized metal trusses that are installed at equal distances from each other after that steel pieces called omega are installed above the trusses and intersect with them. After all-steel truss processing is completed, treated metal boards are laid. Finally, external concrete slabs are painted with acrylic paint and can be painted with any other color on top of it, Internal doors and the main door are installed in addition to the windows and the inner face of the wall panels, underside of the plasterboard ceiling panels are painted with plastic paint. In addition to tiling, the process is carried out.

Table 3 example is for Al-Ilymun suburb source Diyarna Company 2022

| Place and Company | Construction | Image | Details |
|--|--|---|--|
| Al-Ilymun suburb/ Al-Nassaria area/ Nablus Diyarna Real Estate Development and Investment Company | Walls are from sandwich panels stuffed with an insulating material of polystyrene (foam) |  |  |



Case 3: models locally prefabricated house in Ramallah

This model is taken from Ramallah. This model is different from the previous one because the house was not designed and imported from abroad but rather was designed and implemented locally. It is made from a sandwich panel. and consists of 3 layers. The outer and inner layers of sheet iron and the insulation material between them with different thicknesses, using 4 cm thick. The insulation material is Polystyrene (compressed foam), insulating heat, cold, and a weak fireproofing degree. Figure 4.



Figure 5. Sandwich Panel source author 2022

Table 4 example is from Ramallah source author 2022

| Place and company | Construction | Image | Details |
|---|--|---|--|
| Al-Rihan suburb/ Ramallah The materials are from: Al Omari Company/ Al-Bireh/ Ramallah | The main material is from the sandwich panel |  |  |




Case 4: prefabricated housing model in Jordan, Amman

The following example is for Konn Company, which specializes in the manufacture of houses made of precast, off-site, insulated concrete components that are assembled on-site at any time and located in the city of Amman. In this example, we find that off-site construction is carried out within modular units in which the construction process and building parts are designed in units, manufactured in a controlled factory environment, and then transported and assembled on-site to form complete buildings. Unlike traditional construction where most components are manufactured on-site, offsite attempts to reduce on-site work and increase the work that can be done on transportable components, DfMA, and offsite construction offers numerous benefits including improved quality, faster design and construction time, reduced costs, increased efficiency, and productivity, lowers construction waste and pollution, and enables mass production and standardization. It also increases digitization which allows for data collection and iterative improvement.



Figure 6. Prefabricated house design is the example from theKonn source
<https://conf.konn.tech/>

Table . 5 examples is for Konn Company source author 2022

| Place and Company | construction | Interior design | image | plan |
|---|---|--|---|--|
| Amman/ Jordan Konn Company | Manufacturing is done inside the factory so that the main component of the building is processed cement with special additives for thermal insulation and other additives |  |  |  |

5. Analysis of case studies

This part of the study deals with a statistical study of questionnaires, To achieve the objectives of the study and to verify its hypotheses, the following statistical methods were used:

- 1-Frequency distribution of answers and percentages.
- 2-Graphs.
- 3- Alpha-Cronbach equation for calculating the coefficient of stability.
- 4-Test the Kai square to denote the differences between the answers.

5-AlosJI. The questionnaire consists of three parts, the first part contains information about the respondent, the second part consists of four questions and answers to them with approval or disagreement, and the third part consists of five multiple-answer questions. To obtain as accurate results as possible, the SPSS statistical program, which refers to the Statistical Package for Social Sciences, was used. Description of the resolution. The study samples were selected based on several criteria, including Academic qualification, The nature of the work to study and understand. The study sample included 100 people who answered the questionnaire. Around 63% were engineers and 28% were others. A large proportion of them is educated with 71% Bachelor of Engineering degree and 16% master's degree. (Figure 6) shows the first part of the questionnaire includes the profession and qualifications of the study sample.

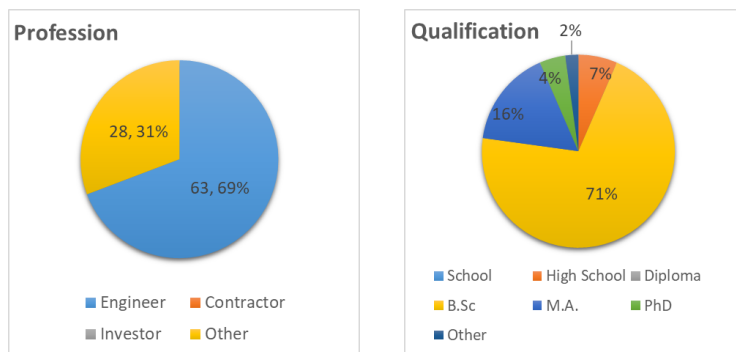


Figure 7. Profession and qualifications of the study sample. source author 2022

6. Survey Results

As a part of this paper, a questionnaire was distributed, focusing on the following questions:

- Do you see the prefabricated houses in Palestine spreading continuously?
- If you had the opportunity to own a house in the way of prefabricated houses, would you, do it?
- Do you think that this type of housing meets the citizen's need for a comfortable life?
- Does prefabricated housing achieve sustainability in Palestine?

- Is Prefabricated housing corresponds to the local environment?

In addition, it explained the reason for the spread of this type of housing, what prefabricated housing can be considered, the most important reasons that limit the spread of the prefabricated housing style, and things that increase the spread of the prefabricated housing pattern in Palestine and how prefabricated housing achieve sustainability.

- Frequency distribution of the answers for the study sample members to the first statement: Do you see the prefabricated houses in Palestine spreading continuously? It is clear from (Figure 7) that the answer for the majority of the study members is (agree), as their number reached (39) individuals and constituted (39%), followed by those whose answer is (disagree) with (30) individuals at a rate of (30%), while the number of those who answered (undecided) was (20) individuals at a rate of (20%).
- Frequency distribution of the answers of the study sample members to the second statement: If you had the opportunity to own a house in the way of prefabricated houses, would you, do it? The big majority answered (agree) it's equal (42%). In contrast, (strongly disagree) was equal (7%). And about (25%) for (undecided).
- Frequency distribution of the answers of the study sample members to the third statement: Do you think that this type of housing meets the citizen's need for a comfortable life? the largest rate in this sector was (51%) answered (agree). And the same as the previous question (strongly disagree) was the smallest rate equal (3%).
- Frequency distribution of the answers of the study sample members to the fourth statement: Does prefabricated housing achieve sustainability in Palestine? the bar chart shows a near amount of the rates which are (26%), (28%) and (32%) with the answers (disagree), (undecided), and (agree) respectively. While (strongly disagree) equal only (2%).
- Frequency distribution of the answers of the study sample members to the last statement: Is Prefabricated housing corresponds to the local environment? (agree) was the highest rate, it was equal (36%). The lowest rate was (3%) for (strongly

agree), while (disagree) was (24%) and (undecided) equal (31%) of the whole answers.

In general for the five previous questions a large range was answered (agree) but in different proportions. And a minor majority answered (strongly disagree) as shown in figure 8.

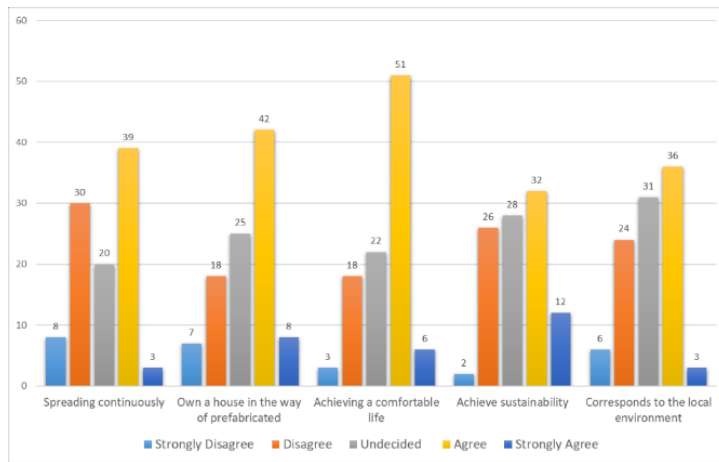


Figure 8. A Likert scale for different questions about prefabricated house in Palestinesource. source author 2022

-the third part consists of five multiple-choice answer questions

1- The questionnaire asked the study sample about the reason for the spread of the prefabricated house in Palestine. As shown in (Figure 8) (69%) answered that the speed of its build and low cost were the reasons for spreading this type of house in Palestine because it provides time and money. Then around the square answered only the speed of its build, and about (1%) answered only low cost. Figure 10 illustrates the answers to the question:

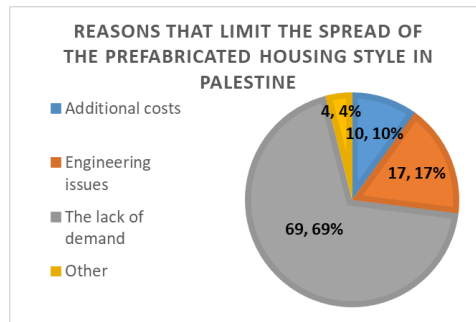


Figure 9. The most important reasons limit the spread of the prefabricated housing style in Palestine. source author 2022

2- What prefabricated housing can be considered, The option is a strong alternative to the traditional housing rate of around (21%). While (26%) was for the option of a poor alternative to traditional housing. These two answerers considered nearly similar rates. The higher ratio was around (44%) for the option of the prefabricated house cannot be a substitute instead of the traditional house.

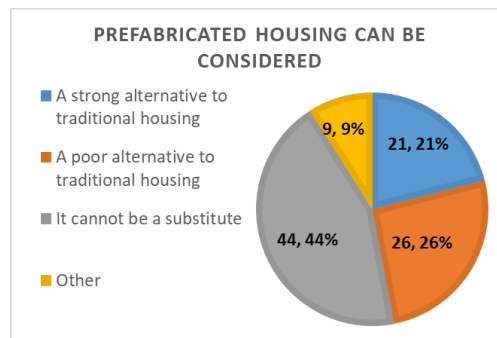


Figure 10. What Prefabricated housing can be considered. source author 2022

3- The most important reasons that limit the spread of the prefabricated house style? large majority was around (70%) for Lack of demand. And the minor ratio equal (4%) answered other. The two other answers were engineering issues and additional costs.

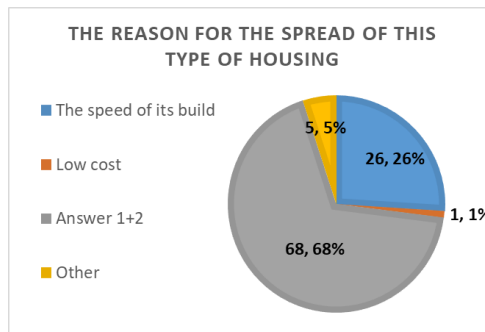


Figure 11. The reasons for spreading the type of prefabricated house in Palestine.
source author 2022

4- increases the spread of the prefabricated house pattern in Palestine. The pie chart in figure 12 decided that The ratio answers respectively were For option 1: knowledge (33%), For option 2 Ease to import from abroad(6%), option 3 increasing demand in the market(18%), and For option 4 knowing the advantages of the building(43%).

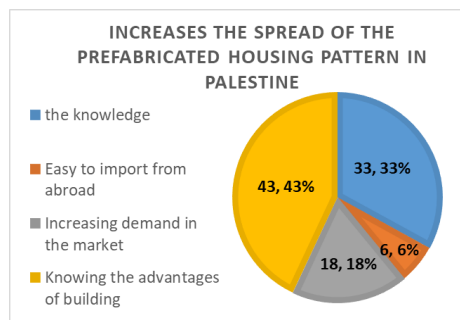


Figure 12. Increases the spread of the prefabricated housing pattern in Palestine.
source author 2022

5- Through what prefabricated housing achieves sustainability? The pie chart is in figure 12. decided that most of the study samples answered (1+2+3), which was equal to above (62%), which means that all the options presented achieve sustainability, and these options were as follows:

- Reducing the impacts on the surrounding environment (the area around the site is idle for a shorter period) and reducing construction waste.

- Social benefits from improving working conditions and increasing safety and public safety at the site.
- Transportation and shipping process (reducing the number of deliveries to the site compared to traditional construction methods).

The rest of the answers are as follows. For option 1 (21%), option 2 (10%), and option 3 (7%).

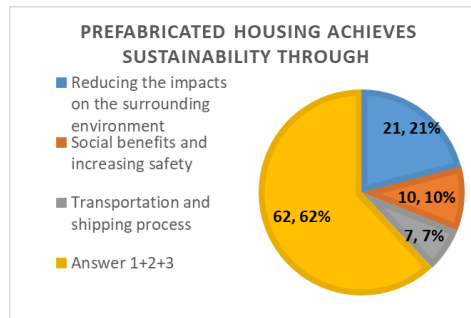


Figure 13. How prefabricated housing achieves sustainability. source author 2022

7. Discussion

The results of the questionnaire identified key issues that need to be highlighted before prefabrication can be established as a common form of construction in Palestine. According to the results, The future of offsite construction is dependent on many factors, not least of which is a better understanding of the construction process and its associated costs. The acquisition of prefabricated houses represents a qualitative leap for traditional housing in Palestine, Prefabricated houses are bound to be an option and a suitable solution at some point in life in our country, but there is a need for awareness to use them and improve their conditions to suit the local architecture. On the other hand, the idea of prefabricated housing is not very widespread in Palestine and may be due to the lack of need significantly in the absence of high population density, and the nature of Palestinian society, which depends on traditional construction methods, which represents stability and other reasons that may relate to import, its costs and the restrictions of occupation. It is necessary to re-study the pre-buildings and prepare them in accordance with the requirements of society and their customs. From the moral and fundamental point of

view, the idea of prefabricated housing should be realistic with the idea of occupation and settlement and what it entails as a Palestinian reality that cannot be ignored. From the engineering point of view prefabricated housing, has many positives for the environment, including the speed of completion, cost, and so on. It can be developed and promote sustainable and green building ideas in design as well as artificial intelligence. The participation of government agencies concerned with technical, environmental, safety, and other specifications and standards that suit Palestine. in our societies it is difficult to consider such type of housing as alternative housing to traditional housing, in addition to that it needs areas of land for everyone to own his own dwelling, in return for what is customary here the most buildings and tall buildings that accommodate the population increase taking place, and it is possible to use such housing as places of entertainment or in tourist resorts and others. it meets the requirements of people and their desire to own a house of age, as well as the importance of the low price of the cost of construction. these houses fit in our country because of our lifestyle that doesn't suit the way we live in these houses. The awareness of community members about this type of construction must be increased. and Most of the buildings in this system, as far as I've seen, weren't at high heights, two or three floors, mostly it can be a good alternative to a country house or a summer resort. The increasing demand for prefabricated housing depends mainly on the social acceptance of this type of housing, especially since the members of our Palestinian society prefer traditional things and things that are familiar with seeing their acquaintances adopt in their homes in general, Prefabricated housing may be environmentally sustainable but may fail socially at the level of meeting the needs of different individuals in the different conditions governed by the location and location of the dwelling it is necessary to introduce the prefabricated housing in Palestine and where it comes from, in addition to clarifying the period of time in which it spread This type of construction remains suitable for construction workshops and chalets as a temporary place and not for housing. the availability of integrated design models that contain all the integrated systems that would provide

human comforts such as smart systems in home management. This actual experience if it is a successful experience will ensure the spread of this style.

8. Recommendations:

Because it's a new technology in our society, it is necessary to educate people about the negatives and positives.

The positive and negative impact that the use of this modern technology may have on the cultural and aesthetic structure of the local buildings, etc., in terms of the impact on the cultural identity in Palestine

And It is necessary to introduce people to the ready-made structure of the building and its advantages through publications or brochures,

9. Acknowledgements

In conclusion, a heartfelt thanks to all those who helped us complete this study, including the companies spread in Palestine and abroad, including Diyarkom Company, Al-Junaidi Company, Iwan Alhandasah Office, Konn Company. Engineer Amjad Dana's office. Engineer. Moaz Al-Sayed Ahmed. Building technology and engineering solutions company - modern building systems.

10. References

- Alonso-Zandari, S., & Hashemi, A. (2017). *Prefabrication in the UK housing construction industry*. In 5th International Conference on Zero Energy Mass Customized Housing-ZEMCH 2016 (pp. 347-360). ZEMCH Network.
- Azman, M.N.A., Ahamad, M.S.S. & Hussin, W.M.A.W. (2012). *Comparative study on prefabrication construction process*. International surveying research journal, 2 (1), 45-58.
- Bertram, N., Fuchs, S., Mischke, J., Palter, R., Strube, G., & Woetzel, J. (2019). *Modular construction: From projects to products*. McKinsey & Company: Capital Projects & Infrastructure, 1-34.
- Gill, J. Dream House Factories. *What happened to the dream of the factory-*

made house?. 218-228.

- Gropius, W., & Wachsmann, K. (2021). **5. *The Palestine Prefabs: A Case Study***. In *The Dream of the Factory-Made House*. PubPub.
- Gropius, W., & Wachsmann, K. (2021). **9. *The General Panel Corporation***. In *The Dream of the Factory-Made House*. PubPub.
- Gorgolewski, M. T. (2008). **12 *The potential for prefabrication in UK housing to improve sustainability***. *Smart and sustainable built environments*, 121.
- Goodier, C., & Gibb, A. (2007). ***Future opportunities for offsite in the UK***. *Construction Management and Economics*, 25(6), 585-595.
- Herbert, G. (1984), ***The dream of the factory-made house***. Walter Gropius and Konrad Wichmann (Cambridge: MIT Press).
- Le Corbusier (1927), ***Towards a new architecture*** (London: The Architectural Press).
- Lopez, D., & Froese, T. M. (2016). ***Analysis of costs and benefits of panelized and modular prefabricated homes***. *Procedia Engineering*, 145, 1291-1297.
- Mohammad, M. F., Baharin, A. S., Musa, M. F., & Yusof, M. R. (2016). ***The potential application of IBS modular system in the construction of housing scheme in Malaysia***. *Procedia-Social and Behavioral Sciences*, 222, 75-82.
- Pressmach (2022), [What Is The Difference Between Precast And Prefabricated Buildings? \(pressmach.com\)](https://pressmach.com)
- Ross, K., Cartwright, P. & Novakovic, O. (2006). ***A guide to modern methods of construction***. Amersham: IHS BRE Press.
- Steinhardt, D. A., & Manley, K. (2016). ***Adoption of prefabricated housing—the role of country context***. *Sustainable cities and society*, 22, 126-135.

Internet

- Baofeng steel structure company.
- https://www.baofengwarehouse.com/about-us_d1
- Konn Company. <https://conf.konn.tech>

Interview

- Architect Amjad Dana June 2022 Engineer and construction contractor for prefabricated homes in Hebron.
- Architect Iyad Bakeer June 2022 Director of Iwan Alhandasah Office in Nablus.
- Civil Engineer Arafat Booziea June 2022 Project Manager of Al-Rihan suburb project in Ramallah.
- Architect Amjad Dana June 2022 Engineer and construction contractor for prefabricated homes in Hebron.
- Civil Engineer Arafat Booziea June 2022 Project Manager of Al-Rihan suburb project in Ramallah.
- Engineer. Moaz Al-Sayed Ahmed. Building technology and engineering solutions company - modern building systems