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Digital Smart Manufacturing Context Urban Street Space Design Landscape Elements Retrofit Analysis

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Abstract

INTRODUCTION: With the growth of the economic level, China's urban residents' urban living standards are also increasingly high, which has produced the story of an urban street space design to improve the requirements. Moreover, with intelligent manufacturing and other computer technology to enhance the efficiency of various industries, smart manufacturing applied to urban spatial design landscapes also has a prototype.
OBJECTIVES: To improve the level of digitization in China, the application of intelligent manufacturing in urban street space design; to promote the transformation of urban landscape elements, urban modernization will increase the level; to solve the problem of the urban environment improvement and economic development is not synchronized; to promote the modernization of urban development, enhance the level of urban informatization and intelligence.
METHODS: Firstly establishes the Wells equation of the optimal path of intelligent manufacturing through the technique of theoretical exposition; secondly, analyzes people's demand for urban street space design by using the method of data statistics and analysis; lastly, summarizes the principles to be followed in the creation of urban street space and the construction outlook through case study.
RESULTS: The Wells equation of the optimal path of smart manufacturing shows that intelligent manufacturing has a significant positive effect on the efficiency of urban street space design; the results of data statistics and analysis show that the current level of urban street space design cannot meet people's growing spiritual and cultural needs; the results of the case study show that the design of urban street space should follow the design principles of safety, closeness to nature, and human-centeredness.
CONCLUSION: Urban street space design in the context of digital intelligent manufacturing should be done promptly, and the level of urban landscape design should be strengthened to meet people's growing spiritual and cultural needs in the post-New Crown epidemic era.

Keywords: smart manufacturing, urban streets, spatial design, landscape elements

Received on 19 February 2023, accepted on 3 october 2023, published on 23 October 2023

doi: 10.4108/ew.4221

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1. Introduction

Streets are places where people travel, participate in public life, and exchange information. From an urban perspective, streets are also spaces outside urban life and pillars of the urban environment and vitality. Urban streets have a long development history as an essential part of human physical life (Conway & Conway, 2021). If the street is alive in society, the city survives. Urban space consists of three-dimensional physical space closely related to cultural heritage, historical sites, and pedestrians. The street's understanding and experience of urban spatial form often extends to the entire urban theme.

As modern urbanization has accelerated since the twentieth century, the share of roads in the world's major cities has grown steadily to about a quarter or even a third of the urban area. At the same time, as transportation has changed, more and more apartment buildings have affected and even destroyed previously spontaneously created urban public spaces(Sheikhmohammadzadeh et al., 2022). The shape of metropolitan areas has also changed significantly. Creating modern, comfortable, attractive urban spaces is vital in shaping the urban landscape, improving living conditions, and facilitating road traffic management. The metropolitan area is formed by the intersection of material elements along the road and is an integral part of urban public space. It consists of continuous architecture, public sculpture, environmental design, street space, and green vegetation. The elements of a metropolitan area are usually the shape, size, and proportions of the urban space, the combination of building clusters, architectural styles, the material and structure of the street interface, and the variety of urban furniture(Mariusz ysień, 2021). Different forms of segmented urban space reflect other spatial characteristics, and various spatial forms give a sense of openness, closure, continuity, or segmentation, affecting the city's image. The shape of urban space is often constrained by many conditions to meet modern city dwellers' physical, psychological, aesthetic, and safety needs (B et al., 2021). Road interfaces must be designed not only to meet the requirements of accessibility and human communication requirements but also to consider physical factors such as distances between buildings, meeting solar energy standards, and reducing noise transmission. They are creating a favorable natural environment for the city and providing open scenic corridors. This paper explains how road space can be effectively managed at the urban planning stage and how road interfaces can be managed to harmonize comfortable forms of space with the environment(Ring et al., 2021).

Explore experiences in urban environmental observation and quantitative indicators, update and revise existing urban planning guidelines to develop algorithmic criteria for evaluating spatial statements, and propose more effective street interface management systems for urban planning. Urban development guidelines will be improved given the actual territorial structure(Maurer, 2021). Based on the study of the urban interface management methodology, an effective system of indicators and quantitative analysis methods are proposed to improve the orientation of urban planning in the management of road areas(Catarina P.A.T.O.I.L.O. TEIXEIRA et al., 2021). The results align with the project's content and shape the city's spatial and ecological landscape. Combining urban space theory and urban planning theory extends the theoretical connotation of urban space to the normative level of detailed planning. It combines it with actual planning, thus eliminating the gap in urban space theory(Fan et al., 2021). It inspires diverse theoretical studies on street forms, normative levels, detailed planning, functionality, and efficiency of urban development services, and standardization and standardization of urban development guidelines in existing urban planning in China.

2. Background of the study

Sustainable urban development has been a hot topic of scientific research. Given the objective and unavoidable damage caused by natural disasters such as earthquakes, hurricanes, terrorist attacks, economic slowdowns, and environmental changes, cities cannot effectively respond to, withstand, and rebuild these damages(Fraccascia et al., 2021). In recent years, the rapid growth and crude construction patterns of Chinese cities have led to a lack of capacity to respond to urban crises, which has undoubtedly exacerbated the risks and consequences that cities face due to various damages and consequences. Human and material losses, as well as economic and social imbalances, are increasing. The N.C.C.P. has had significant social, economic, and regional impacts on cities, vital to economic development and the last line of defense against disasters and threats(Bonilla-Bedoya et al., 2021). This has led to widespread recognition of the vulnerability of cities and highlighted the limitations of traditional planning and programming approaches used in complex social-ecological systems such as cities.

Behind many extreme weather phenomena, themes such as "sustainable development," "low green carbon dioxide emissions," and "zero energy" have become hot topics for academic research and urban practice. Policies to peak CO2 emissions by 2020 and 2030 have led to profound changes in economic and social systems, and urban planning and construction must meet policy requirements at all levels(Teixeira et al., 2021). As the foundation of urban space, roads are essential for people's daily travel, work, and life and profoundly impact promoting low-carbon urban change. At the same time, roads are critical areas for urban disaster prevention, and their regional characteristics are closely related to people's evacuation and urban disaster risk. Since the global outbreak of New Crown Pneumonia in 2019, travel practices and rules of engagement have changed. Cities worldwide have begun to focus on sustainable road traffic management. They are committed to upgrading spaces and managing modern facilities to cope with the current impacts of the 2019 neo-crest pandemic. Significant changes in the use of urban roads have occurred during the pandemic. In this regard, urban renewal is a diverse trend that requires leadership, multi-thematic engagement, flexibility, and intelligent planning.

Traditional upgrading of road space has focused mainly on permanent targets. As a result of global climate change, natural disasters, and other perturbations, planning methods have placed greater emphasis on reactive prevention and management, neglecting the dynamic adaptation process of urban road transport. Most top-down administrative and expert approaches in the planning process need more bottom-up platforms for public participation and communication, often leading to space use and demand failures. Historic urban spaces are one of the weak points of public safety in cities, with long construction periods, uneven distribution of use rights, separation of administrative purposes, limited response to natural hazards, and uncertain risks. Given the risks associated with urban insecurity, there is an urgent need to investigate how to improve historic urban spaces' vulnerability, adaptability, and learning capacity. Urban street space design based on functional zoning is shown in Figure 1.

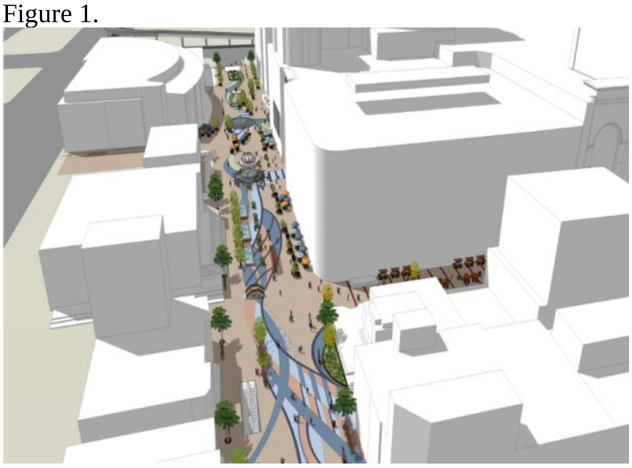

Figure 1 Urban street space design based on functional zoning

3. Research methodology

3.1 Digital Framework for Smart Manufacturing

The term "intelligence" in the context of intelligent manufacturing includes two aspects: knowledge and intelligence. The first is the basis for intellectual development, and the second is the ability of technicians to acquire knowledge and apply it to solve problems(Xia et al., 2023). The definition of data generation varies from country to country. In Germany, smart manufacturing is a digitalized innovative manufacturing model integrating bright manufacturing elements through the Internet of Things(Chi, 2023). Governments worldwide view smart manufacturing as a way to transform and improve traditional industries through technologies such as information technology and new innovative manufacturing models. According to China's national conditions, intelligent manufacturing is a new innovative method based on developing and applying modern information technology combined with advanced smart manufacturing, design, manufacturing, service management, manufacturing, and service technologies.

Smart manufacturing includes hardware and software systems such as C.N.C. machine tools, automated bright manufacturing lines, robots, and other automated intelligent manufacturing equipment, as well as data loggers such as pressure and vibration sensors and industrial cameras. ERPs, intelligent manufacturing execution systems (M.E.S.), and data analysis systems for a company. This paper focuses on the safe and efficient management of hardware-generated data, data analytics and intelligent solutions, and the management of upstream and downstream enterprise penetration(Nguyen et al., 2022). From a data perspective, the smart manufacturing process can be divided into seven parts: data acquisition, transmission, storage, preprocessing, analysis, visualization, and application. The primary data in the intelligent manufacturing process are processing parameters and equipment data, such as cutting speed, feed speed, feed distance, and cutting depth(Sharmin et al., 2023). Data such as quality control, inventory, process, procedure, and personnel are also critical in an intelligent management program. There are four standard data collection methods for data processing: smart manufacturing data is collected using different sensors used in the brilliant manufacturing line; machining parameters and operating procedures are obtained from data interfaces between C.N.C. machines and other equipment, and industrial cameras on the intelligent manufacturing line record and monitor the innovative manufacturing process(Dogani et al., 2021). Radio Frequency Identification (RFID) is used to track the progress of intelligent manufacturing and logistics of products. Industrial sensors and cameras are additional modules connected directly to a wired or wireless network and converted to a digital format using a converter—a small landscaping plan for a city street, as shown in Figure 2.

Figure 2 Mini-landscape design for urban streets

During the data collection process, it can be concluded that smart manufacturing data contains sensitive information about the company's products' intelligent manufacturing process, design, and smart manufacturing progress(Z. Z. Yang et al., 2021). It is easier to compensate for the significant damage if the data is recovered or altered. Therefore, the security of the data storage method is crucial. First, intelligent manufacturing data storage systems must have a security infrastructure that can withstand large-scale cyberattacks and individual points of failure. Second, they must support standard data encryption algorithms that protect privacy and integrity and prevent tampering with private data(Zhao et al., 2023). In addition, a comprehensive data flow control mechanism is required to segregate data and people so that only authorized users can access specific data.

Reliable data storage systems ensure the security of permanent data, but data cannot be stored in one place. Data sharing between departments and between multiple companies are common data-sharing scenarios with security risks. First, the communication environment cannot guarantee complete security because data receivers and servers are unreliable nodes. Therefore, appropriate encryption algorithms must be selected based on various smart data exchange requirements to ensure the safety of simple text during data exchange and the security of data sender keys and other private data. Overall, securing data storage and sharing is a prerequisite for all innovative manufacturing applications and an important research direction for intelligent data management systems.

A cloud-based innovative manufacturing system can be categorized bottom-up into physical device, communication, network, and application layers (H. Yang et al., 2022). The physical hardware layer is responsible for all the functions at the bottom of the system. This is the first intelligent manufacturing system with data acquisition, equipment operation, and innovative manufacturing planning capabilities. It contains a set of microsensors to determine the environmental factors and cylinder types used in machining operations(Li et al., 2021). Because of the differences between components, they need a network that connects them, the Internet of Things. The physical device layer is the foundation of the IoT, and the communication layer above the physical device layer is the link between the physical device layer of the system and the network layer. In addition to the physical devices being able to transmit collected data over the network and through multiple layers of applications, various application-level management commands can be sent to the physical devices to ensure their proper functioning, and the communication level is also responsible for security and transformation. The data transmitted to the physical device needs to be standardized. The communication level should be converted to the data format required at the network level to ensure secure data transmission. Above the communication level is a network level that provides all the services the system requires, including data storage, data analytics, platform services, I.T. services, instant messaging, and advanced services(M. Opazo-Basáez et al., 2023). The network layer can be divided into two parts: local network services and cloud services. The local network is responsive but has limited computing resources, making it suitable for complex and poorly performing real-time tasks. The response is slow but scalable enough to perform complex operations that require more computational resources, and the two networks can work together for more functionality. The top layer of the system is a user-driven application layer that provides visualization services and panel functions that can be adapted to different business projects(Nicula et al., 2022). Traditional innovative manufacturing system architectures have security risks at communication and network levels.

On the other hand, the data traffic level is vulnerable to data capture and manipulation. In contrast, the network level is susceptible to storage and transmission risks, single points of interruption, and privacy threats associated with third-party services. Applying blockchain technology in the communication layer and reorganizing Intelligent Network Systems (I.M.S.) solves the security and trust issues in I.M.S. and provides a more stable infrastructure storage technology. Smart manufacturing in urban street space design application model, as follows:

The Wells equation for the optimal path for intelligent manufacturing is given below:

$$Y^2Z + a_1XYZ + a_3YZ^2 = X^3 + a_2X^2Z + a_4XZ^2 + a_6Z^3 \quad (1)$$

In Equation (1), the right-hand side of the equation is decreasing in power because all powers of X are to be considered without considering the casual error term.

$$y^2Z^3 + a_1xyZ^3 + a_3yZ^3 = x^3Z^3 + a_4xZ^3 + a_6Z^3 \quad (2)$$

The specific algorithm for x and y in Equation (2) is as follows:

$$x = \frac{X}{Z} \quad (3)$$

$$y = \frac{Y}{Z} \quad (4)$$

After simplifying Equation (1) and Equation (2):

$$y^2 + a_1xy + a_3y = x^3 + a_2x^2 + a_4x + a_6 \quad (5)$$

After further simplification:

$$y^2 = x^3 + ax + b \quad (6)$$

3.2 Blockchain Theory for Smart Manufacturing

The main goal of industrial modernization is the continuous development of new technologies in manufacturing to improve intelligent manufacturing processes and increase product efficiency and quality, which increases production, improves the quality and sustainability of innovative manufacturing processes, and reduces the cost of smart manufacturing with manual intervention. Intelligent manufacturing (I.M.S.) based on IoT technology enables communication and collaboration between manufacturing machines and control systems, integrates different customer teams, uses algorithms to control the manufacturing process, and uses decision-making algorithms to analyze sensor data, which ensures automation, programming, and data sharing in the intelligent manufacturing process. From a developmental perspective, smart manufacturing uses sensor technology, numerical modeling, data modeling, and data analytics to analyze and derive smart manufacturing data by integrating the various stages of the intelligent manufacturing process and the changing needs and conditions of factories, suppliers, and customers—the ultimate adaptability and intelligence of the product. Smart manufacturing can be categorized into three main stages and five main goals. The three main steps are collecting large amounts of data related to equipment operation. It is the raw material for intelligent manufacturing based on IoT systems, which contains information from industrial devices through sensors and transmits it to the data layer, providing helpful information for the smart manufacturing process to support business decisions, automating the entire implementation process, optimizing the system structure and managing business strategies. Urban street design in the context of smart manufacturing, as shown in Figure 3.

Figure 3 Urban street design in the context of smart manufacturing

Blockchain is a third-generation web technology that combines cryptography, distributed networks, and smart contracts. The first generation of web technology was provided by web portals such as Sina and Yahoo, which provided users with ready-made content that could only be viewed in one direction and could not be authored or interacted with. The second generation of internet technology, WeChat and Weibo, gave users an open platform to express their opinions and create content online. The development of second-generation online technologies has made people's lives easier. However, there is a problem: while users appear to be posting their work online, the ownership of this information is essentially in the hands of the platform service provider, and overall security can only rely on the trust of the technology service provider. They are securing data. To address this problem, third-generation network technologies based on blockchain have emerged, solving the problem of centralized service providers monopolizing data and restoring ownership of user data. The primary data structure of a blockchain is called a block, where each block stores a hash value describing the parent block. Each block can be built precisely after the main building, creating a unique combination of chains. No matter what data is manipulated in the blockchain, the entire chain will collapse, which is the theoretical basis for securing data in the blockchain. Blocks can be categorized into blocks and chunks. These blocks contain detailed information about events, usually stored in a Merkle tree data structure. It is a binary tree that can be used to compute and query large amounts of distributed data and effectively verify the integrity of the data. Merkle tree consists of leaves and root nodes.

Using Merkel Root, if the total number of events is N, the details of each event can be found quickly. Look up log2(n) to check the events in a block. The block header stores a summary of all information about the league. The difficulty value is the target value of the current workload protection algorithm, which is stored in Mantissa+ index bit format and takes up 4 bytes of disk space. A random number is a data field added to the response calculation that satisfies the complexity goal and occupies 4 bytes of disk space. Timestamps are specified times consisting of blocks defined in Unix time code. In addition to the above information, a Bitcoin block includes a block-sized transaction counter, which records the number of transactions in the league and occupies disk space.

3.3 Research design

The experimental research project was divided into four parts: factor screening, scenario construction, data collection, and statistical analysis. The testing process was as follows: First, a field study was conducted on residential streets with high population density, and the results were summarized and analyzed to determine the main environmental factors affecting population density. In the second study, an individual street was selected as a model street, and a realistic model of an urban spatial scene was simulated. Based on the first study, a controlled experiment was conducted to manage the physical environment factors, generate different street images, create a new questionnaire, and distribute the simulated pictures. The validity of the questionnaire was verified by collecting data to assess the effectiveness of urban landscape modeling intelligently. Finally, the data collected in the second study was analyzed to determine how environmental change factors influence the intelligent manufacturing of bright urban road areas, the range of values to achieve optimal benefits and the relationship between ecological preferences and brilliant road performance.

To understand the factors affecting the performance of residential streets in intelligent cities, the general relaxation methods of urban spaces, and the preferences of recreational space users, and to prepare for scenario modeling, a study of residential streets was conducted—questionnaire Survey. In the field survey, respondents were asked to fill in questionnaires shared online and offline to understand older people's problems with using smartphones. The authors conducted a sentiment survey on using urban streets in this study.

The most convenient walking distance is 300 meters. If it exceeds 300 meters, the ideal route is 500 meters, depending on the weather conditions. For the experiment, the researcher chose the course based on the following criteria: functional road brightness, easy identification of the start and end points, and a length of less than 500 meters. Both sides were mainly used in commercial and residential areas, and the space should contain as many different research elements and dense populations as possible. This study focuses on residential neighborhoods with high population density and mix. In selecting areas of different types of blocks, one will note that residential streets vary by neighborhood type, street widths, and functional street types. For example, residential, educational, and research areas are mainly used on both sides of busy streets and are usually less than 20 meters wide. Pedestrians should have a level corridor. Street space consists primarily of relatively continuous side houses along the street interface. Low fences surround some streets; most road users are surrounded by residents and employees who travel, talk, walk, and shop on the street. The design of urban street space based on the water environment is shown in Figure 4.

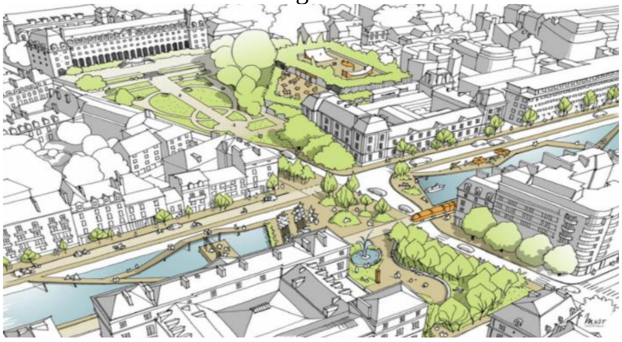

Figure 4 Urban street space design based on the water environment

A questionnaire on urban space utilization was developed based on the elements of urban environments with intelligent manufacturing capabilities. The questionnaire was divided into three parts. The first part collects basic information on age, gender, occupation, density, and duration of urban roads. The second part of the survey uses a five-point approach to assess and monitor environmental factors affecting the perception of urban road traffic. The third part of the survey focused on describing positive and negative aspects using a semantic approach to understand the recreational patterns of residential urban road users and their preferences for recreational space features. The questionnaire describes the subjective benefits of urban spatial intelligence regarding stress reduction, emotional relaxation, and fatigue. The survey consisted of 22 questions and 13 questions. The influencing factors are vectors. This paper synthesizes the environmental factors affecting the image of urban road space in four dimensions: spatial elements (3 elements), natural elements (3 elements), functional elements (5 elements), control elements (2 elements), and user preferences for living room features. Comparing the mean results of the different environmental factors showed that visibility, ambiance, crowds, pedestrian width, and nighttime lighting significantly influenced perceptions of living space use on the road. The size of protected spaces, the availability of areas such as chairs and garbage cans, and store services affect the user experience. The availability of abundant vegetation, mobile stores, sports facilities, and fountains has relatively little impact on the perception of use. Based on the statistical data, the size, nature, and functional characteristics of the location of the measured roads had a significant impact on participants' perceptions of daily road use.

4. Results and discussion

4.1 Urban street space design principles and methods

Safety is the primary and most important principle in the design of urban environments and can be used for interior design and recreation. The interviews also emphasized the importance of road safety. The safety of urban street space is mainly reflected in road and pedestrian safety, while pedestrian safety is primarily reflected in the safety of the pedestrian environment. Suitable public spaces can improve the environment in road areas. However, poor planning and maintenance of public spaces can compromise road safety, for example, by placing signs outside destroyed buildings, roads, and paths to prevent slipping in winter. As well as ensuring the safety of public spaces, attention should be paid to the safety of greenery to avoid planting large fruit trees, brambles, poisonous plants, significant plant pests, and rotten holes in trees. Some people can use streets and street activities without fear of dismantling or tripping, such as comfortable street sizes, pleasant spatial environments, appropriate walking areas, and transparent visibility. These conditions can significantly increase people's sense of safety. In addition, continuous, undisturbed streets in urban areas intelligently create a walkable environment that allows users to move from one place to another, significantly increasing the sense of safety. The spatial design aspect ratio (a) of urban streets is shown in Figure 5.

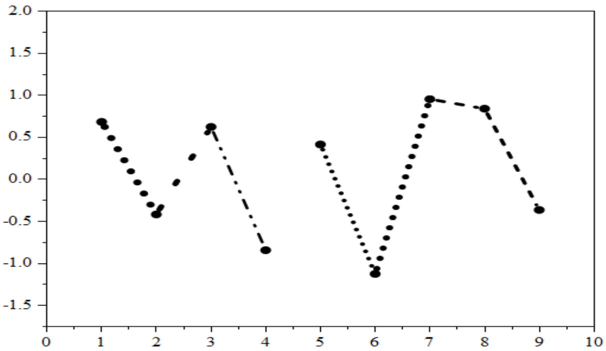

Figure 5 Aspect ratio of urban street space design (I)

To determine the comfort of the road space, the following design methods can be used: Provide moderately open road interfaces. The sense of infinite space can psychologically give people a sense of endless expansion and addiction. Experience and other relevant experiences have shown that open roads (especially the aspect ratio of the road) can affect the ability of people to benefit from the benefits of intelligent manufacturing. Open roads make it easier to take advantage of smart manufacturing, but the more significant the road traffic, the better the benefits of intelligent manufacturing. The distance between height and width is balanced with the D/H ratio (roadway aspect ratio). If the ratio D/H is greater than 1, the distance between the two dimensions increases as the percentage rises; if the ratio D/H is less than 1, the distance between the two dimensions increases proportionally to decrease, and the temporary urgency increases proportionally and gradually decreases. If the D/H ratio is between 1 and 2, this is an appropriate ratio corresponding to people's preference for a broader perspective. To provide a good walking experience and create a positive perception of the urban space, the intelligent fabrication of bright urban areas needs to integrate eco-design with the realities of the situation and refer to the link between the street edge and the street width.

a D/H ratio of 1 to 2 provides open road interfaces to accommodate human use. Crossing the sidewalk only on the street and not staying there for long periods does not promote an intelligent manufacturing experience. The narrow width of the sidewalk significantly reduces the social distance as people feel their personal lives may be disrupted. From a sensory observation perspective, the optimal hearing area is within a 7-meter radius, the most extensive normal hearing area is within 35 meters, other facial features are visible within 25 meters, and everyday conversations can occur within 1-3 meters, making important communication details visible and facilitating Conversation. Two to three meters is an appropriate distance. As the walking width is well proportioned, it effectively creates a unified interface, convenient walking, and supporting walking space, providing a suitable environment for people to experience smart manufacturing. Urban streets in different neighborhoods have different forms of play and stone. In walkable areas in large metropolitan areas, a large amount of space and infrastructure can be utilized to fill in the appropriate spatial hierarchy and enrich the content and structure of the room.

In small pedestrianized urban living spaces, the area's openness can be ensured by small low shrubs and plants on the ground, mirrored effects, and mirrored fixtures in still water, visually expanding the sense of scale of the space and the visual impact. In addition, surfaces can modulate the feeling at the scale of the area. For example, more significant, more advanced coatings can create a sense of spacious scale in a room, while smaller, more compact surface shapes can create a sense of compact scale. Roadway materials can also affect the size and orientation of a room, and the specific use of roadway materials can be chosen wisely depending on the situation. Designing Aspect Ratios for Urban Street Spaces (II), shown in Figure 6.

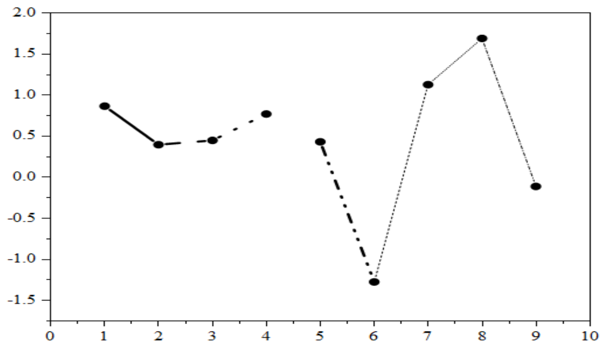

Figure 6 Aspect ratio of urban street space design (II)

An excellent social environment promotes innovative manufacturing behaviors, and building suitable urban spaces fosters communication between people and helps to improve the intelligent manufacturing power of the road environment. An excellent social area requires a pleasant street social environment, which can be achieved by creating a semi-enclosed social space. The characteristics of social interactions on the road can be categorized based on the features of the parking area, which can be divided into behavior and parking. People usually stay where they can be trusted or at the edge of their business for security and privacy reasons. Therefore, in innovative environments for urban residential street bright maker spaces that combine human security and data protection needs, various open areas can be segmented by combining street equipment and plant climbing to provide a sense of zone separation and security; alternatively, by adjusting the height and location of planting, as well as the structures, sizes, and colors of the various greenery species, they can be surrounded by different shapes of plants to provide a sense of separation and security without interfering with the semi-enclosed communication space to give a good view, which not only solves people's privacy issues but also provides a more comprehensive environmental experience. In contrast, the urban area gains a sense of hierarchy and increases people's independence.

4.2 Analysis of Intelligent Manufacturing Strategies for Urban Street Space Design

Proximity to nature is one of the principles of thoughtful city planning. Many experimental studies have confirmed people's preference for and attachment to the heart, and two critical background theories of bright manufacturing environment theory have shown that natural environments can effectively promote the recovery of people's physical and mental health. The "biological hypothesis" also refers to human nature being similar to heart. People are born, whether animals, plants, or other living things. The principle of proximity to nature requires people to design environments in the context of intelligent manufacturing in urban areas that pay attention to the positive effects of nature on human physical and mental health and bring people closer to nature. In the context of intelligent manufacturing in residential areas, the natural character of the urban regions can be improved by consciously increasing the use of natural elements and expanding green spaces. They are getting closer to nature through daily walks and activities or adding interactive landscape equipment to interact with natural ingredients. The most common way to get closer to nature is to add devices that interact with water, allowing people to interact with its natural characteristics. Mimic natural forms. Raw materials can evoke contact with nature and promote psychological and mental health.

Therefore, the construction of intelligent manufacturing in urban road transportation should consider the principle of ecological knowledge alienation so that people can gradually get rid of daily environmental pressure and achieve the effect of intelligent manufacturing. For example, multi-layer plant protection can be used to improve the natural characteristics of the road environment. Small cut flowers outside the lawn can be used in areas suitable for walking, while wild plants can be used in areas unsuitable for walking. Combining street layout and greenery can create a comfortable, safe, and private spatial environment where people can create their own creative or conceptual environments and create a positive environment. The level of urban street design sculpture and landscape application in different regions of China is shown in Figure 7.

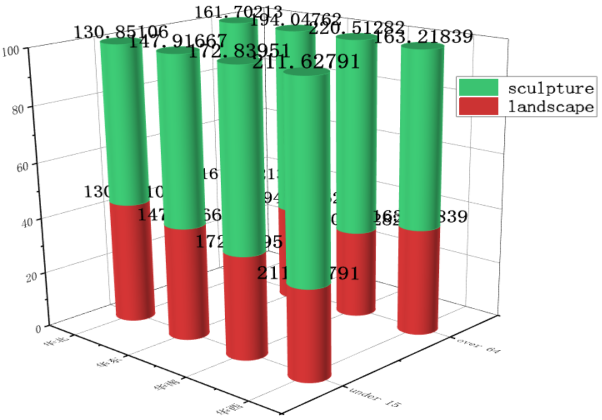

Figure 7 Level of sculpture and landscape application of urban street design in different regions of China

Understanding nature and its interactions in urban spaces is an essential prerequisite for realizing the benefits of intelligent manufacturing. Through direct contact between different senses and spirits, people can create emotional experiences (e.g., visual, auditory, olfactory, tactile, etc.) and realize emotional communication. Although the relevant research examples differ from the Author's, they are still of some reference value. Therefore, the interaction between people can be promoted when building the natural environment for road transportation, thus bringing good benefits from intelligent manufacturing. Visual observation can create an intuitive experience of wild road environments and enhance the effect of intellectually astute fabrication of spatially specific road environments. Ensure appropriate greening metrics. For the visual experience, it is essential to note that chlorophyll areas are also known as green visibility in street environments. Previous studies have shown that urban environments with 20-30% greenness have a more intelligent smart-making effect. Therefore, when designing urban environments in urban spaces, care should be taken to increase the vertical and horizontal naturalness of the natural landscape structure by increasing or decreasing the rate of greening controls such as treetops and vegetation.

Like low green roads, climbing plants can be planted vertically to increase green and visual velocity. Climbers attach to buildings to create green walls and roofs that match the chlorophyll of the roadway. Crossing green streets provides visual continuity to the street space and parking. At the same time, shrubs can be planted on low-green streets, which increases the green visibility of houses and enriches the plant diversity of urban spaces. They can also be used as people and vehicles. It is important to note that green to improve the road landscape is based on human visual perception, so ensuring a clear view is essential to managing the road environment and creating beautiful landscapes. When designing urban roads, plant species should be rich and varied, dominated as much as possible by forms of chlorophyll, making plant communities with temporary natural conditions, seasonal changes, and ecological development. Improvement of the environmental and natural environment of the road enables users to efficiently, healthily, and intelligently manufacture in the background and natural environment.

Furthermore, in the context of intelligent manufacturing in urban areas, ecological planning using native plants is recommended because native plants are well adapted to the environment and develop and stimulate special memories and ideas. Some relevant studies have shown that aquatic landscapes also have smart manufacturing functions. In residential areas, adding water features can improve the intelligent performance of urban environments and provide a practical visual experience. The level of urban street design sculpture and landscape application is shown in Figure 8.

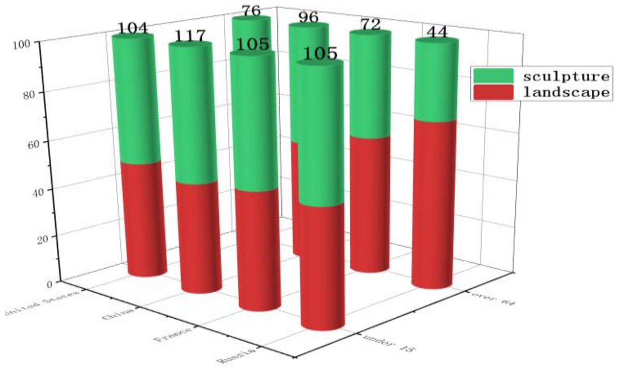

Figure 8 Levels of sculpture and landscape application for urban street design

Scent has a strong emotional quality. In urban spaces, botanical elements are essential to creating a scent experience, and using aromatic plants is the most common technique used in scent design. Using wood and aromatic herbs for efficiency, scent, shape, and color, this practical design creates an urban environment with sound manufacturing effects and scent memory points. When people experience the same or similar odors again, it evokes special memories of the mentally astute manufacturing experience experienced in the street environment. It plays a role in mentally sharp manufacturing mental health. Different aromatic plants have other effects, such as lemon and peppermint for refreshing the ears and laurel and grasshopper for relieving stress. Human-inhabited street spaces can be filled with the scent of woody plants such as cinnamon, grasshoppers, wax flowers, magnolia, and lilac. Herbaceous plants include orchids, roses, and mint. Therefore, when designing urban environments, safer and more visible textured plants or materials can provide a good touch experience or improve the touch experience by manually adding patterns, textures, etc.

5. Conclusion

This study is based on the theory of intelligent manufacturing environments. It applies the knowledge of ecopsychology and eco-behavior to the intellectual climate of bright manufacturing spaces in urban streets. The design emphasizes the importance of urban road transportation in improving human health. In the context of intelligent manufacturing, relevant environmental theories were combined with the functions and characteristics of living spaces to identify the physical and ecological factors that influence the efficiency of intelligent manufacturing in smart cities and information functions. A residential-urban landscape model for use in urban spaces was developed, and simulated scenarios of residential street changes were evaluated using the P.R.S. scale. This paper describes the principles and methods of urban residential design for good mental health and psychological output. An excellent urban spatial environment significantly impacts people's mental health and promotes healthy social behaviors on urban roads; it improves people's overall awareness of the natural environment and their understanding of it. Street rooms can be adapted for use by different groups of people, provide a suitable environment for intelligent manufacturing, and identify dynamic and static spaces to meet people's perceived smart manufacturing needs in various business environments. Activity spaces are organized linearly through stories related to interests, interactions, and experiences that entice people to explore the street space, increase the amount of time people spend in the activity space, and increase opportunities for mentally intelligent manufacturing.

References

[1] B, A. A. Q. A. A., A, L. W., C, M. A. Q. A., & B, S. S. (2021). Developing a Quantitative Tool to Measure the Extent to Which Public Spaces Meet User Needs. Urban Forestry & Urban Greening, 23(23), 1–14. https://doi.org/10.1016/j.ufug.2021.127152

[2] Bonilla-Bedoya, S., Lopez-Ulloa, M., Mora-Garces, A., Macedo-Pezzopane, J. E., Salazar, L., & Herrera, M. A. (2021). Urban soils as a spatial indicator of quality for urban socio-ecological systems. Journal of Environmental Management, 300-300. https://doi.org/10.1016/j.jenvman.2021.113556

[3] Catarina P.A.T.O.I.L.O. TEIXEIRA, Cláudia O.L.I.V.E.I.R.A. FERNANDES, Ahern, J., Joo P.R.A.D.I.N.H.O. HONRADO, & Farinha-Marques, P. (2021). Urban Ecological Novelty Assessment: Implications for Urban Green Infrastructure Planning and Management. Science of The Total Environment, 67(78), 145121. https://doi.org/10.1016/j.scitotenv.2021.145121

[4] Chi, H. (2023). Safety management of Internet of Things engineering construction based on GPU parallel computing. Optik, 273, 170447-. https://doi.org/10.1016/j.ijleo.2022.170447

[5] Conway, M., & Conway, A. (2021). Multi-modal interactions on urban streets: New conflicts and emerging challenges in a mixed-use neighborhood: A case study of New York. Applied Geography, 134-134.

[6] Dogani, J., Farahmand, M., & Daryanavard, H. (2021). A new method to detect attacks on the Internet of Things (IoT) using adaptive learning based on cellular learning automata. Etri Journal, 11, 56–67. https://doi.org/10.4218/etrij.2021-0044

[7] Fan, Y. V., Varbanov, P. S., Jií Jaromír Kleme, & Romanenko, S. V. (2021). Urban and industrial symbiosis for the circular economy: Total EcoSite Integration. Journal of Environmental Management, 279, 111829. https://doi.org/10.1016/j.jenvman.2020.111829

[8] Fraccascia, L., Spagnoli, M., Riccini, L., & Nastasi, A. (2021). Designing the biomethane production chain from urban wastes at the regional level: An application to the Rome Metropolitan Area. Journal of Environmental Management, 297, 113328. https://doi.org/10.1016/j.jenvman.2021.113328

[9] Li, S., Zhu, J., Chen, Z., & Luo, T. (2021). Double-layer energy management system based on energy sharing cloud for virtual residential microgrid. Applied Energy, 282, 56–70. https://doi.org/10.1016/j.apenergy.2020.116089

[10] M. Opazo-Basáez, Vendrell-Herrero, F., Bustinza, O., Vaillant, Y., & Mari, J. (2023). Is digital transformation equally attractive to all manufacturers? Contextualizing the operational and customer benefits of smart manufacturing. International Journal of Physical Distribution & Logistics Management, 467, 6367. https://doi.org/10.1108/ijpdlm-12-2021-0538

[11] Mariusz ysień. (2021). Teaching Spatial Planning Using Elements of Design Thinking as an Example of Heuristic in Urban Planning. Sustainability, 13(13), 12–23. https://doi.org/10.3390/su13084225

[12] Maurer, V. C., Patricia. (2021). More than nature: Linkages between well-being and greenspace influenced by a combination of elements of nature and non-nature in a New York City urban park. Urban Forestry & Urban Greening, 61(1), 56–67.

[13] Nguyen, Hq., Bui, Hk., Phan, Vm., & Seo, Ts. (2022). An internet of things-based point-of-care device for direct reverse-transcription-loop mediated isothermal amplification to identify SARS-CoV-2. Biosensors & Bioelectronics, 195, 113655. https://doi.org/10.1016/j.bios.2021.113655

[14] Nicula, A. S., Boan, C. N., Gligor, V., & Coci, E. A. (2022). Celebrating the Great Union through Smart Digital Solutions: Lessons from Alba Iulia, Romania: Journal of Urban History, 48(2), 425–443. https://doi.org/10.1177/0096144220940713

[15] Ring, Z., Damyanovic, D., & Reinwald, F. (2021). Green and Open Space Factor Vienna: A steering and evaluation tool for urban green infrastructure. Urban Forestry & Urban Greening, 62(3), 127131. https://doi.org/10.1016/j.ufug.2021.127131

[16] Sharmin, M., Tjoelker, M. G., Pfautsch, S., Esperon-Rodriguez, M., Rymer, P. D., & Power, S. A. (2023). Tree crown traits and planting context contribute to reducing urban heat. Urban Forestry & Urban Greening, 178(178), 189–194. https://doi.org/10.1016/j.ufug.2023.127913

[17] Sheikhmohammadzadeh, A., Saunier, N., Waygood, E. O. D., & Li, Ms. E. (2022). I am developing an Objective Framework to Evaluate Street Functions. Sustainability, 34(34), 34–45. https://doi.org/10.3390/su14127184

[18] Teixeira, C. P., Fernandes, C. O., Ahern, J., Honrado, J. P., & Farinha-Marques, P. (2021). Urban ecological novelty assessment: Implications for urban green infrastructure planning and management. Science of the Total Environment, 773-773.

[19] Xia, P., Huang, Y., Tao, Z., Liu, C., & Liu, J. (2023). A digital twin-enhanced semi-supervised framework for motor fault diagnosis based on phase-contrastive current dot pattern. Reliability Engineering & System Safety, 45(45), 35–45. https://doi.org/10.1016/j.ress.2023.109256

[20] Yang, H., Ong, S. K., Nee, A. Y. C., Jiang, G., & Mei, X. (2022). Microservices-based cloud-edge collaborative condition monitoring platform for smart manufacturing systems. International Journal of Production Research, 134(134), 23–33. https://doi.org/10.1080/00207543.2022.2098075

[21] Yang, Z. Z., Zhang, C., Zeng, G. M., Tan, X. F., Huang, D. L., Zhou, J. W., Fang, Q. Z., Yang, K. H., Wang, H., & Wei, J. (2021). State-of-the-art progress in the rational design of layered double hydroxide-based photocatalysts for photocatalytic and photoelectrochemical H2/O2 production. Coordination Chemistry Reviews, 446, 214103-. https://doi.org/10.1016/j.ccr.2021.214103

[22] Zhao, Y., Meng, R., Zhang, Y., & Yang, Q. (2023). Image encryption algorithm based on a new chaotic system with Rubik's cube transform and Brownian motion model. Optik, 273, 170342-. https://doi.org/10.1016/j.ijleo.2022.170342