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OPTIMIZING TOURISM FACTORY DESIGN: A STRATEGIC FRAMEWORK FOR ENHANCING VISITOR EXPERIENCE THROUGH SPATIAL ZONING AND VISUAL GRAPH ANALYSIS

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ABSTRACT
This study aims to enhance visitor experience in tourism factory by developing a strategic framework for spatial design, using the Hwa Meei's "Eye Fun Vision" tourism factory as a case study. The research employs expert consensus techniques, such as the Delphi method, and space syntax analysis to identify key spatial elements and optimize the layout of factory tour spaces. The findings highlight the importance of spatial zoning, connectivity, and visitor engagement in creating effective and memorable factory tours. Through case analysis of major factory tours in South Korea, Taiwan, Japan, Germany, and the United States, the study identifies critical zones such as introduction, history, manufacture, activity, and sales. A Visual Graph Analysis (VGA) of the Hwa Meei tour space further reveals how visual connectivity and integration can enhance visitor flow and interaction. The results show that strategically arranged zones, with interactive elements and well-designed movement paths, significantly improve visitor engagement. The study offers practical recommendations for applying this spatial design framework to various industries, promoting the growth of industrial tourism. This research contributes to the field by providing a structured approach to factory tour design, combining both expert insights and data-driven spatial analysis to create visitor-centric, educational, and brand-enhancing experiences.

Keywords: Tourism Factory, Industrial Tourism, Spatial Zoning, Visual Graph Analysis

1 INTRODUCTION

The growing trend of industrial tourism, which involves guided tours through manufacturing facilities, offers companies a unique opportunity to engage with the public while showcasing their production processes and brand history. This type of tourism fosters brand loyalty and provides educational value, allowing visitors to experience firsthand how products are made and understand the history and culture behind the brand. When visitors enter a tourism factory, they typically follow a predetermined path designed by the factory tour organizers. Therefore, the sequence and organization of the spatial design within tourism factories significantly impact the visitor experience. Properly planned spatial layouts not only guide visitor movement effectively but also influence how they engage with the factory environment and interpret its narratives (Hillier & Hanson, 1984 [6]; Turner et al., 2001 [20]).

Existing studies provide a foundation for understanding the spatial components necessary for booming industrial tourism. Jia (2010) emphasized integrating dynamic displays and interactive activities to actively engage visitors, making tours more immersive [1]. Lee (2015) identified accessibility, including amenities such as galleries and souvenir shops, and curated experiential activities as vital contributors to tourist satisfaction in factory settings [2]. Lin (2019) further highlighted the role of service experiences and cultural and educational heritage preservation in attracting and retaining visitors [3]. Although these studies deal with the importance of interactive and experiential elements, they fail to address the spatial organization of tours and their impact on the quality of visitor experiences. Moreover, although they discuss key experiential aspects, they must deeply explore how spatial sequencing and organizational strategies within tourism factories influence visitor behavior and satisfaction.

To address this gap, insights from the fields of museum and theme park design provide a valuable framework for understanding spatial dynamics in industrial tourism. Dera and Ridzqo (2021) discussed

the application of spatial zoning to organize spaces to optimize visitor flow and enhance engagement [4]. Similarly, Peponis et al. (2004) and Turner et al. (2005) have demonstrated the effectiveness of space syntax techniques in analyzing and designing spaces to facilitate movement and interaction, particularly in environments with complex spatial layouts such as museums [5][7]. These approaches suggest that integrating spatial analysis into factory tour design can create an environment where visitors interact meaningfully with exhibits, fostering deeper brand connections.

In response to the need for a structured approach to factory tour spatial design, this study aims to develop a strategic framework that enhances the visitor experience through spatial zoning based on Delphi and visual graph analysis (VGA). Using the Hwa Meei "Eye Fun Vision" tourism factory in Taiwan as a case study, this research combines expert consensus techniques, such as the Delphi method, with case study analysis. Additionally, it incorporates space syntax analysis to identify and optimize the spatial zoning of factory tours, ensuring a practical and visitor-centric design approach. This study's findings are expected to offer actionable insights for industries seeking to enhance visitor experiences while reinforcing corporate identity through strategic tourism factory spatial design.

2 RELATED WORKS

2.1 Essential factors and elements in devleoping tourism factories

Research in industrial tourism highlights key elements that enhance the appeal of destinations like galleries and factory tours. Lee's (2015) study organized 34 determinants into a hierarchical structure, focusing on accessibility, amenities, and ancillary services. Analyses of tourist sites emphasize experiential activities, such as video/photo galleries, brand history exhibitions, and production process observations, which foster deeper visitor engagement [2]. Lin (2019), using the Network Relationship Map (NRM), identified product exhibitions, marketing promotions, service experiences, and educational heritage conservation as critical drivers of service value [3].

Jia's (2010) research emphasized integrating experiential tourism into industrial sites through dynamic displays and interactive experiences, highlighting production processes and company history [1]. The concept of spatial zoning, applied in theme parks and museums, has been used to examine the impact of spatial organization on visitor experiences. Dera and Ridzqo's (2021) study of zoo landscapes demonstrated that strategically placed exhibit zones enhance educational and recreational value [4], while Yoo's research on Samsung and SK exhibition halls explored how spatial division delivers effective brand messages [8, 9].

These studies underscore the importance of strategic spatial organization, product exhibitions, and interactive experiences in making industrial tourist sites more appealing and providing visitors with memorable and educational experiences.

2.2 Expert consensus techniques and space syntax method for museum and tourism

Expert consensus techniques like the Delphi method, the Analytical Hierarchy Process (AHP), and space syntax are widely used to enhance spatial layouts in museums and tourism. These methods integrate expert insights and analyze spatial configurations to optimize movement and engagement.

The Delphi method refines expert input through iterative surveys to reach a consensus on spatial design issues. Ruhanen (2004) applied it to develop sustainable tourism strategies [10], while Garrod et al. (2011) used it for heritage tourism to improve space organization for storytelling [11]. In museums, Zatori et al. (2016) applied Delphi to prioritize elements that enhance visitor engagement [12], while Hsu et al. (2011) used AHP to rank spatial components like exhibit accessibility, helping planners create more structured layouts [13].

Space syntax, particularly Visual Graph Analysis (VGA), examines the relationships between spaces and their impact on visitor movement. Peponis et al. (2004) applied space syntax at MoMA, revealing that visually integrated areas encouraged exploration, enhancing visitor interaction [5]. Nubani et al. (2018) used visibility graph analysis to compute exhibit visibility and movement patterns [14], while Li et al. (2020) applied space syntax to analyze museums in China, resulting in rearranged layouts for better visitor experiences [15]. These methods—Delphi, AHP, and space syntax—have proven effective in identifying key design elements and optimizing visitor experiences by analyzing spatial layouts.

3 METHODOLOGY

This study focuses on optimizing the spatial design of factory tours by identifying vital spatial elements through case studies and the Delphi method. These elements are organized into a systematic zoning framework. Visual Graph Analysis (VGA) data plays a crucial role by demonstrating how these spatial elements interact and influence visitor movement patterns, validating the proposed design in real-world settings.

3.1 Case analysis of tourism factory

We conducted case studies of representative factory tours and field visits to analyze space zoning and the content elements within factory tours. The study focused on eyewear companies such as Hwa Meei and factory tours in industrial tourism countries, including South Korea, Japan, Taiwan, Germany, and the United States. We selected two representative factory tours from each country, focusing on light manufacturing industries (e.g., apparel, cosmetics, and eyewear). For each case, spaces were analyzed through on-site visits, videos, and literature. Examples include Zeiss in Germany, Oakley's factory tour in the United States, and the Megane Museum in Japan. In South Korea, the Amore Factory was selected, and in Taiwan, the Eminent Creative Luggage Tourist Factory. Four factories were visited in Asia, while US and German cases were studied via secondary sources. This approach provided a robust framework for understanding spatial zoning's role in enhancing visitor experiences in tourism factory.

Table 1. Representative Cases of Tourism Factory

Company	Sector	Sub-areas
Amore Factory (Korea)	Cosmetics	Introduction of Founder/CEO, Manufacture Process, Photozone, Company History, Company Product History, DIY, Manufacture Equipment, Manufacture Process
Eminent Creative Luggage Tourist Factory (Taiwan)	Luggage	Photo Zone, Introduction of Founder/CEO, Company History, Company Product history, Manufacture Equipment, Manufacture Process, Company Product Line, Quiz, DIY, Cafe, Goods Shop
Megane museum (Japan)	Eyewear	Introduction of Founder/CEO, Company History, Company Product History, Product history, Manufacture Equipment, DIY, Cafe, Goods Shop, Company Product Line
Shiseido Factory (Japan)	Cosmetics	Manufacture process, company product history, hands-on activity, DIY, Company History, Photozone, Manufacture Equipment, Manufacture Process, Company Product Line,
ZEISS Museum (Germany)	Eyewear	Company History, Company Product History, Goods Shop, Hands-on Activity, Company Product Line Archive, PhotoZone
Oakley Factory Tour (United States)	Eyewear	Introduction of Founder/CEO, Company History, Hands-on Activity, Manufacture Process, Company Product History, Goods Shop, Company Product Line, Cafe

The factory tour cases are organized by country, company, sector, and sub-areas. This study compares the critical features of factories and museums across South Korea, Taiwan, Japan, Germany, and the United States. South Korea's Amore Factory (cosmetics) includes sub-areas like introducing the founder/CEO, manufacturing process, photo zone, company/product history, DIY, and manufacturing devices. Taiwan’s Eminent Creative Luggage Tourist Factory (luggage) features a photo zone, company history, product line, quizzes, DIY, a café, and a goods shop. Japan’s Megane Museum (eyewear) and Shiseido Osaka Ibaraki Factory (cosmetics) focus on manufacturing processes, company history, DIY, and interactive activities. Germany’s ZEISS Museum (eyewear) includes company/product history, a goods shop, hands-on activities, and a product line. In the US, Oakley’s Factory Tour (eyewear) covers sub-areas like the Founder/CEO introduction, company history, hands-on activities, manufacture, and a café. The six representative cases mentioned above were used to identify critical spatial elements for factory tours. In this study, the cafeteria was excluded from the analysis of Hwa Meei visitors. The 12 identified spatial elements were: photo zone, founder and CEO introduction, company history, product

history, overall product history, manufacture equipment, manufacture process, product line, games and quizzes, hands-on activities, DIY, and goods shop.

3.2 Delphi method for space zoning

3.2.1. Delphi method

The Delphi method defined factory tour space zoning and its content elements. This qualitative technique gathers expert opinions in multiple rounds until a consensus is reached (Linstone & Turoff, 1975) [16]. First, experts related to the subject are selected, forming a panel of 10–15 members (Ven & Delbecq, 1974) [17]. A primary questionnaire is self-administered to gather initial insights. A second questionnaire is developed based on responses, using a 5-point Likert scale for more straightforward statistical analysis. The Delphi process continues until expert opinions converge, and content validity, convergence, consensus, and stability are measured after each round. Lawshe's (1975) formula for Content Validity Ratio (CVR) is used to determine the importance of each element, where a CVR value of 1.0 indicates complete agreement among experts [18]. Questions with lower CVR values are re-evaluated or removed, ensuring only the most relevant elements are retained for spatial zoning.

$$CVR = \frac{N_e - (\frac{N}{2})}{\frac{N}{2}} \quad (1)$$

Table 2. The minimum Threshold for CVR based on the Number of Respondents

N	5	6	7	8	9	10	11	12	13	14	15	20	25	30	35	40
Min.	.99	.99	.99	.75	.78	.62	.59	.56	.54	.51	.49	.42	.37	.33	.31	.29

The degree of convergence measures the alignment of expert opinions. It is calculated by comparing the third quartile (Q3, 75%) and first quartile (Q1, 25%) of expert responses. A convergence value of less than 0.50 indicates well-aligned opinions. Consensus is determined when 50% of experts agree on a response, with a consensus score greater than 0.75 reflecting strong agreement. The Stability Coefficient is calculated by dividing the mean by the standard deviation (SD) to obtain the Coefficient of Variation (CV). A CV of less than 0.50 suggests that expert opinions are stable, helping to determine whether to proceed with or conclude the Delphi survey.

$$Convergence = \frac{Q_3 - Q_1}{2} \quad (2)$$

$$Consensus = 1 - \frac{Q_3 - Q_1}{Median} \quad (3)$$

$$CV = \frac{SD}{Mean} \quad (4)$$

This study conducted four Delphi surveys with experts to identify critical factors for space zoning and content organization in tourism factories. The Delphi panel consisted of 10 experts (7 women, 3 men) aged 34 to 51, all with at least a bachelor's degree. Their expertise spanned political science, cultural arts, architectural planning, environmental art design, and more, ensuring a well-rounded approach. Professionally, they held roles in strategic planning, content management, academia, and museum curation, with 4 to 24 years of experience, providing a solid foundation for the Delphi process. In the first Delphi survey, participants reviewed spatial elements and definitions of 12 tourism factories, selecting 'agree,' 'disagree,' or 'complement,' and suggesting modifications if needed. Based on these responses, a second questionnaire presented revised elements, with participants asked to rate their appropriateness—the third questionnaire focused on areas of disagreement, refining the expert consensus on zoning. A CVR value of .62 or higher was considered valid for inclusion in this study.

3.2.2. Outcomes of delphi

In the first Delphi survey, the researcher proposed 12 spatial elements for the factory tour: photo zone, introduction of the founder and CEO, company history, company product history, product entire history, manufacture equipment, manufacture process, company product line, games and quizzes, hands-on

activities, DIY experience, and goods shop. After the first round of expert feedback, the spatial elements were adjusted, and 13 elements were identified. Notably, the introduction of the founder and CEO was replaced with “Company Founding Background and MVC,” games and quizzes were removed, and three new elements—information center, community contribution, and café—were added. Additionally, “DIY Experience” was renamed to “DIY Workshop,” and “Manufacture Process” was expanded to include both manufacturing equipment and processes.

During the second Delphi survey, further adjustments were made. “Product Entire History” was removed, as it received a low Content Validity Ratio (CVR 0.2), low agreement (0.375), and high convergence (1.25), indicating it was not deemed essential by the experts. The remaining 12 elements were agreed upon, including the photo zone, company founding background and MVC, company history, company product history, company product manufacturing process, company product line archive, hands-on and interactive activities, DIY workshop, goods shop, information desk, company ESG (replacing community contribution), and café.

In the third Delphi survey, the definition of “Company ESG” did not reach consensus (CVR 0.4, agreement 0.625, convergence 0.75). Therefore, the name and definition of this element were revised for the fourth round. After the fourth Delphi survey, the final set of 11 spatial elements was established. These included the photo zone, company founding background and MVC, company history, company product history, company product manufacturing process, company product line archive, hands-on and interactive activities, DIY workshop, goods shop, information desk, and café.

Table 2. Spatial Zoning for Tourism Factory

Order	Zone	Sub-areas
1	Information	13) Information Desk
2	Introduction	2) Cooperation Founding Background & MVC
3	History	3) Company History, 4) Company Product History
4	Manufacture	7) Manufacture Process, 8)Company Product Line Archive
*	Activity	10) Hands-on/Interactive Activity, 11) DIY Workshop
	Sales	12) Goods Shop, 15) Cafe
	Attraction	1) Photo Zone

The “Eye Fun Vision” tourism factory is meticulously designed to maximize visitor engagement through six distinct zones, each tailored to provide a unique and memorable experience. The zones labeled Information, Introduction, History, and Manufacture follow a sequential order, ensuring a logical narrative that guides visitors through the journey of Hwa Meei’s legacy and manufacturing expertise. Conversely, the zones marked with an asterisk (Activity, Sales, and Attraction) are flexible in their exploration, allowing visitors to engage with them based on individual preferences and interests.

The Information Zone serves as the starting point, welcoming visitors at the information desk and preparing them for their tour. The journey continues to the Introduction Zone, featuring the "See Hwa Meei" exhibit, which introduces the brand's founding background, vision, and mission, laying a solid foundation of corporate identity.

The History Zone delves into the development of the eyewear industry and Hwa Meei’s corporate legacy, showcasing exhibits like the “Domestic Eyeglasses Industry” and the “Hwa Meei Enterprise Timeline.” Following this is the Manufacture Zone, where visitors gain insight into the technical and creative processes of eyewear production through displays such as the “Celebrity Wall,” “4 Kinds of Eyeglasses Scene Display,” and “Lens Manufacturing Process.”

The Activity Zone, offering high interactivity and educational value, provides hands-on experiences like “Frames DIY” and exhibits on “Different Eye Pathologies” and “Sports Visual Knowledge.” Immersive activities include tests like “Amplitude of Accommodation,” “Laser Lenses Resolution,” and “Impact Resistance in Different Lenses.” Visitors can also use advanced eyewear technologies, such as “Army Protective Eyewear.”

The Sales Zone caters to visitors interested in purchasing eyewear and souvenirs, with a glasses shop and vending cart offering curated items. Finally, the Attraction Zone captivates visitors with visually stunning displays, including the “Owl Collection Display” and the “3D Painted Wall,” providing photo opportunities that encourage sharing and engagement.

Table 3. Spatial Zoning for Hwa Meei's Eye Fun Vision

Order	Zone	Sub-areas of Hwa Meei
1	Information	X
2	Introduction	See Hwa Meei
3	History	Domestic Eyeglasses Industry, Hwa Meei Enterprise Timeline
4	Manufacture	Celebrity Wall, 4 kinds of Eyeglasses scene display, Lens Manufacturing Process
*	Activity	Frames DIY, Hand Eye Coordination Toy, Different Eye Pathologies, Sports Visual Knowledge, First Hand Experience of Color Lenses, 3D glasses Experience, Amplitude of Accommodation Testing, Laser Lenses Resolution Test, UV Lens Tester, Impact Resistance in different Lenses, Army Protective Eyewear
	Sales	Glasses Shop, Vending Cart
	Attraction	Owl Collection Display, 3D Painted Wall

4 CASE STUDY AND VISUAL GRAPH ANALYSIS

4.1 Environmental setting of Hwa Meei's Eye Fun Vision

Hwa Meei, a global sports eyewear manufacturer, established the 'Eye Fun Vision' tourist factory in 2016. The main goal of the factory tour is to showcase the heritage of eyewear manufacturing in Taiwan and raise awareness about vision protection and correction. Eye Fun Vision, Taiwan's first eyewear tourism factory, is designed to reflect Hwa Meei's corporate identity and features the brand's owl mascot. The facility provides visitors with insights into eyewear production's industrial and cultural aspects, offering experiences like DIY sunglasses-making, interactive optical games, professional optometry services, and a wide range of eyewear products. The space is divided into four main areas and 21 sub-areas.

This table lists the 21 subareas within the Hwa Meei Optical Company tourism factory, categorized into four main areas. Area 1 focuses on the history of Hwa Meei, featuring subareas such as "See Hwa Meei," "Owl Collection Display," "3D Painted Wall," and "Celebrity Wall." Area 2 highlights the eyewear industry and Hwa Meei's corporate timeline, with subareas including "Domestic Eyeglasses Industry," "4 Kinds of Glasses Scene Display," "Hwa Meei Enterprise Timeline," and "Frames DIY." Area 3 is dedicated to various eye conditions and lens testing, with subareas like "Different Eye Pathologies," "Amplitude of Accommodation Testing," and "Military Protective Glasses." Area 4 consists of the "Glasses Shop," where visitors can purchase eyewear, marking the final stop in the tourism factory. Each area presents a distinct theme, providing visitors with a diverse range of experiences as they explore critical elements of eyewear production, history, and technology.

Figure 1. Hwa Meei's Tourism Factory 'Eye Fun Vision'

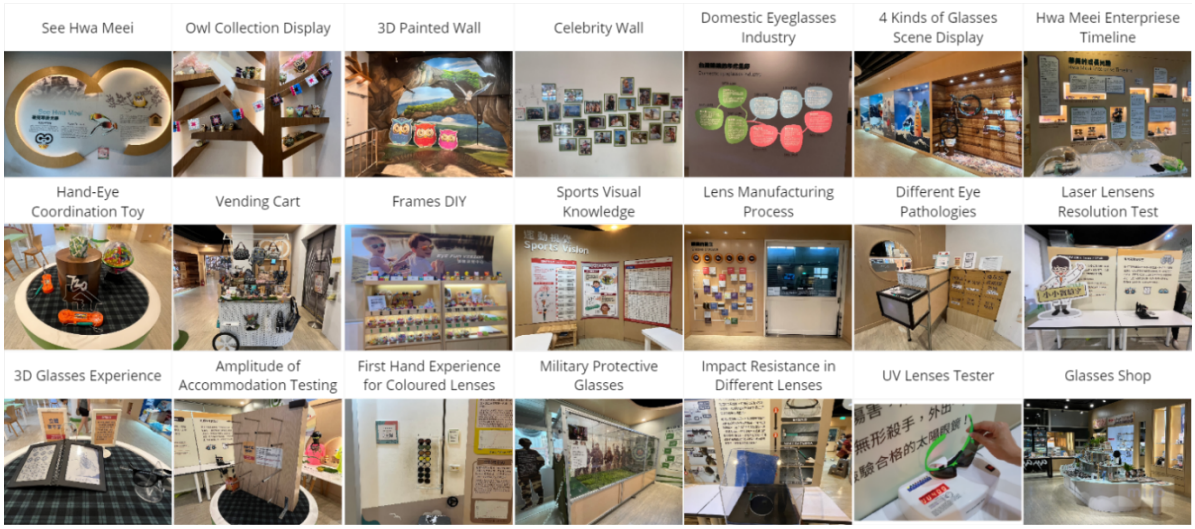

Figure 2. 21 Sub-areas of Hwa Meei's Tourism Factory 'Eye Fun Vision'

4.2 Spatial analysis of Hwa Meei tourism factory with delphi

This study aimed to identify and optimize sub-areas' design within the existing Hwa Meei factory tour using the Delphi method. The 21 sub-areas were categorized into six zones: Introduction, History, Manufacture, Activity, Sales, and Attraction. Since the Information Zone was irrelevant to the Hwa Meei factory, it was excluded from the zoning. Each zone was assigned a unique color for clarity: orange for Introduction, blue for History, green for Manufacture, yellow for Activity, red for Sales, and purple for Attraction. Initial analysis of the existing layout revealed significant issues with the spatial zoning and sequence of the sub-areas. The zones were disorganized to facilitate a logical flow or enhance visitor engagement. Based on the Delphi method, expert feedback was used to reorganize the sub-areas into a more practical layout.

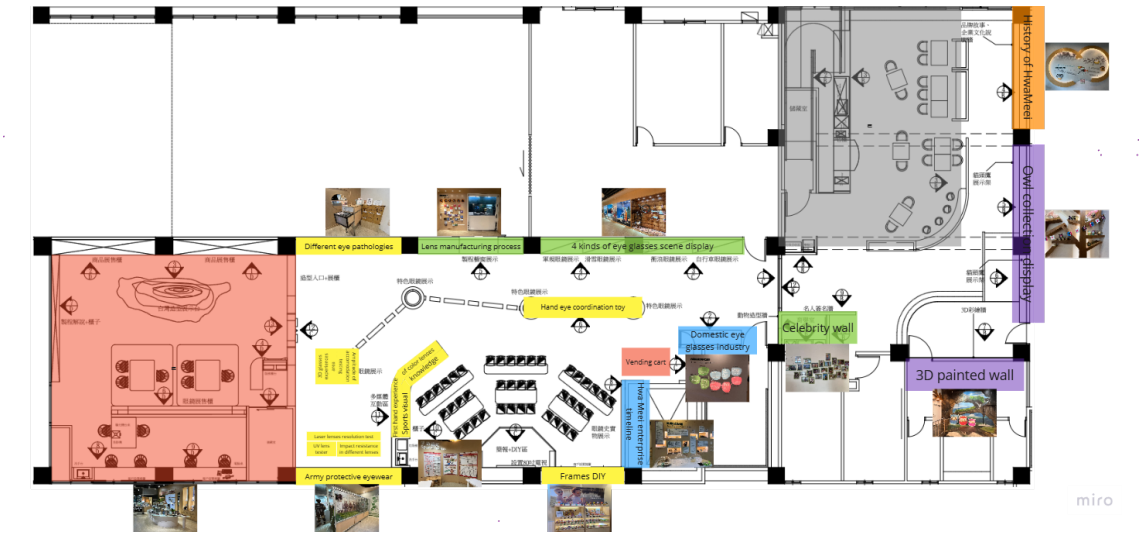

Figure 3. Before Zoning and Ordering: Initial Layout of the tourism factory Subareas

The optimized layout arranged the Introduction, History, and Manufacture zones sequentially, as these zones require a logical narrative flow to convey essential brand and production insights. On the other hand, the Activity, Sales, and Attraction zones, which do not depend on a fixed order, were strategically positioned to maximize visitor engagement and flow flexibility.

The orange Introduction Zone, placed at the beginning of the tour, serves as the entry point for visitors to familiarize themselves with the brand's identity. This zone includes the "See Hwa Meei" exhibit, which highlights the company's founding background, mission, vision, and corporate values, providing a foundation for understanding the tour's narrative.

Following the Introduction Zone, the purple Attraction Zone, located prominently at the entrance, features visually captivating elements like the 3D Painted Wall and Owl Collection. These displays are designed to immediately grab visitors' attention and set a positive tone for the tour while offering memorable photo opportunities.
The blue History Zone included exhibits such as the History of Hwa Meei, the Domestic Eyeglass Industry, and the Enterprise Timeline, providing a rich historical context and showcasing the company's heritage. The green Manufacture Zone highlighted technical and creative aspects of eyewear production with displays like the Lens Manufacturing Process and Celebrity Wall, offering an engaging insight into the brand's craftsmanship. The red Sales Zone contained the Vending Cart and Glasses Shop, allowing visitors to purchase products and souvenirs. Finally, the yellow Activity Zone featured highly interactive exhibits, such as Frames DIY, 3D Glasses Experience, and various lens testing areas, offering hands-on activities that enhance engagement and educational value.

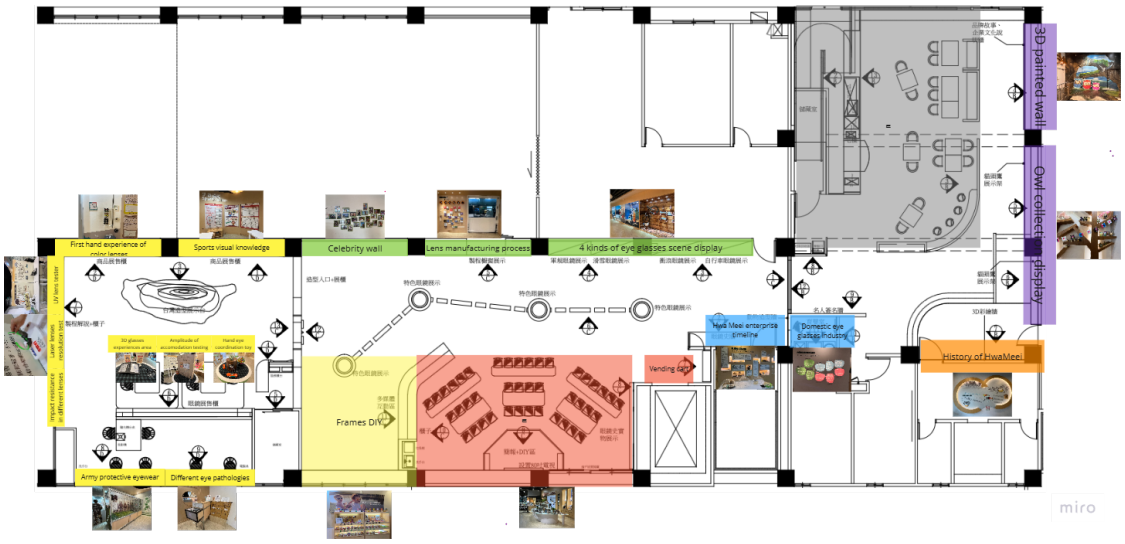

Figure 4. After Zoning and Ordering: Optimized Layout Based on Spatial Zoning and Visitor Flow

4.3 Visual graph analysis with space syntax

The spatial structure of the Hwa Meei space was analyzed using space syntax to identify topological relationships and quantitatively describe the spatial configuration (Hillier & Hanson, 1984) [6]. The primary goal was to analyze the factory tour's spatial structure and understand visitor movement patterns. Using Visual Graph Analysis (VGA), the study evaluated the visual connectivity of the interior spaces, excluding the café (Turner et al., 2005) [19]. The VGA graph was modeled in CAD and imported into the depthmap 8.0 program for analysis, extracting metrics like connectivity, control, integration, and intelligibility (Turner, 2004) [7].
Several indicators were examined to predict visitor movement. Points with high connectivity are major intersections or key points along routes (Hillier & Hanson, 1984) [6]. High visual integration areas are accessible and often hubs for tours (Turner et al., 2005) [19]. Areas with a high visual clustering coefficient attract more attention and encourage visitors to stay longer. Visual control assesses how locations influence movement, while high visual entropy indicates areas where visitors may experience confusion (Turner, 2004) [7]. Lastly, areas with high visual mean depth are less accessible and likely receive fewer visitors (Hillier & Hanson, 1984) [6].
This analysis process was conducted in four major steps. First, the floor plan of the Hwa Meei tourism factory was digitized to prepare it for analysis within the software, ensuring accurate spatial analysis. Second, the visibility of each exhibit space and movement path was analyzed to generate a visibility graph. This allowed for an assessment of how well visually connected key exhibits or major visitor points were. Third, visitor movement paths were predicted based on the visibility analysis results and compared with actual visitor data, enabling the identification of visitor movement patterns that differed from expectations. Finally, areas requiring improvement were identified based on the analysis, and specific design enhancement measures were proposed. These included adjustments to exhibit locations, optimization of movement paths, and design modifications to strengthen visual connectivity.

The efficiency of spatial layout can be evaluated by combining the proposed spatial zones with the statistical analysis results. Using Space Syntax and performing a Visibility Graph Analysis (VGA) with Depthmap, several potential improvements in the spatial design of the Hwa Meei tourism factory, "Eye Fun Vision," were identified. Based on the VGA results, design adjustments were proposed to enhance the visual connectivity of the space, allowing visitors to experience the space more effectively.

The four main zones proposed in the study—Information, Introduction, History, and Manufacturing—were arranged in a specific sequence, identified as having high connectivity and high visual integration based on statistical analysis results. These findings suggest that visitors will move naturally along a connected path through these zones. In other words, the sequential arrangement of these zones is designed to allow visitors to experience the space efficiently and intuitively, playing a key role in maintaining a smooth flow throughout the exhibition space.

Besides, points with high visual controllability can play a crucial role in guiding the flow of visitors. Placing important information or directional elements at these points would be highly effective. This approach helps visitors naturally notice these points, obtain the necessary information, and navigate the space efficiently. The four main zones proposed in the study—Information, Introduction, History, and Manufacturing—were arranged in a specific sequence, which was identified as having high connectivity and high visual integration according to the statistical analysis results. Thus, the sequential arrangement of these zones is designed to allow visitors to experience the exhibit efficiently and intuitively, playing a crucial role in maintaining a smooth flow throughout the exhibition space.

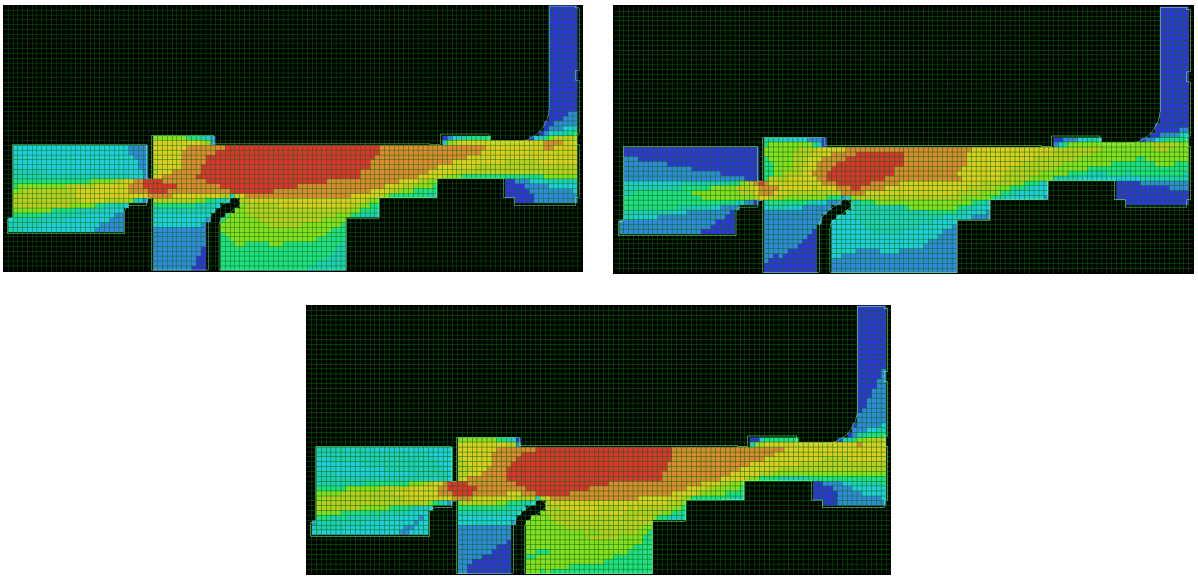

Figure 5. Connectivity, Visual Integration, and Visual Controllability

Locations with high clustering coefficients should be utilized as focal points for visitor engagement. Hands-on activities and DIY workshops have been shown to increase visitor participation significantly. Statistical analysis suggests these activities are more likely to occur in areas with high Visual Clustering Coefficients. This implies that such spaces should be intentionally designed to attract concentrated visitor attention. In other words, spaces designated for these activities should be tailored to draw visitors and enhance their participation levels naturally.

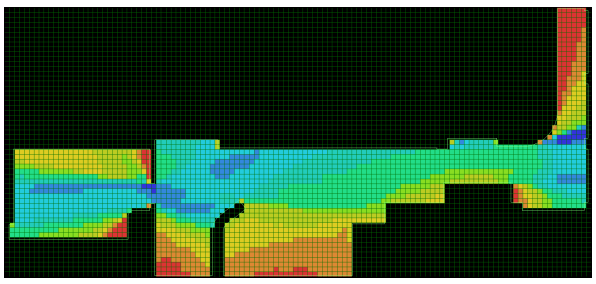

Figure 6. Visual Clustering Coefficient

5 DISCUSSION

This study aimed to enhance the spatial design of factory tours by integrating expert consensus through the Delphi method and utilizing space syntax analysis to optimize visitor movement and engagement. The research revealed critical insights into how spatial zoning and layout can significantly influence visitor experience and the practical considerations needed to design adequate tourism factory spaces. The Delphi method was instrumental in deriving key spatial elements and sub-areas essential for factory tours. The iterative rounds of expert consensus allowed for the refinement and validation of spatial components such as the photo zone, company history, manufacturing process, and hands-on activity areas.The clear division of zones—such as Information, Manufacturing, and History—ensured that the space had a logical flow, enhancing visitor understanding of both the company's history and its product manufacturing processes.

The Visual Graph Analysis (VGA) of the factory's spatial configuration, particularly the Hwa Meei "Eye Fun Vision" case, demonstrated the importance of visual connectivity and control in influencing visitor movement patterns. Areas with high connectivity, such as the photo zones and manufacturing displays, became natural hubs where visitors lingered or interacted more deeply with exhibits. This suggests that spatial elements with high integration and connectivity should be strategically placed to capture visitor attention and enhance engagement.

The analysis also identified areas of low visual integration, such as less accessible zones that required a redesign to improve their visibility and engagement potential. The study's findings underline the significance of thoughtful spatial design in enhancing industrial tourism's educational and entertainment value. The integration of interactive activities, DIY workshops, and visually accessible manufacturing processes not only provides educational benefits but also strengthens brand loyalty by fostering memorable experiences. However, the research also highlighted the challenge of balancing corporate objectives (such as showcasing brand heritage) with visitor-centric design, particularly in zones like manufacturing areas, where safety and operational constraints might limit visitor interaction.

6 CONCLUSIONS

This research successfully identified and validated core spatial elements and zoning strategies for factory tours through expert consensus techniques and space syntax analysis. The study established a systematic framework that includes critical zones—such as introduction, history, and manufacturing—supported by hands-on activities and visitor-centric design strategies. Using the Delphi method, the study aligned the spatial design with expert insights. At the same time, the application of Visual Graph Analysis allowed for data-driven recommendations to optimize visitor flow and interaction.

The case analysis of the Hwa Meei "Eye Fun Vision" factory tour demonstrates the potential of well-designed factory tours to enhance visitor engagement, promote corporate identity, and provide educational value. The research contributes to industrial tourism by offering a comprehensive spatial design framework that can be adapted across various sectors and geographies. Furthermore, the findings stress the importance of integrating expert knowledge and spatial analysis tools to create more meaningful and memorable visitor experiences.

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