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Market Regeneration in Line with Sustainable Urban Development

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Abstract: This article presents the study of the optimal design solutions for regeneration of marketplaces. It examines the design variants for the revitalisation of the marketplace, in particular, investment in their modernisation in order to find the most optimal model for transforming these public spaces to have a significant impact on the city's development. The research is a comparative analysis of the implementation of regeneration design models on the marketplace within the Oliwa district of Gdansk (Poland).The data for the case study design models includes analysis based on various optimisation criteria, taking into account the urban and economic aspects of the city landscape when selecting a specific space revitalisation design model. The implementation of regeneration investment includes a number of complex processes that must be sustainable and so require rational social and spatial planning, as well as proper organisation in terms of cost and time.

Keywords: economic analysis; marketplace regeneration; optimisation; space syntax; spatial analysis; urban design

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1. Introduction

Public markets are vital elements of public space in modern cities. They are some of the most truly unique and city-defining elements of the landscape of a city.

All over the world, marketplaces have and still do play an important role because of various historical, cultural and social issues.

As authors have mentioned [1–7], in many parts of the world, those marketplaces are still vivid spots and key connecting points in the city space (e.g., Beşiktaş Fish Market in Istanbul, New Market Pazarii Ri in Tirana, New Market in Stazione, Termini in Rome).

In Europe, there is a visible change in the understanding of the role of the market in the contemporary city, as well as important changes in what constitutes market communities. Markets are no longer just places of trade, but also cultural spaces. Undoubtedly, public markets play an important role in the socio-economic structure of modern cities [8,9]. In addition, cities, their districts and different public spaces including public and local markets, like other market brands, carry cultural meaning, cache and recognisable symbols of a given city or neighbourhood. Furthermore, markets also play an economic role in defining the city's or neighbourhood's identity whilst being its recognisable symbol [10].

In Poland, the existence of traditional markets has been an integral part of the lives of urban communities, but their role is seen only as a space of trade, often used only for two days of the week [11,12]. At the same time, there is a growing demand for local centres in every neighbourhood, and a lack of meeting places for residents. Transforming existing markets into vital public space, therefore, can also be important for the local community. The transformed marketplace can create a space for multiple purposes: place for trade, meeting place, cultural venues and restaurant zones.

This case study focuses on the case of the Oliwa Marketplace in Gdansk. It is a pilot regeneration, which will serve as an example of market regeneration strategy in Poland. It constitutes a prototype for future research to be used in other locations.

It is part of a research and implementation program carried out by a research team consisting of three units represented successively by: the City Initiative Association (Stowarzyszenie Inicjatywa Miasto)—Project Leader, the Faculty of Architecture of the Gdańsk University of Technology and the Academy of Fine Arts in Gdańsk.

The results of the study will form a comprehensive strategy for the transformation of market areas in Poland.

The purpose of the present study is to find the most optimal model for transforming these public spaces. This article discusses optimisation whilst choosing a final design solution which is part of the market regeneration plan, using different variants/models of spatial design for the case study. The "Polanki" Marketplace (Targowisko "Polanki") case study, located in the Gdańsk-Oliwa district, Poland, is closely related to the ongoing research project concerning the regeneration of urban markets [13] (pp. 71–78). The study's main challenge was to search for the micro scale optimal design/solution proposal and that is why the site of the marketplace has been taken into consideration and tested. For the purposes of our study, we specifically focused on the process of the most effective use of the square—hence, the deliberate delimitation of the area.

Firstly, the article considers optimisation issues: optimisation in general and optimisation in the specific context of spatial and social costs and time factors of implementation.

Secondly, it describes the overall goal of the project, conducted within the framework of the GOSPOSTRATEG program financed by the National Centre for Research and Development in Poland, and the purpose of the research [14,15].

Thirdly, it focuses on a particular case study—the pilot implementation plans for the Oliwa Marketplace—with the aim of defining the regeneration processes of this marketplace, and optimising the criteria adopted throughout the study.

Finally, it discusses the analysis of the case study design models, leading to a final conclusion defining the spatial and economic boundaries of the optimal design model and its recommendations for implementation.

The proposed models are the result of 2 years of analysis and research conducted at the marketplace [15]. Project designs were preceded by several detailed studies and additional workshops with market space users (buyers and sellers).

The purpose of optimisation is to arrive at the best possible solution (selected from a specific set) on the basis of adopted criteria, which are expressed using mathematical algorithms, i.e., objective functions. At the point of result and decision making, multi-criteria optimisation brings much better results, and so the authors chose that model in the research. Multi-criteria decision problems can be classified into the following groups:

Multiple-purpose decision problems wherevalues do not have a predetermined number of options with problem-specific feature values.

The problem of multi-attribute decisions, for which there are a limited number of decision options and models [16–18].

In the research, we use optimisation in the context of spatial and social implementation factors and in the context of cost and time implementation factor issues. The models subjected to a detailed analysis presented in the article are the result of deeper studies, representative examples of extensive design analyses carried out during the grant implementation, which was preceded by separate studies (i.e., workshops with the market space users) on demography and neighbouring objects.

The purpose of this paper is to choose the most optimised version for market distortions using the three above-mentioned criteria.

2. Stages of the Optimisation Process

2.1. Spatial

Space syntax is a method [19,20] commonly used to show the relationship between the topological dependencies of space in cities and the presence of people in these spaces. The most important factor influencing the analysis of space is still its configuration, i.e., the relationships taking place within it. The theory suggests that the way elements of space are stacked together does in fact influence the behaviour of its users [21]. It is usually used as a tool to show the relationship between the syntax of different spaces in cities and their usage [22–25]. This method overlaps with observations made in space and is based on intuitive exploration. As has been proven in many previous studies (see, e.g., https://spacesyntax.com/project/trafalgar-square/ accessed on 26 June 2021), the mathematical method of space syntax coincides with observations made in space. For this reason, it was decided to use this method as representative.

In our case, we needed to evaluate the spatial configuration options for changing the functions of the existing market.

The goal of the study was to choose the best spatial option that would fulfil a number of criteria: it should be convenient for stall holder trading, it would best integrate the entire quarter (in which the district town hall stands) and through which we would create a connection with the market hall standing in the square. Due to the fact that the space syntax method has fractal features, the entire market space was divided into smaller spaces (like in a city) and analysed on the basis of the longest axial lines situated inside of each space.

2.2. Economy (Cost and Time)

In practice, the essential elements of optimisation and, at the same time, project management investment are as follows: the budget for the implementation of a given project, the resources assigned to it and its implementation time. Very often, the search for the optimal solution comes down to taking into account two criteria: minimising costs and the time of project implementation. It should also be emphasised that the shortest completion time of a construction investment is not usually the same as the lowest cost. In the curve of total costs (kc) (Figure 1), one can surmise, inter alia, two important factors from the point of view of optimisation [26].

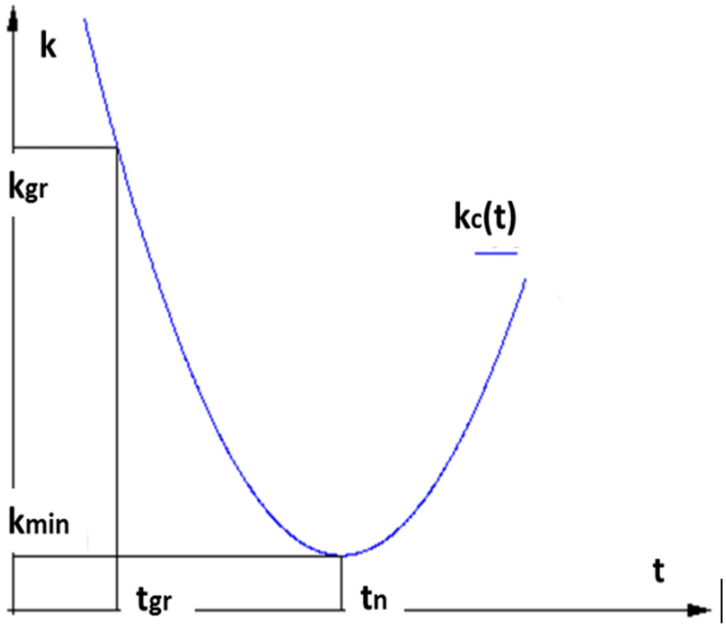

Figure 1. Dependence of project cost over time of implementation (after Fridgeirsson and Rosłon, 2017 [26]).

tn represents the normal time of project implementation, which corresponds to the lowest cost of its implementation (kmin),

tgr represents the limit time, i.e., the shortest possible time for implementation of the project, which corresponds to the limit cost (kgr).

Appropriate analysis of various variants of related projects as well as the corresponding costs and execution times makes it possible to determine the total cost curve. When we exceed the time for normal project implementation, we observe an increase in investment cost. This gives a clear sign to the investor that the optimal solution he or she is looking for is within the range between normal and cut-off time. The choice of the best solution depends in this case on the investor's preference [27].

It should also be noted that the optimisation of practical projects in the field of architecture and construction is complex, which means that the time needed to solve investment problems grows exponentially with the size of the investment [28–30]. There are also numerous scope limitations using optimisation methods, including heuristic and accurate ones, to find the optimal solution. [26].

One of the basic optimisation problems is scheduling tasks. The cause of this problem is the interdisciplinary nature of architectural and construction investment projects and their high specificity [31–34]. One of the tools that can be used to solve problems in the field of construction, architecture and scheduling is costs criteria [35–38] or multi-criteria analysis framework and optimisation [39,40]. These algorithms ensure that the best possible solution is found, but at the same time, it should be noted that the results obtained by applying any optimisation methods are strictly dependent on the input parameters used. The above standards must be considered at the stage of infrastructure design, but also maintained throughout the period of its operation and take into account the problems of effective financial spending [41–44]. In the analysed example, the authors focused mostly on space syntax, the criterion of time and cost of implementation depending on various development variants.

It is critically important also to remember that research design was aimed specifically at a micro study of a very specific area in the city. The aim of the study was dictated by the regulations related to the research grant under which the regeneration of the market square was carried out. In essence, the research grant provided the scope but also the limitations to our study that we had to keep in mind. In the above-mentioned GOSPOSTRATEG research grant for the square case study, the issues deemed to be most crucial were specifically defined as economic, spatial and social issues. One of the key guidelines was then the finances and duration of the project, and those considerations had to play a central role. Such a framework was necessary to implement the changes, hence, the decision that it would constitute one of the key guidelines during the optimisation process.

3. Purpose of Research: Case Study Description

Marketplaces, i.e., separate areas or buildings (square, street, market hall) with permanent or seasonal retail outlets or devices, are intended for trade and play an important role. They have a significant impact on the quality of life in cities. What also matters is their attractiveness in the eyes of the inhabitants. The key issue of marketplace management is at the heart of issues related to sustainable development—it combines economic, environmental and social issues. All this has been underlined in the research of the Gospostrateg project.

The aim of this research is to analyse the variants of pilot projects for the modernisation and regeneration of the Oliwa Market [14].

In particular, the initial marketplace designs and the programme for their implementation: type, scope and method of construction works were analysed in order to select the most sustainable development investment, three models for implementation were selected.

The article presents these three selected model-variants for which detailed design solutions were proposed. During the studies in the earliest stages of this project, there were more than only three model designs, but those presented in the article have been elaborated in detail as the most representative ones.

It is assumed that the results of the analysis are to identify a solution that takes into account the spatial modifications (to redesign the space) of the market and the implementation of the spatial concept. Essentially, this would ensure the functionality of a given layout and increase the number of buyers and sellers, as well as stress the importance of this location on the city map as an important public and city-forming space.

In order to indicate the optimal solution, quantitative data (cost and time of implementation of activities for each of the three selected models) and qualitative data (determined based on space syntax expertise) are analysed. This complex analysis will arrive at a rational and effective solution for the urban layout of the public space. It takes into account numerous varied criteria such as economic, technical, functional, environmental and social aspects.

To this end, the site of the Oliwa Market required regeneration and changes to its spatial organisation. Specifically, it was necessary to arrange the space by replacing the surfacing to designate zoning, that is, marking the places for trade in the "drawing" through floor surfaces. The aim of the work was to obtain an orderly space for trade on trading days when the market was filled with farmers and artisans selling their goods.

The condition of the Oliwa Market in 2018 required immediate intervention. Besides socio-economic problems, this space was neglected in terms of infrastructure and space quality as well as aesthetics. On market days (Wednesdays and Saturdays), the number of users was constantly declining. Outside of market days, the area was used as an illegal parking lot. It was an example of public space in Gdańsk, which, like many others in Poland, had lost its importance, was slowly degrading and was vulnerable to the prospect of transforming the area into another function altogether. The place, despite its past, undoubtedly constituted one of the most important elements for building the identity of the district, but was no longer an interesting local district centre.

The social factor (such as age and occupation of the space users of the market places) was also the subject of studies before the design process was undertaken. Based on that work, a number of conclusions were arrived at. It has been proved that approximately 25–30% of buyers at city marketplaces are people of retirement age. At some marketplaces, already more than half of the sellers are people of retirement age. At the same time, there are not many new, young sellers. If the current trends remain unchanged, the percentage of people in 2030 will be as high as 60. A disrupted generational change, resulting from the lack of interest in running trade fairs by young people, may lead to a demographic collapse in the next few years. Currently, this is the greatest threat facing trade in marketplaces. Marketplace monitoring data which was conducted during the whole process of transformation of the elaborated public place clearly shows this observation [45–49]. Monitoring data constitutes also the preliminary design guidelines for the design models.

The case concerns a specific place study (covering a marketplace site which has been a subject of the implementation pilot design conducted and financed under the research grant) constituting a prototype which, in the future, can potentially be used in other locations.

The wider context of the research has been underlined and expanded in the introduction, where the explanation of the particular site has been elaborated. However, the study searches for the micro scale optimal design proposal (preceded already by extensive demographic research and numerous partial design studies), that is why the site of the marketplace and the final three models have been taken into consideration and tested.

4. Projects Stage Model Description

Suggestions for solving the current problem within the research mainly involved developing a comprehensive operational strategy for socio-economic activation, enriching the cultural offer and transforming the programme concept. In addition, the project proposed improving the aesthetics of degraded exhibition areas and providing redevelopment models. Those model variants serve as the basis of the research. The subject of the analysis is a variation of a three-stage task:

Stage I: consecutive demolition of the existing surfaces and the removal of the barracks, pavilions and kiosks in the marketplace;

Stage II: construction of new surfaces for the shopping square;

Stage III: construction of small architecture elements, including waste and storage shelters together with another similar structure.

Three design variants were developed and then analysed.

4.1. Description of the Designed Condition—Option 1/Model 1

The design assumption in Model 1 was:

Trade is to take place in planned sales points within 3 × 3 m squares designated by surfacing divisions, where, for the duration of the market trading, tents will be set up. There are planned 80 cm spacing breaks in the layout of sales points due to the restrictions introduced during the COVID-19 pandemic. Many of the retail outlets allow for the possibility of direct sales from cars. On other days, the square space will be used as a culture-forming place—an active public space intended for various events within the business plan of the market operator(Figure 2).

Figure 2. Oliwa Marketplace site plan. Proposed development of the square—option 1/Model 1, drawing by the authors.

In this option on fair days, there will be a number of cars parked in the square. A similar system has been operating in the market for the past 30 years. Whilst it is more convenient for sellers, the aesthetic level and comfort for buyers is very low. There is no space for additional greenery because of the space needed for cars to manoeuvre and park. The complex scope of construction works for the first option includes, respectively: demolition works, earthworks, surface works and elements of small architecture. As part of the surface works, it is planned to build a square with a granite paved surface area of 1060 m^2 and create 35 m^2 of landscaped areas. As part of the small architecture works, the plan proposes the creation of a small wooden shed.

4.2. Description of the Designed Condition—Option 2/Model 2

The design assumption in Model 2 was:

Trade is to take place in the planned sales points within 3 × 3 m squares designated by surfacing divisions and only for the duration of trading will tents be set up. There are planned 80 cm spacing breaks in the layout of sales points due to the restrictions introduced during the COVID-19 pandemic. Some of the retail outlets assume direct sales from cars. On other days, the square space will be used as a culture-forming place—an active public space intended for various events within the business plan of the market operator (Figure 3).

Figure 3. Oliwa Marketplace site plan. Proposed development of the square—option 2/Model 2, drawing by the authors.

The commercial square will be separated by a system of plant pots with vegetation, as shown on the land development plan, between these, steel ropes with fasteners will be stretched to delineate utility separation. A waste and storage shed will be located in the northeast corner of the plot at Schopenhauer Street. There are at least two parallel internal pavements proposed in the fair space that will assure safe circulation of pedestrians on the plot. Only ten trade places are provided for cars. The other two parking places are for supply vans for the trade hall. There is also a place for parking food trucks in the north of the market. Thus, in addition to trade, a small gastronomic zone in the area is also possible.

The complex scope of construction works for the second option includes, respectively: demolition works, earthworks, surface works and elements of small architecture. As part of the surface works, it is planned to build a square with a granite paved surface with an area of 846 m^2, recreate the nearby pavement on the right with an area of 44 m^2, build a gravel surface path with an area of 190 m^2 and create 35 m^2 of landscaped areas and 10 m^2 of rain gardens. As part of the works related to small architecture, the plan is to include the following structures: a wooden shed, 21 sales boxes, a wooden platform, 11 decorative pots and 4 wooden benches.

4.3. Description of the Designed Condition—Option 3/Model 3

The design assumption in Model 3 was:

The market trade and sales activities are to take place in planned 3 × 3 m sales points designated by surfacing divisions, and only for the duration of trading will tents be set up. There are planned 80 cm spacing breaks in the layout of sales points due to the restrictions introduced during the COVID-19 pandemic. None of the retail outlets assume direct sales from cars. Cars are completely excluded from the area. On other days, the square space will be used as a culture-forming place—an active public space intended for various events within the business plan of the market operator(Figure 4).

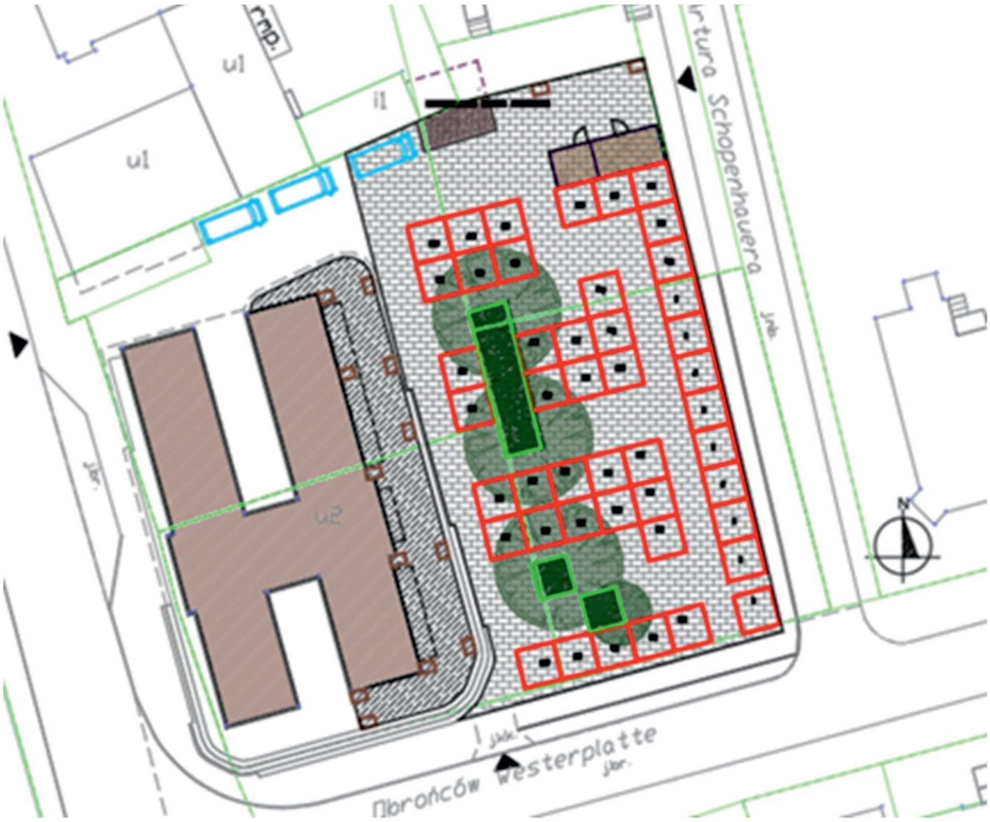

Figure 4. Oliwa Marketplace site plan. Proposed development of the square—option3/ Model 3, drawing by the authors.

The commercial square will be separated by a system of plant pots with vegetation, marked on the land development plan, between these, steel ropes with fasteners will be stretched to delineate utility separation. A waste and storage shed will be located in the northeast corner of the plot. Several internal pavements which assure safe circulation of pedestriansare proposed in the market space.

The complex scope of construction works for the third option includes, respectively: demolition works, earthworks, surface works and elements of small architecture. As part of the surface works, the plan is to build a square with a granite paved surface with an area of 1035 m^2, construct a path with a gravel surface with an area of 180 m^2 and create 60 m^2 of landscaped areas. As part of the works related to small architecture, it is planned to construct: a wooden shed, 45 sales boxes, a wooden platform, 14 decorative pots and 6 wooden benches.

5. Criteria Adopted for Optimisation, Selection of the Optimal Variant

5.1. Social, Spatial (Environmental, Security and Functional) Criteria

Each of the three spatial development design proposals were transformed into a model (a fictive urban system), which was then converted into an axial map and tested via spatial analysis. The model treats closed buildings, green spaces and stall spaces as inaccessible. All open spaces, stairs and passages through buildings were treated as convex spaces. In the end, the parameters of Connectivity, Global Choice and Global Spatial Integration were illustrated (Figures 5–7).

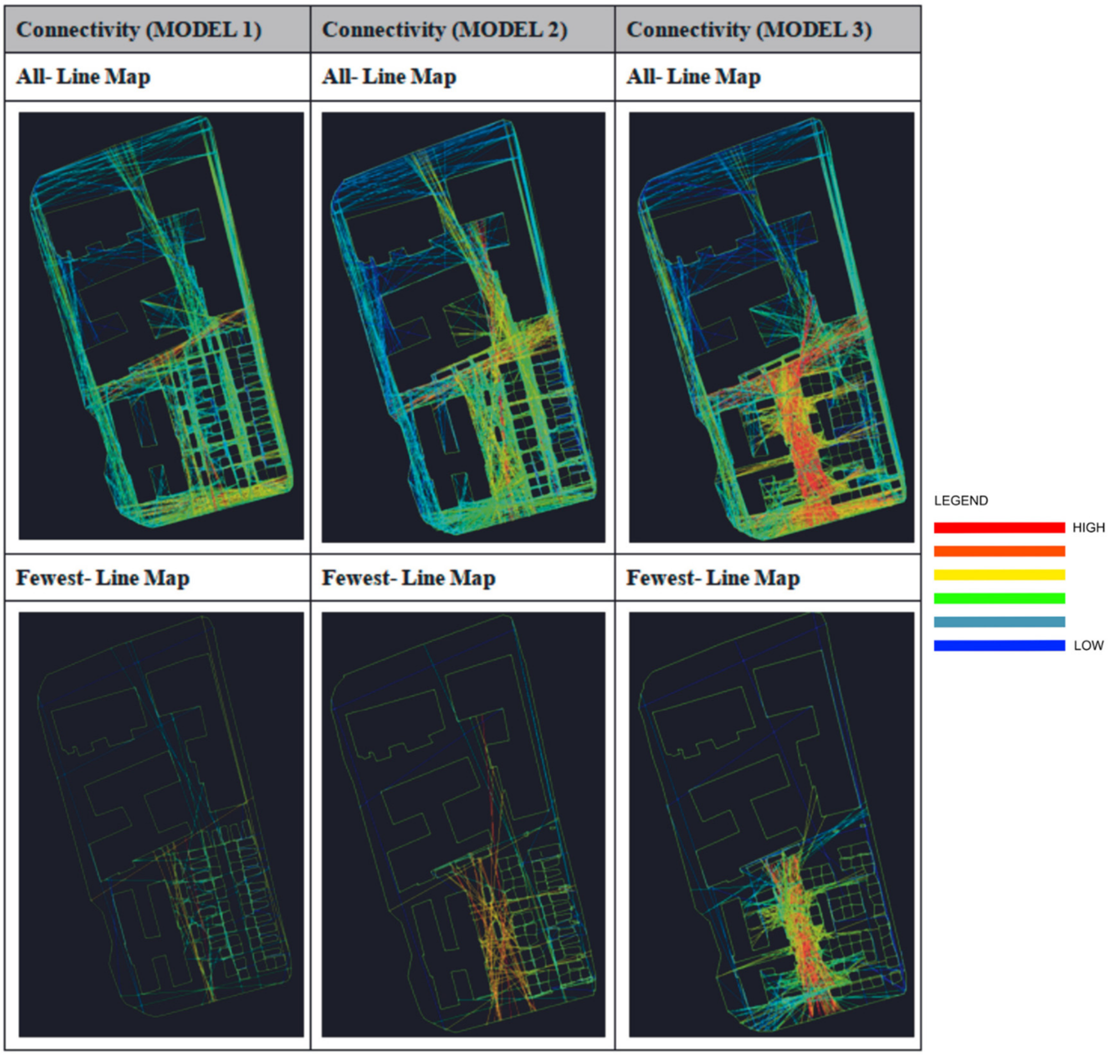

Figure 5. Oliwa Marketplace space syntax analysis. Connectivity parameter; comparative statement for three model designs, drawing by the authors.

These three parameters are the basic parameters that describe the relationship between the spaces.

Connectivity measures the number of spaces immediately connecting a space of origin [19] (p. 103). Conventional measures of place network connectivity capture only the metric characteristics of streets related to physical connectivity without considering the geometric characteristics related to visual connectivity. Our bodies interact with the built environment through a system of metric distances while our minds interact with the built environment through a system of visual distances [21,37].

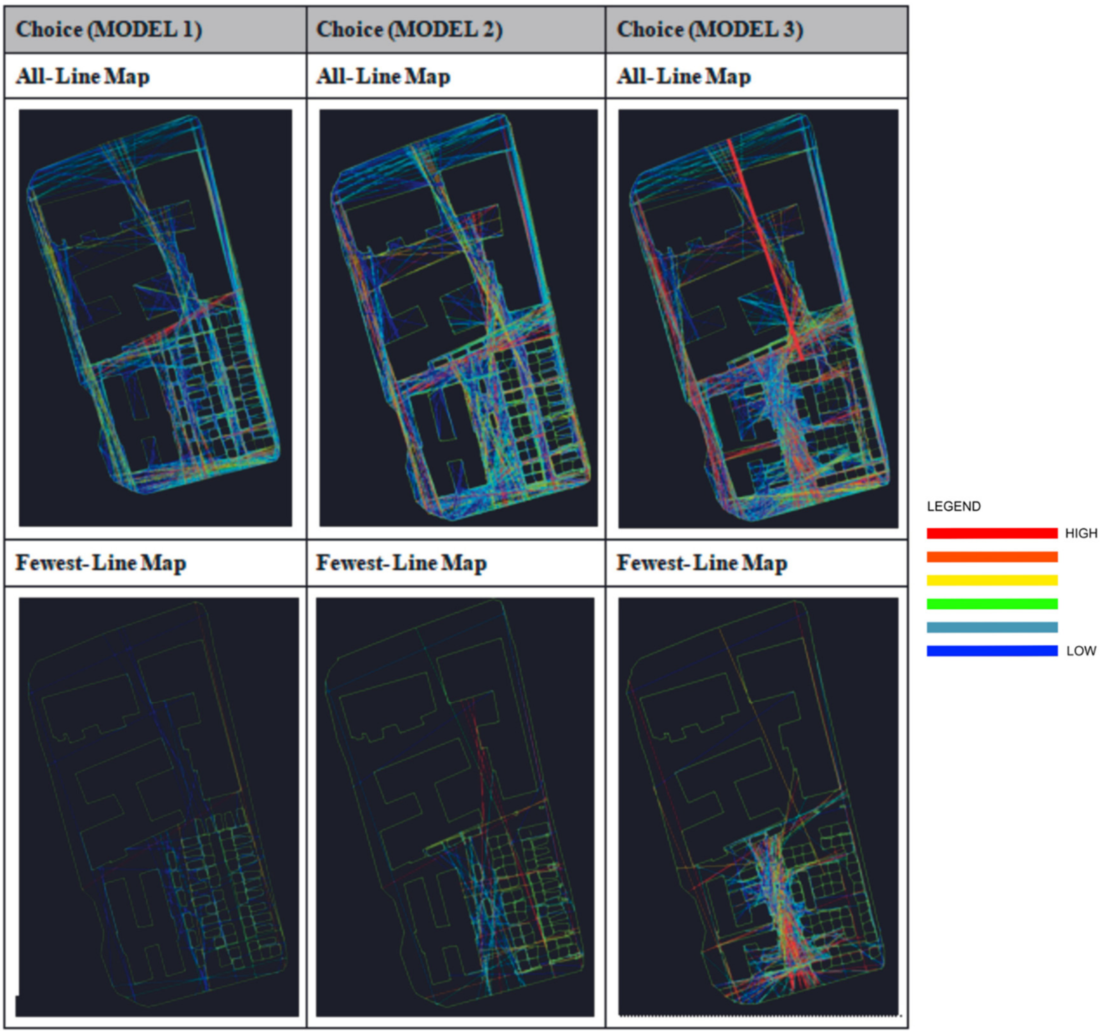

Figure 6. Oliwa Marketplace space syntax analysis. Choice parameter; comparative statement for three model designs, drawing by the authors.

The parameter of Choice, as Hillier et al. say: "measures how likely an axial line or a street segment is passed through using the shortest routes from all spaces to every other spaces in the entire system or within a predetermined distance (radius) from each segment" [50] (p. 237). The parameter of Integration is a parameter normalised by measurement of distance from a space of origin to all others in a given system under study. In general, it calculates how close the origin space is to all other spaces and can be seen as the measurement of relative asymmetry (or relative depth) [19] (pp. 108–109).

The parameter of Integration measures the potential for meetings in a space for social exchanges [20]. The potential of meetings is determined by the presence of people within the space. The concept of Integration is sometimes used interchangeably with the concept of accessibility [51]. The algorithm used calculates the shortest distance—expressed in a topological way—between individual points on the map.

Summarising, the parameter of Connectivity shows how many other spaces cross a space of origin (the more red lines there are, the more connections there are to this space), the parameter of Choice shows how busy the space is and the parameter of Integration shows how central the space is. To find more information about space syntax analysis attribute summaries, please refer to Appendix A.

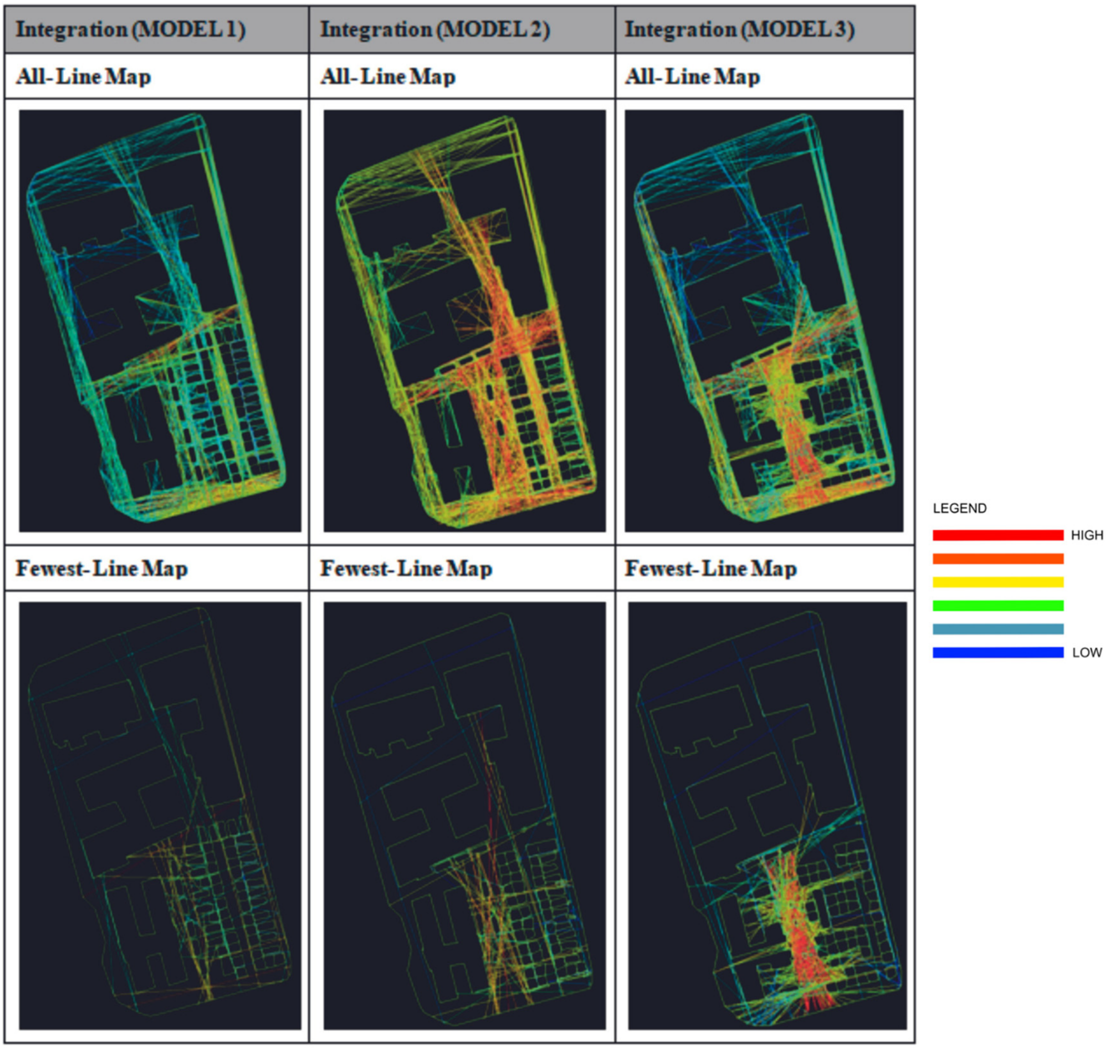

Figure 7. Oliwa Marketplace space syntax analysis. Integration parameter; comparative statement for three model designs, drawing by the authors.

Connectivity of these three models shows that the most connected is the third model. The decision to open the side entrances to the market hall and connect it with the open-air market resulted in an increase in the connectivity parameter in such a way that the middle part of the quarter has the most number of connections with other spaces in the entire system.

The Choice parameter shows how often a given space will be used to get to all other spaces in the system. It is clearly visible that the third system would favour choosing the passage between the northern and southern part of the quarter and moving through the hall and the open-air market.

The Integration parameter shows which spaces are the most central in the entire system, and thus the probability of users appearing in them. None of the spaces in the first model are well integrated with other spaces in the system. The second model clearly shows very good integration of both the north–south passage and the square in front of the hall.

In the third system, the northern spaces are less integrated with the market space, while the hall and the marketplace are very well integrated with each other.

5.2. Cost Criteria

For each variant, the cost of work had to be properly calculated and determined. To do that, all project documentation was prepared, on the basis of which a bill of quantities was prepared. Based on these, three investment cost estimates were prepared.

The following assumptions were made for the calculation:

The detailed method used the rates and prices from the first quarter of 2021 of the Sekocenbud system price list, current market prices of materials and information obtained from material producers. The following works were taken into account: demolition works, edges, resistors, earthworks, surface works, landscaping and elements of small architecture. On the basis of the cost estimate prepared, taking into account the above assumptions, the cost of carrying out the works to be undertaken under the three proposed variants was determined. The results are presented in the statement of cost estimates (including VAT) for the implementation of the scope of work provided for in options 1, 2 and 3, below. The data are as follows:377,086.66 monetary units for option 1 (Model 1), 476,594.42 monetary units for option 2 (Model 2) and 568,762.22 monetary units for option3 (Model 3).

Option 3 has the highest cost of works planned to be carried out under the given solution (Figure 8).

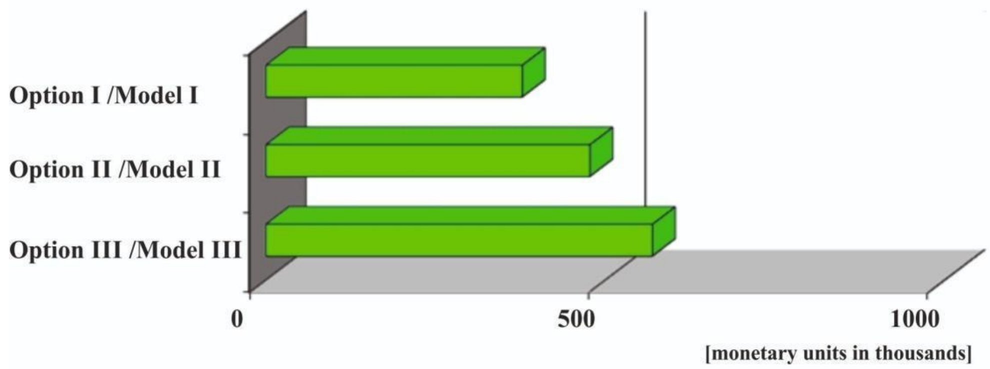

Figure 8. Costs of works envisaged for implementation under options 1, 2 and 3.

The cost of performing the scope of work covered by option 2 represents 83.80% of the cost that would be incurred by implementing option 3. The cost of carrying out work according to option 1 represents almost 66.30% of the cost of performing the scope of work provided for in option 3 (Figure 9).

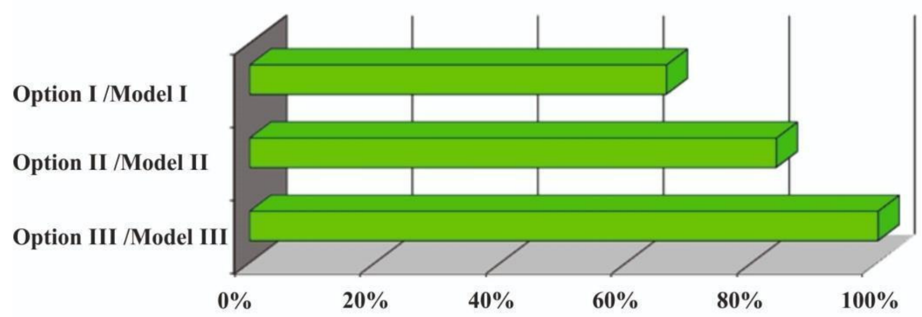

Figure 9. Percentages of the costs of works envisaged for implementation under options 1, 2 and 3.

5.3. Time Criteria

In order to determine the time of the execution of works, construction schedules were prepared for each of the three proposed variants.

The following assumptions were made within the schedules: the scope of works results from the project documentation prepared for the three considered variants, the works are carried out in the shortest possible time (using the method of uniform work, in some cases parallel and subsequent execution) and the basis for determining the tangible expenditure of labour and equipment is obtained from the construction cost estimates prepared using the detailed calculation method.

The data below presents the statement of cost estimates (excluding VAT) for the implementation of the scope of work provided for in options 1, 2and 3.

The summary of the implementation times for the three proposed variants are as follows:

There are a total of 438 work shifts for option 1 (Model 1), 423 work shifts for option 2 (Model 2) and 467 work shifts for option 3 (Model 3), where work shifts are the times in units.

The time related to the implementation of the works covered by option 3 is the longest—467 working shifts (Figure 10). This is primarily due to the greatest range of activities to be carried out.

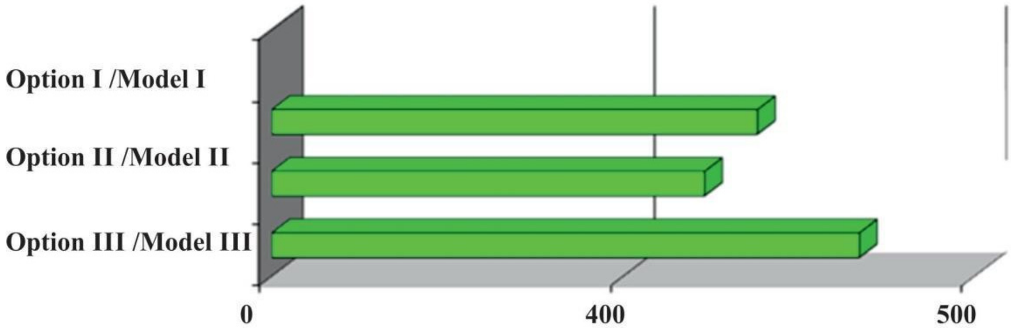

Figure 10. Duration of the works envisaged for implementation under options 1, 2 and 3.

6. Conclusions

Remark: As proven, the first design model, which focuses on the habits of sellers and their points of view, is the most economical solution. However, this model, which favours parking cars on the square, is not the right solution in the context of creating a user-friendly space. On the other hand, considering only the spatial aspect of the space and its functioning and connection with the neighbourhood, measured by the space syntax analysis, the third model appears to be the best solution. Finally, we conclude that Model 2 is the most optimal, and that by balancing the costs versus spatial solutions, it is possible to effectively improve the current management structures of marketplaces and, as a result, transform them as living public spaces. We conclude that the balance between cost and design assumptions informs implementation in various conditions, allowing for the changing nature of local markets to thrive and bring them closer to the inhabitants (in a more sustainable way).

The consideration and analysis of the selected models to implement investment in market regeneration (Figure 11) executed and presented in the article justifies the methods, conclusions and statements presented below:

1. The implementation of regeneration investment must take into account the balance of profits and losses and creating optimal solutions for the main project. Social and spatial aspects are not the only elements that make up a sustainable implementation model. Cost and time criteria are critical in determining the final optimal implementation (Table 1). It is imperative that the final investment decision, and all related practical aspects, undergo broad analysis. It must take into account criteria of a different nature, such as social and environmental considerations.

2. Given the complex nature of the interactions of various criteria, and the multiplicity of possible decisions and actions, it is essential that the process of solution optimisation be started as early as possible, i.e., at the design stage. Such an approach allows the consideration of all options and makes it possible to take a comprehensive look at the regeneration process and its investment. An example of such an optimisation at this stage can include the size and shape of the design solutions, type of material and technology used or proposed structural solutions. Such an early and comprehensive analysis is also rational from the point of view of the efficiency of spending. It should be emphasised that

as the scope and size of investments increase, the complexity of their analysis increases, but at the same time the possibility for optimising solutions also increases.

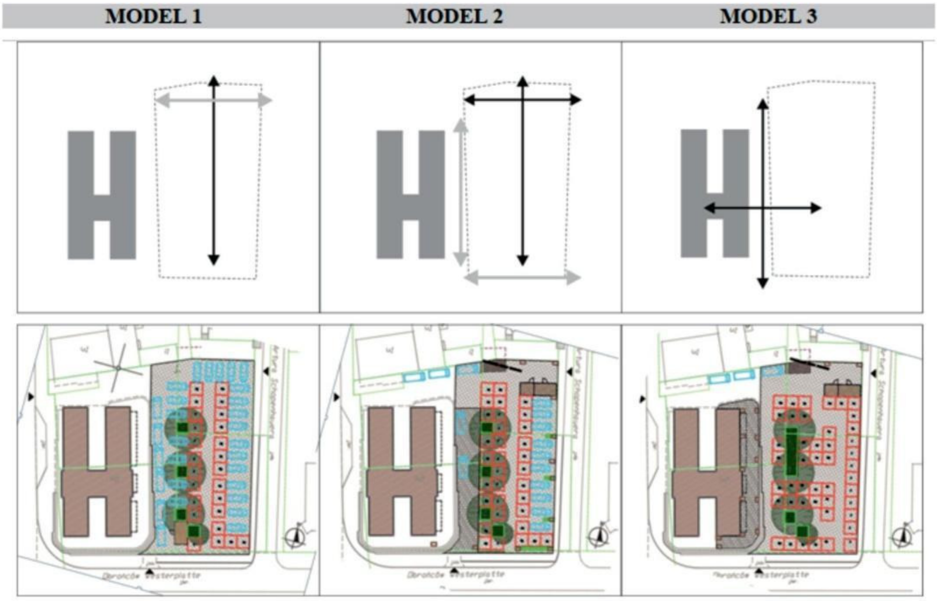

Figure 11. Three selected design models scheme drawing—three variants of the case study design proposals taken into account for the research.

Table 1. Midterm and final evaluation of the three design models—three variants and the chosen model (suggestion) of the most optimal solution to be implemented.

Criteria/MODEL	MODEL 1	MODEL 2	MODEL 3
Spatial Social	1 1	2 3	3 2
Mid Evaluation	2	5	5
additional factors needed		no final choice M2 = M3	
Time (working shifts) Cost	2 3	3 2	1 1
Final Evaluation	7	10 data	7 data

3. The regeneration process is undoubtedly complex, and must take into account social, spatial, cost, time, functionality, safety and environmental criteria. Optimisation of solutions should be carried out in many forms through workshops, public consultation, environmental interviews, on many occasions and at various stages of preparation, sometimes also during the implementation of the investment. The recommended solution (Model 2) takes into account the long-term forecast of pedestrian traffic, as well as other parameters. Consequently, this solution ensures the safety of the public space is maintained at the highest level, whilst allowing successful redevelopment of the marketplace and the whole district, and it takes into account issues such as a reduction in the degradation of the public space, and the material, environmental and economic losses of its users (sellers, buyers, inhabitants).

4. The analysis presented in the article and the proposed solution for the regeneration of the marketplace (Model 2) takes into account all of the current and future social and spatial needs, expectations of marketplace users and social and functional requirements. In a broader context, it also meets the objectives of sustainable development and aspects of creating places, with a particular focus on their flexibility, and urban development

impact. Implementation of the optimal design variant is crucial in the context of successful regeneration and ensuring a so-called "domino effect" of the project. In this context, the future of the marketplace after implementation of the chosen variant-model seems to be very promising for the further development of the entire district.

Moreover, it is important to note that the tested implementation model is currently at the implementation stage in the broader context of the project. Subsequent implementation could be the basis for discussions with other cities, where the problem of maintaining markets has clearly emerged. We are gratified to see that our study is perceived as relevant and can be potentially useful to other cities and communities around the country. This is an urgent problem that needs to be addressed, particularly in view of the generational change facing these areas.

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Appendix A

A clear explanation of the factors actually measured during the testing phase has been added in the Appendix A, as an attribute summary with details and data supplemental to space syntax analysis of the models.

Attribute Summary

	Attribute	Minimum	Average	Maximum
1	Connectivity	2	10.9333	33
2	Line Length	5.82553	25.9758	110.069
3	Choice	1	106.187	1104
4	Choice [Norm]	0.000370233	0.0393138	0.408738
5	Entropy	1.14773	1.66832	2.01792
6	Integration [HH]	1.57464	2.76622	5.03885
7	Integration [P-value]	1.57464	2.76622	5.03885
8	Integration [Tekl]	0.69574	0.77798	0.897682
9	Intensity	0.803583	1.24223	2.02169
10	Harmonic Mean Depth	5.10811	15.4297	39.0863
11	Mean Depth	1.74324	2.43495	3.37838
12	Node Count	75	75	75
13	Relativised Entropy	1.2489	1.74067	2.23086

OK

Attributionsummary with details and data supplemental to space syntax analysis of MODEL 1

Attribute Summary

	Attribute	Minimum	Average	Maximum
1	Connectivity	4	185.273	466
2	Line Length	0.753007	31.7609	110.069
3	Choice	0	1275.64	13480
4	Choice [Norm]	0	0.00209895	0.0221801
5	Entropy	0.985697	1.38848	1.69289
6	Integration [HH]	2.8904	6.91974	12.1312
7	Integration [P-value]	2.8904	6.91974	12.1312
8	Integration [Tekl]	0.792552	0.887443	0.966661
9	Intensity	0.549531	1.26574	1.9506
10	Harmonic Mean Depth	5.85033	89.6503	532.719
11	Mean Depth	1.62103	2.15652	3.60653
12	Node Count	1104	1104	1104
13	Relativised Entropy	1.33678	1.7507	2.78389

OK

Attribution summary with details and data supplemental to space syntax analysis of MODEL 2

Attribute Summary

	Attribute	Minimum	Average	Maximum
1	Connectivity	3	108.532	212
2	Line Length	7.40154	27.2773	110.069
3	Choice	0	203.079	1654
4	Choice [Norm]	0	0.00531259	0.043269
5	Entropy	0.721513	1.22828	1.60695
6	Integration [HH]	3.04807	9.12793	23.0197
7	Integration [P-value]	3.04807	9.12793	23.0197
8	Integration [Tekl]	0.791331	0.949678	1.17185
9	Intensity	0.506842	1.95006	3.51604
10	Harmonic Mean Depth	4.74399	61.3619	120.592
11	Mean Depth	1.24188	1.73314	2.82671
12	Node Count	278	278	278
13	Relativised Entropy	1.1093	1.42681	2.73285

OK

Attribution summary with details and data supplemental to space syntax analysis of MODEL 3

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