University of the Built Environment
EST. 1919

Patron: His Majesty King Charles III

Horizons, 60 Queen's Road, Reading, RG1 4BS
ube.ac.uk | +44(0)118 921 4696 | enquiries@ube.ac.uk

University of the Built Environment
Institutional Research Repository

Title	Towards Sustainable Construction in China: A Systematic Review of Barriers to Offsite Methods
Author(s)	M. Alhawamdeh and Angela Lee
ORCID	https://orcid.org/; https://orcid.org/0000-0003-0769-5215
Type	Article
Publication title	Buildings
Publisher	MDPI
ISSN/ISBN	2075-5309
Date	9 September 2025
Version	
DOI	
Repository link	https://ube.repository.guildhe.ac.uk/id/eprint/191/
Link to publication	https://www.mdpi.com/2075-5309/15/18/3299
Notes	This publication version may differ from the final version

Copyright:
The University aims to make research outputs available to a broader audience via its digital Repository. Where copyright permits, full text material held in the Repository is made freely available.
URLs from GuildHE Research Repositories maybe freely distributed and linked to. Please refer to each manuscript for any further copyright restrictions.

Reuse: Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page, and the content is not changed in any way.

buildings

MDPI

Systematic Review

Towards Sustainable Construction in China: A Systematic Review of Barriers to Offsite Methods

Mahmoud Alhawamdeh [1,*] and Angela Lee [2]

[1] Department of Business and Management, Bath Business School, Bath Spa University, Newton St Loe, Bath BA2 9BN, UK
[2] School of the Built Environment, University of the Built Environment, 60 Queens Rd, Reading RG1 4BS, UK; a.lee@ube.ac.uk
* Correspondence: m.alhawamdeh@bathspa.ac.uk

Abstract

Offsite construction (OSC) has been increasingly promoted as a solution for a more sustainable construction industry. This method enhances the performance and efficiency of the construction industry by improving time and cost planning, health and safety, enhanced construction quality, and fostering a more environmentally sustainable built environment. China's Fourteenth Five-Year Plan (2021–2025) mandates that at least 30% of new homes be constructed using OSC techniques by 2025, with the target of achieving 100% by 2035. With such a scalable challenge, this systematic research aims to identify and classify OSC adoption barriers, whether modular, volumetric, or panelised construction, by synthesising existing research studies. Through the analysis of 48 research articles published from 2013 to 2023, the review identifies key barriers hindering OSC adoption in China. The five most frequent barriers are as follows: lack of skills and expertise in OSC within organisations, absence of design codes and national standards for prefabrication, poor cooperation and integration among stakeholders in the supply chain, immature regulatory systems, and complexity in OSC project management. Trends in barrier prevalence by publication year are also discussed to highlight changes in research focus and to inform recommendations for future work that could support greater uptake of OSC in China.

Keywords: offsite construction (OSC); prefabrication; China; barriers; systematic review

check for updates

Academic Editors: Daniel Ferrández Vega, Paulo Santos and Alicia Zaragoza Benzal

Received: 28 July 2025
Revised: 4 September 2025
Accepted: 9 September 2025
Published: 12 September 2025

Citation: Alhawamdeh, M.; Lee, A. Towards Sustainable Construction in China: A Systematic Review of Barriers to Offsite Methods. *Buildings* **2025**, *15*, 3299. https://doi.org/10.3390/buildings15183299

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

The construction industry is a major energy consumer and a key source of greenhouse gas emissions. According to the 2022 Global Status Report for Buildings and Construction (Buildings-GSR), the building and construction sector accounted for about 37% of energy- and process-related CO_2 emissions and over 34% of the global energy demand in 2021 [1]. Onsite construction, widely practiced in China, has faced criticism due to low productivity, extended project durations, poor safety records, air pollution, considerable waste generation, and other issues [2,3]. Offsite construction (OSC), also known as prefabrication, industrialised building, modern methods of construction (MMC), and offsite manufacturing, is recognised as a sustainable construction approach that enhances industry efficiency worldwide and has gained widespread attention in the past decade. OSC refers to the production and pre-assembly of building components in a controlled environment, which are subsequently delivered and assembled at the project site [4,5]. This method is energy-efficient, environmentally friendly, labour-saving, and promotes improved construction

quality and safety, alongside faster project completion times, aligning well with sustainable development goals for the industry [3,6,7]. A notable example is the rapid completion of a 1000-bed OSC-based hospital in Wuhan, China, in under two weeks in response to the COVID-19 pandemic, which brought global attention to OSC's potential as an innovative construction solution [8].

As a result, the Chinese government has prioritised OSC over traditional onsite construction [9–12]. Over the past decade, numerous policies have been enacted to drive OSC development. For example, in Shanghai, an economic incentive policy provides 100 yuan per square metre for prefabricated housing projects over 30,000 square metres with an assembly rate of 45% or higher, capped at a maximum subsidy of 10 million yuan per project [13]. The 2019 China Prefabricated Building Development Report indicates that, following a 2016 directive from the General Office of the China State Council, all 31 provinces introduced policy documents to advance prefabricated building development, continuously refining these policies and implementation measures from 2016 to 2019 [14]. The latest Fourteenth Five-Year Plan (2021–2025) mandates that at least 30% of new housing adopt OSC methods by 2025, with a target of 100% by 2035 [15]. Benefiting from these national policies, the promotion of China's prefabricated construction sector has proven growth and a steady increase in new construction area. For instance, 740 million square metres of prefabricated buildings were completed in 2021, an 18% rise from 2020, representing around 24.5% of the total new construction area [16].

While the concept of OSC is well-established, with benefits documented across various indicators such as time, cost, quality, and sustainability, its adoption in China remains challenging. Despite policy support, the industry struggles with multiple barriers and has yet to achieve high levels of modularisation [17,18]. Research has identified several OSC barriers in China, including limited professional skills, substandard structural quality, inadequate regulatory frameworks, and a lack of design specifications [7,19–22]. Compared to other major economies like Denmark, Sweden, Singapore, and Japan, the proportion of prefabricated buildings in China has significant room for growth [16]. In 2022, data showed that many countries are adopting OSC on a wider scale. For example, OSC accounted for approximately 45% of the housing market in Sweden, Finland, and Norway, and 10–15% in Germany and Japan, while remaining below 6% in China, Australia, and the USA [20,23,24]. In the UK, the government has introduced policies covering standards, technical systems, professional certification, and workforce training across the industry chain to support OSC development. Similarly, in Singapore, effective regulations and laws on standardised specifications encourage stakeholders to adopt OSC, while incentive measures such as cash rewards and training programmes promote reform and innovation among contractors [12]. While the Chinese government has established a number of policies, regulations, and targets, such as the Fourteenth Five-Year Plan (2021–2025), to support off-site construction (OSC) development, their effectiveness remains limited. These measures lack regular updates and sufficient alignment with OSC standards necessary to ensure compliance and quality as the industry expands [15,16,19]. Xie et al. [25] recognise this substantial challenge, further noting that the supply capacity of prefabrication plants currently falls short of meeting the target of 30% annual construction volume through prefabricated methods [26,27].

To address these issues, this paper presents a systematic review of the literature, clarifying the predominant barriers to OSC in China. It aims to prioritise these barriers in promoting prefabricated buildings, exploring how the benefits of OSC can be leveraged to enhance adoption and how these barriers, if unaddressed, could impede future uptake.

2. Methodology

A systematic review serves as a rigorous, repeatable, and unbiased research method for analysing existing studies to define the current knowledge boundaries within a particular field and identify gaps for further exploration [28]. In this study, the PRISMA framework was applied, aiming to provide an extensive overview of the existing literature. This structured approach is especially useful for conducting thorough and systematic reviews of the literature in social science research [29]. This review process encompasses systematic searches of peer-reviewed sources, screening, critical evaluation, metadata extraction, and content analysis, as shown in Figure 1. Selection criteria focused primarily on articles directly relevant to the study topic, along with some studies on related themes due to their significant impact.

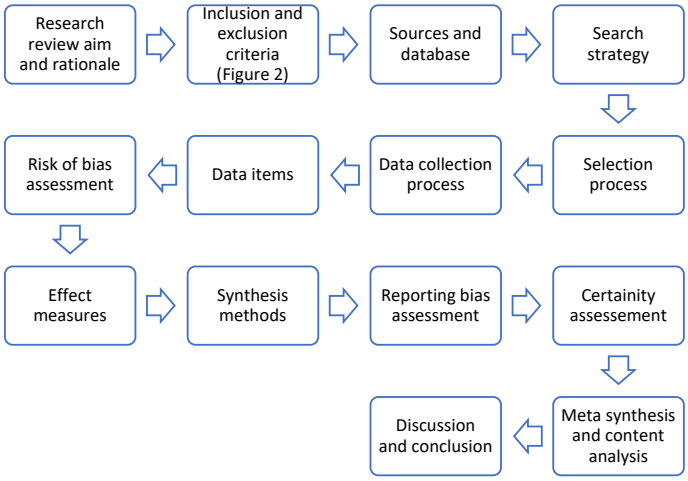

Figure 1. Methodology framework of the study adhering to PRISMA guidelines.

To maintain objectivity and transparency, and to minimise bias, the research employed a structured synthesis, combining both quantitative and qualitative analyses. Data were sourced from ScienceDirect and Scopus, two major citation databases. Scopus, which indexes 99.11% of journals covered by Web of Science, was chosen for its broad scope and frequent application in systematic reviews across disciplines, including OSC [30].

Key search terms included 'offsite construction' (OSC), 'offsite production,' 'offsite manufacturing' (OSM), 'prefabrication,' 'prefabricated construction' (PC), 'prefabricated buildings' (PB), 'prefabricated prefinished volumetric construction' (PPVC), 'prefabricated housing production' (PHP), 'modular integrated construction' (MIC), 'modular construction,' 'modern methods of construction' (MMC), 'industrialized housing building,' 'industrialized buildings system' (IBS), 'industrialized construction,' 'volumetric modular construction,' and 'volumetric construction.' These terms were combined with terms like 'barriers,' 'constraints,' 'challenges,' 'limitations,' 'problems,' 'impediments,' 'hindrances,' and 'factors' to locate relevant studies in the title, abstract, or keywords. Although limited to research in China, only English-language publications were included, identifying 480 papers as of December 2023. The search was further refined to focus on OSC barriers between 2013 and 2023, yielding 125 papers. A ten-year window is a widely accepted duration in systematic reviews, as it provides sufficient scope to identify developments and trends while ensuring that the evidence base remains current and relevant. These papers underwent a manual screening by the research team for relevance based on time frame and geographical focus, resulting in 48 papers meeting the criteria for full review. Figure 2 illustrates this selection process in a flowchart.

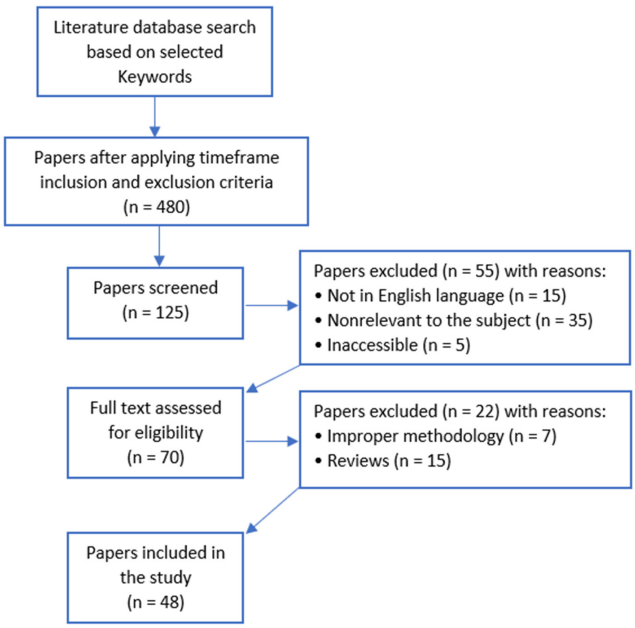

Figure 2. Reporting items flowchart for the study review process.

To assess the methodological quality of the included studies, the Mixed Methods Appraisal Tool (MMAT, 2018 version) was applied across all 48 articles. Each study was evaluated according to relevant MMAT criteria for its design (qualitative, quantitative, or mixed methods). Scores were then calculated as a percentage of criteria met. The results of this assessment are presented in Table A1. Overall, the majority of studies demonstrated acceptable to high methodological quality, with scores ranging from 60% to 100%. More than two-thirds of the reviewed studies achieved a quality rating of 80% or above, indicating that most employed clear research questions, appropriate designs, and sufficiently rigorous analyses. Only two studies fell below 70%, due to a small sample size, limited reporting of sampling strategies, and potential biases. Taken together, these results suggest that the body of literature included in this review is of generally good quality and at minimal risk of bias, providing a sound basis for the synthesis of barriers to OSC adoption in China.

The paper review process was carried out by the two authors in several stages. First, each author independently conducted database searches using different keywords, as previously described. This was followed by a joint discussion, defining inclusion and exclusion criteria, the selection of eligible studies, and a comparability check through a random sample of both included and excluded papers. Finally, the remaining papers' full texts were assessed against the agreed inclusion criteria, with any disagreements resolved through discussion until consensus was reached.

The process of data extraction involved cataloguing lists of barriers for comparison across studies, identifying patterns and differences, and organising the findings into a spreadsheet linked to the original studies and their references. The synthesis grouped the data, leading to the identification of 40 different challenges, which were then organised for classification and analysis. The analysis was divided into three phases: (I) a descriptive examination of trends such as publication year, research methods, journal sources, and OSC terminology; (II) an in-depth classification of challenges using the PESTLE framework; and (III) an analysis of barriers over the specified time period of this review. To avoid bias, each step was followed up independently by the two authors, then discussed collectively to ensure agreement and strengthen confidence in the findings. Additional checks and reviews were also carried out to avoid errors or misleading decisions during the systematic review.

3. Results and Discussion

Figure 3 presents the number of articles included in this review by publication year, covering a decade from 2013 to 2023. The regression analysis shows a moderate positive correlation, demonstrating an increasing research interest in China, particularly over the last six years, with 81.25% of the 48 articles published during this period. This trend may reflect a growing commitment among researchers, practitioners, and stakeholders to address challenges to OSC adoption in the coming decades. A substantial increase is observed in 2023, with 23% of the reviewed articles published in that year alone. China's target for 2025, which requires 30% of new annual construction to utilise prefabricated construction methods [27], has likely contributed to the surge in publications focused on OSC by 2023. Additionally, a peak is evident in 2018 and 2019, possibly due to the implementation of policies and protocols in preceding years (see Section 3.3). Although research production may have been affected by the global COVID-19 pandemic, limited evidence exists to confirm this. Nonetheless, the sustained interest in OSC research and its outputs remains apparent.

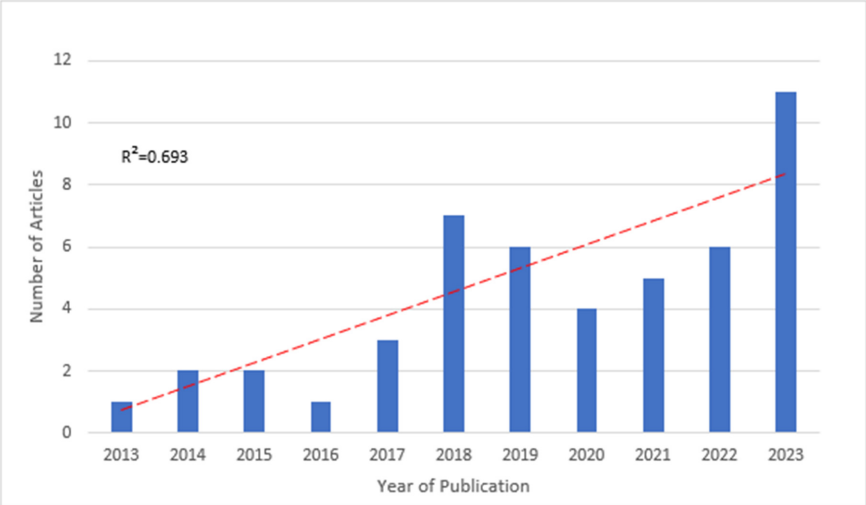

Figure 3. Yearly trend in published OSC articles in China from 2013 to 2023.

The 48 studies adopted several data collection methods on the barriers to the application of OSC (Figure 4). This involved the use of mixed methods (20 articles, 41.6%), questionnaires (14 articles, 29.2%), interviews (8 articles, 16.6%), workshops (1 articles, 2.1%), observations (1 articles, 2.1%), and other methods (3 articles, 8.4%). Nearly half of the research conducted employed a mixed-method approach to investigate the barriers; at total of 16 of which used both interviews and questionnaires, while others combined surveys and interviews with additional methods such as observation or group discussion [31–34]. Notably, studies [31,34] could arguably be considered mixed-methods, but they were classified as mono-method here for consistency in categorisation, as the use of additional methods was only briefly reported and not as a core part of the research design. These instruments are suitable because data on the importance and impact of barriers can be effectively gathered through the insights of practitioners and stakeholders. The superior adoption of questionnaires is especially justified, as they enable faster data collection, support quantitative analysis, and are widely used in construction management research [35]. Additionally, qualitative interviews serve as a valuable tool in construction management studies, as they allow for a deeper exploration of complex issues, enabling researchers to ask follow-up questions and examine sensitive topics more thoroughly [36].

Consequently, the studies included employed appropriate and robust methods to assess the barriers to the adoption of OSC.

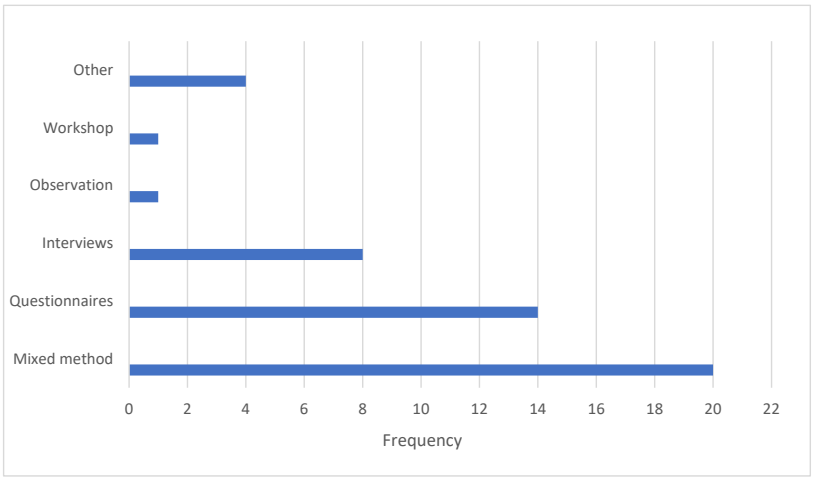

Figure 4. Distribution of data collection tools employed used in the reviewed papers.

The majority of reviewed articles did not specify a particular project type, and instead generally referred to "construction" or "buildings." Only a small number of articles focused specifically on housing construction [32,37–42], while one article was specific to high-rise construction [43] and another focused on mechanical, electrical, and plumbing (MEP) construction [33]. These project-type categories were derived from the articles reviewed. Future research would benefit from a more targeted focus on specific project types, as this approach can yield more specialised insights, enhance the relevance and applicability of findings, and ultimately improve the practical impact of future studies.

In relation to the various initiatives of the Chinese government, it is noteworthy that different terms are used in the OSC literature, such as prefabricated construction (PC) [44–46], prefabricated buildings (PB) [34,47,48], industrialised building system (IBS) [39,49], prefabricated housing production (PHP) [32,40], prefabrication [50], modular integrated construction (MIC) [43], and modern methods of construction (MMC). However, while MMC covers a broad range of methods that include OSC, not all MMC methods can be classified as OSC; although MMC technically encompasses a wide range of technologies, including OSC, not all MMC methods fall under OSC [4]. Since terminology can influence the formulation of policies and industry standards, recognising these varied terms highlights the potential need for more precise language in regulatory or professional guidelines. This could support more informed decision-making and establish clearer standards across the industry. Furthermore, identifying these differences in terminology clarifies the broader OSC field for readers, helping them navigate the literature more effectively and preventing potential misunderstandings. For researchers, awareness of alternate terms allows for more comprehensive searches of the literature, capturing a broader range of studies and contributing to a richer understanding of OSC research and practices.

Highlighting the journal distribution of articles included in the study is valuable, as it reflects the quality of the studies reviewed. The frequency distribution of these studies across peer-reviewed journals indicated that research on barriers forms a significant part of the scope within most construction management journals. This underscores the critical need for a comprehensive examination of these barriers and the development of an effective framework to address them. It can be observed that the majority of these journals are among the top-tier publications in construction engineering and management, suggesting that diverse, high-quality articles were incorporated in the review. Key journals include Journal of Sustainability, Cleaner Production, Engineering, Building, Construction and

Architectural Management, and Building Research and Information. This distribution provides a useful reference for future submissions on OSC barrier research, indicating the journals that welcome scholarly contributions in this area. A summary of the full metadata list of the 48 reviewed articles is provided in Table A2.

3.1. Barriers

Table 1 provides a summary of 40 barriers identified in the literature. Each article was reviewed for barriers, and a frequency count was recorded and attributed to the source article. Across the 48 reviewed papers, a total of 377 references to barriers were identified. The barriers were ranked by frequency in ascending order and categorised according to the PESTLE framework (political, economic, social, technical, legal, and environmental) to structure the discussion. In this context, political and legal barriers were grouped to streamline analysis. The PESTLE analysis approach, originally based on Professor Francis Aguilar's ETPS model [51], is a strategic tool used to identify and evaluate key external factors influencing an organisation. It has become widely applied over time, across different contexts, to support managers and professionals in making informed strategic decisions. The PESTLE framework is particularly valuable for systematic reviews because it provides a comprehensive and structured lens for categorising diverse findings. By examining political, economic, social, technological, legal, and environmental dimensions, it helps synthesise and categorise complex information, highlight patterns, and ensure that critical external influencing factors are not overlooked.

In examining the distribution of barriers across categories in Figure 5, it is clear that technical barriers are the most commonly cited, representing 39.0% of all references, while environmental barriers account for only 1%. This indicates a strong emphasis on technical and technological factors, with limited focus on environmental considerations. This minimal attention to environmental factors aligns with the nature of OSC, which inherently addresses numerous environmental concerns compared to traditional construction methods, naturally leading to fewer environmental challenges hindering its adoption. The Figure also highlights that social barriers are the second most frequently cited, representing 35.0% of total references. Alhawamdeh and Lee [52] emphasise that human factors are critical due to their direct and indirect impacts on the construction sector's performance. Political/legal and economic barriers follow, with percentages close to each other, accounting for 18% and 17%, respectively. Notably, despite governmental efforts to promote OSC implementation, political and legal barriers remain evident in China with three identified barriers related to governance included in the top five. Each category of barriers will be discussed in detail in the following sections.

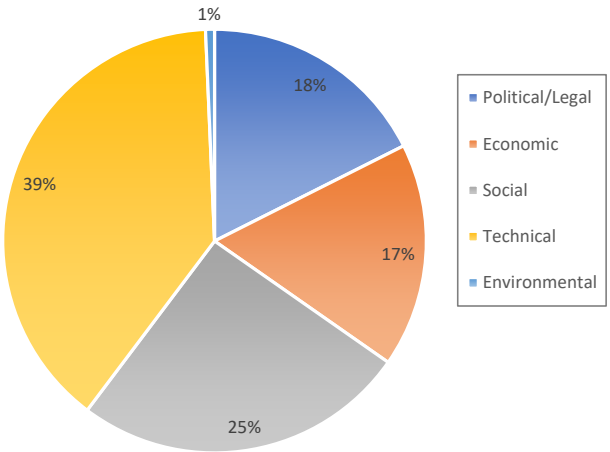

Figure 5. Barriers to OSC identified in the reviewed articles.

Table 1. Barriers to OSC identified in the reviewed articles.

No.	Barriers	Source	PESTLE Category	Freq.	Rank
B1	Limited OSC expertise and capabilities within the organisation	[19–22,24,31,33,34,37–40,43–45,48–50,53–65]	Social	31	1
B2	Absence of a design codes and national standards for prefabrications	[10,19–21,33,37–39,42–45,48–50,53–56,60,61,64–68]	Political/Legal Technical	26	2
B3	Poor integration and cooperation between value chain stakeholders	[19,32,34,38–40,42–45,48,50,55–59,61,64–67]	Social Technical	22	3
B4	Immature regulatory system/insufficient policy constraints	[10,19–22,33,37,39,40,45–48,54,56,57,59,61,68,69]	Political/Legal	21	4
B5	Lack of standardised management practices for OSC in project delivery/complexity in management	[10,21,22,39,41,48,49,53,54,56,60,63–67,70]	Technical	17	5
B6	Transportation limitations	[10,21,32,39,42,43,54,55,57,59,60,62–64,66,70]	Technical	16	6
B7	Increased project costs	[10,21,22,24,39,43–45,48,53,55–57,65,70]	Economical	15	7
B8	Limited government support and financial incentives	[10,20,37,38,44,48,55–57,66,68,71–73]	Economical Political/Legal	14	8
B9	Increased capital cost	[10,19,20,24,37–40,45,48,54–56,65]	Economical	14	8
B10	Limited knowledge and understanding of OSC's potential advantages	[10,21,22,32,44–46,54,56–58,65,71,73]	Social	14	8
B11	Insufficient facilities and supply chain alternatives/ restricted manufacturing capacity	[10,19–21,33,37,38,43,50,54,56,70,74]	Technical	13	11
B12	Low-quality/performance of prefabricated components	[10,20,21,31,33,37,38,54–56,61,62]	Technical	12	12
B13	Reluctance to change/conservative and risk-averse mindset	[10,19,21,22,38,39,45,46,54,55,57,63]	Social	12	12
B14	Site layout limitations	[10,21,24,38,39,54,55,57,59,63,74]	Technical	11	14
B15	Insufficient equipment and technologies for effective project delivery	[19,31,39,45,48,49,59,61,64,65]	Technical	10	15
B16	Inadequate promotion in the marketplace	[22,24,45,46,48,53,65,69,71]	Social	9	16
B17	Limited/uncertainty of market demand	[10,19,21,45,54,56,57,66,74]	Social	9	16
B18	Limited investment in research and development (R&D) across the sector	[19,45,46,48,53,56,57,71]	Economical	8	18
B19	Unfavourable building regulations	[10,21,22,43,44,48,54,66]	Political/Legal	8	19
B20	Limiting for aesthetic and creative or complex design	[10,21,38,43,54–56,63]	Technical	8	20
B21	Lack of design flexibility and adaptability to late-stage changes	[19,38,39,44,55,57,66]	Technical	7	21
B22	Insufficient information and guidance about OSC	[20,22,37,49,55,57,61]	Technical	7	21
B23	Lacking the ability to attain economies of scale	[19,33,39,44,48,56,60]	Economical	7	21
B24	Demand significant coordination and scheduling throughout the construction process	[21,43,54,63,65,67,70]	Technical	7	21
B25	Absence of certification and accreditation for manufacturing products/methods	[39,42,44,49,57,64]	Political/Legal	6	25
B26	Narrow range of standard prefabricated components/monotony of structure type	[19,38,39,57,64,75]	Technical Social	6	25
B27	Uncertainty over quality and performance	[22,38,39,47,57]	Social	5	27
B28	Prolonged lead times for finalised project planning and design stages	[38,39,55,57,65]	Technical Economical	5	27
B29	Inadequate/poorly defined business model	[10,21,43,54,56]	Economical	5	27
B30	Sceptical attitudes and unfavourable perceptions of OSC	[10,38,39,44]	Social	4	30
B31	High transportation costs	[22,24,44,57]	Economical	4	30
B32	Restrictive construction tolerances	[38,57,65,66]	Technical	4	30
B33	Complex interfaces that clash with traditional project process	[10,41,57,65]	Technical	4	30

Table 1. *Cont.*

No.	Barriers	Source	PESTLE Category	Freq.	Rank
B34	Project necessitates bespoke design/Modular design complexity	[41,43,55,63]	Technical	4	30
B35	Environmental constraints	[31,57,74]	Environmental	3	35
B36	Demand increased clarity, accuracy, and thorough decision-making during the initial planning phase	[38,43,59]	Technical	3	35
B37	Unsuitable standard contractual terms	[49,61]	Political/Legal	2	37
B38	Project condition	[43,70]	Technical Economical	2	37
B39	Difficulty in securing funding	[66]	Economical	1	39
B40	Lack or complicated quality assurance and control during project delivery	[64]	Technical	1	39
Total				377	

3.2. PESTLE Analysis

3.2.1. Political/Legal Barriers

Political and legal decisions play a crucial role in shaping the regulatory environment for OSC at a broad level. Consequently, barriers related to the enhancement of OSC regulations, policies, standards, and guidelines for prefabrication are pressing concerns (e.g., B2, B4, B8, B19, B25, and B37). In the early stages of OSC development, mandatory policies are particularly impactful. For instance, the absence of design codes and national standards for prefabrication (B2) and an immature regulatory system (B4), frequently cited in the reviewed literature, significantly influence project costs, quality control, economies of scale, and increase risks associated with the effective and successful completion of projects [19,24,33,48,57].

An effective legal framework and procedural standards are essential for successful OSC implementation that guides the actions of developers, designers, contractors, and government officials throughout the construction process [19]. Standardised and uniform design in prefabrication allows clients to improve construction efficiency and optimise material usage by reducing engineering modifications, maintenance costs, and waste generation during building construction [24]. However, these policies and regulations must be regularly updated in line with OSC development to ensure compliance and quality as the industry matures; otherwise, they risk limiting flexibility, hindering progress, and elevating costs [16,76].

Preferential policies serve as incentives, particularly during the middle stage of OSC development. A persistent concern is the lack of governmental financial support or incentives for OSC application (B8), which has perhaps contributed to its moderate uptake in China. Government subsidy policies, such as tax breaks for companies using OSC methods, fee reductions, grants for R&D investment, or minimum assembly rate requirements, play a significant role in shaping the production and operational decisions of building developers and influencing the OSC market [14,73]. These incentives make OSC financially attractive, encouraging stakeholders to invest during the industry's growth phase [16,37,55]. Such measures are crucial for building momentum after the initial adoption phase, creating a foundation for OSC as a viable industry.

In the middle and, especially, later stages of OSC development, policies promoting continuous improvement and expansion become essential, shifting focus from direct financial incentives to fostering innovation, quality, and sustainability. For instance, government-backed certification and accreditation programmes (e.g., B25) that recognise high standards in sustainable OSC practices encourage companies to uphold or elevate their standards as the industry matures [39,44,49]. Such programmes, which emphasise long-term quality

and environmental impact, provide the necessary support to guide the industry toward self-sustained growth at maturity without relying on direct financial incentives.

Given the ambitious target set in China's Fourteenth Five-Year Plan (2021–2025) to achieve 100% OSC for new homes by 2035 [15], the barriers discussed above represent critical challenges that require immediate attention. Despite substantial governmental support for OSC, it is noteworthy that seven recent review articles [9,10,21,45,57,66] identify limited market demand as a critical barrier (B18), all of which were published post 2018. This suggests that additional forms of government incentives may be necessary to foster greater OSC adoption and meet the plan's objectives.

3.2.2. Economic Barriers

Challenges in adopting OSC and implementing cost-effective solutions are closely tied to economic barriers, reflecting their impact on overall business profitability compared with traditional construction methods. The current construction practices and management approaches are falling short of expected financial returns due to inefficiencies, frequent errors, heightened risks, poor resource management, unreliable supply chains, extended project timelines, and inadequate safety records. These traditional models are increasingly ineffective, necessitating a shift toward more efficient business frameworks that embrace modern methods of construction (MMC) as central elements of the system. This is evidenced by barrier B29, where an inadequate or poorly defined business model has been a limiting factor in promoting OSC within the Chinese construction industry.

Primarily, OSC is associated with higher capital costs (B9), which, in turn, raise overall project costs (B7). This cyclical impact affects both construction teams and clients, often deterring OSC project implementation despite its long-term benefits. Capital cost is a significant concern for OSC investors due to the high initial funding required for specialised equipment, new machinery, mould fabrication, prefabrication facilities, skilled labour, storage space, and additional costs associated with contractual liabilities and supply chain management [24,50]. Mao et al. [77] reported that the incremental cost of using prefabrication methods could range from 27% to 109% compared to traditional construction methods. Although OSC has demonstrated cost-effectiveness and lifecycle savings [7], improper management can result in significant cost overruns, imposing a considerable financial burden on construction companies. For example, delays in component deliveries can increase schedule delays and result in additional costs for hired equipment and labour, while issues like tower and mobile crane breakdowns can halt installation and further extend schedules.

Despite evidence in the OSC literature highlighting long-term cost benefits, such as reduced storage costs, improved worker health and safety, waste reduction, minimised rework, and decreased project delays due to weather, construction stakeholders, including architects, project managers, surveyors, and contractors, often overlook these gains in favour of immediate cost concerns [7]. Additionally, increased project costs are reinforced by barriers such as the challenge of achieving economies of scale in OSC (B23), particularly given the repetitive nature of component and panel production, as well as extended lead times that directly impact costs (B28) [38]. Large-scale module production can help distribute fixed costs across a greater volume, allowing Chinese construction clients and contractors to potentially achieve economies of scale and thereby reduce average production and project costs. Furthermore, transport costs associated with delivering components to the construction site (B31) remain a barrier, particularly given fuel price volatility and the need for specialised vehicles [22,24,44,57].

As noted previously, insufficient government subsidies and incentives (B8) are a barrier to the wider adoption of OSC. Increased national and provincial support has

been suggested as necessary to encourage OSC projects. However, given that the nature of construction industry is highly fragmented, and stakeholders often resist innovation and follow conservative practices [22,45], government intervention plays a crucial role in OSC implementation. For instance, in Hong Kong, private developers receive gross floor area concessions when incorporating OSC [55]. Finally, many of the reviewed articles highlight a general lack of R&D in China's construction sector (B18), which may underlie several of the barriers identified in Table 1.

3.2.3. Social Barriers

Social barriers were the second most frequently cited category among the reviewed articles, covering various human factors linked to stakeholders' attitudes and behaviours toward OSC. Multiple studies emphasise how critical these behaviours are for the successful adoption of OSC in the construction sector.

The most significant social barrier identified was the limited OSC expertise and capabilities within organisations (B1), cited 31 times and representing nearly 10% of all references to the 40 barriers in Table 1. Expertise in OSC among suppliers, contractors, and designers is essential to successfully shift from traditional, labour-intensive approaches to scale-intensive methods. In a competitive market, experienced suppliers can provide high-quality components at reasonable prices, designers can offer diverse designs, and contractors can be better equipped to apply OSC methods effectively [44]. However, this expertise alone is insufficient without effective communication and coordination among project participants (B3). A core principle in the architecture, engineering, and construction (AEC) industries is that project success relies on seamless communication, information sharing, and collaboration among multidisciplinary stakeholders to deliver optimal value [20,42,65]. While technical mechanisms, such as communication and collaboration platforms, can support these needs, the role of industry stakeholders remains central. For instance, the vertical fragmentation of the construction industry often limits contractors' involvement in early decision-making, hindering the development of effective OSC implementation plans and proposals [57].

Resistance to adopting OSC (B13) was also notably cited, with emphasis on the conservative and risk-averse nature of the industry, organisations, and individuals. The transition toward digital and more sustainable construction involves functional, formative, and skills-based challenges that much of the traditional industry is likely to resist [20,37]. In this context, establishing appropriate mandatory regulations and incentive policies is essential and could make a substantial impact on increasing OSC adoption.

Furthermore, four review articles noted that scepticism and negative perceptions toward OSC (B30) persist within the sector [10,38,39,44]. Barriers B16, B17, B26, and B27 further support this view, highlighting issues such as limited market demand, lack of market promotion, a narrow range of standard prefabricated components, monotony in structural types, and uncertainty over the performance and quality of OSC projects. These factors collectively influence the perceptions and willingness of construction stakeholders, including clients, contractors, and owners, to adopt or invest in prefabricated buildings. Importantly, perhaps barrier B10 encapsulates this overarching social concern, as there remains a general lack of awareness of OSC's benefits across China, particularly among owners and developers.

3.2.4. Technical Barriers

Technical barriers encompass the availability of infrastructure, procedures, equipment, tools, and innovative processes and technological solutions essential for design and standardisation in the implementation of OSC. The term Modern Methods of Construction

(MMC) describes innovative construction processes and technologies that deviate from conventional onsite practices, frequently incorporating OSC solutions to enhance the efficiency, sustainability, and cost-effectiveness of building design and construction. In the reviewed literature, approximately half of the barriers to OSC adoption are attributed to technical factors, underscoring their importance for acceptance and implementation. As shown in Table 1, four of the ten highest-ranked barriers are technical. These technical barriers can be grouped into those related to the design of OSC (B2, B20, B21, B32, B33, and B34), the 'product' outcomes of OSC (B12, B26, and B38), and the OSC process itself (B3, B5, B6, B11, B14, B15, B22, B24, B28, B36, and B40).

The absence of standardised design codes and national standards for prefabrication (B2) is identified as the second most significant barrier to the widespread adoption of OSC. This gap presents both a regulatory and technical challenge, as these standards are crucial for aligning onsite implementation with offsite fabrication processes. Design codes and national standards set clear expectations for quality, safety, and technical requirements, which are essential for the seamless integration of prefabricated components, particularly when multiple manufacturers are involved in an OSC project [53,54]. Without these standards, ambiguity in specifications can lead to discrepancies, delays, and additional costs during construction. This misalignment also creates uncertainty among stakeholders, potentially slowing the adoption of OSC practices.

Establishing comprehensive standards and codes is therefore essential for streamlining processes in OSC. This need is further underscored by barriers B5, B24, and B36, which highlight the demand for standardised management practices, extensive coordination and scheduling across the construction process, and enhanced accuracy during the initial planning phase—all of which are critical for effective and efficient oversight of OSC processes. Given the precise technical requirements of OSC during the planning, production, and construction stages, as well as the limited experience in implementing OSC in Chinese construction (as noted in B1), there is a pronounced need for accuracy and strict adherence to specifications. This complexity calls for meticulous attention to details, making standardised practices indispensable for successful OSC implementation [39,46,67].

Among OSC product-related barriers, the poor quality of prefabricated components (B12) emerges due to the underperformance of building parts. While OSC is expected to improve quality assurance and control by shifting production and construction to a more controlled environment, thus minimising defects and onsite disruptions. Nevertheless, scepticism about its effectiveness persists. Negative experiences, such as instances of poor OSC performance leading to issues like building leaks, low quality, and architectural monotony, continue to fuel this scepticism [37].

Technical barriers were predominantly process-oriented, with key challenges such as poor stakeholder cooperation and integration (B3), transportation constraints (B6), limited facilities and supply chain options (B11), and site layout challenges (B14). The lack of technological infrastructure for collaboration, such as digital platforms within the OSC supply chain, hinders effective integration and clear communication among stakeholders, limiting the sharing of experiences and best practices [40]. The construction industry's vertical fragmentation creates a design information gap between manufacturers and designers, restricts contractor involvement in early project planning, and results in inadequate transitions of design data and inconsistent logistics information [22,45,57]. These challenges can lead to significant delays, especially given OSC projects' tight schedules and costly assembly equipment.

Transport limitations (B6) were also highlighted as a significant concern, influencing clients' and developers' willingness to adopt OSC, as noted in 16 studies. These limitations stem from logistical constraints, such as module and component size, transportation timing, costs, and route conditions [62]. Luo et al. [60] further emphasised the challenges of transport-

ing prefabricated components under limited investment and resources, including factors like transportation mode, distance, and route. Additionally, restricted availability of facilities and supply chain options often extend transportation distances, complicating the planning and identification of the most time and cost-efficient routes for projects [54].

3.2.5. Environmental Barriers

Only one environmental barrier was identified, which aligns with expectations, as OSC, by its very nature, inherently addresses several environmental concerns more effectively than traditional construction methods. These include reduced construction waste from improved workmanship and onsite storage practices, lower carbon emissions from minimised material and equipment deliveries, and decreased site operative travel. A general environmental barrier (B35) was used to capture risks from external natural factors such as unexpected or extreme weather events, fires, and earthquakes, which can disrupt construction activities [31,57,74].

While only one environmental barrier (B35) was identified, its limited representation in the literature does not necessarily imply a lack of relevance. Instead, it may reflect the fact that environmental factors are often embedded within broader technical, regulatory, or social considerations, and, thus, are less frequently classified as stand-alone barriers in published studies. For example, issues relating to carbon emissions, energy efficiency, or waste management may be discussed in the context of government policy or technological performance rather than explicitly labelled as "environmental."

3.3. Analysis of Barriers by Timeframe

Figure 6 illustrates the barriers identified in this review over the period 2013–2023, enabling a comparative analysis of the survey years for each barrier. Cooler colours (green, blue, and purple) represent articles from earlier years starting in 2013, while warmer colours (red, orange, and yellow) highlight more recent publications. The analysis shows a notable increase in attention to most barriers over the last six years, marking a shift from the narrower focus observed before 2018. This trend suggests a parallel rise in both the volume of papers published (as described in Section 3) and depth of attention to barriers in OSC, reflecting the growing interest in OSC as a sustainable solution to address development demands within China's construction industry and urbanisation reforms in recent years.

In this context, the Chinese central and regional governments have implemented a range of regulations, policies, and strategies to advance the development of OSC. The promotion and application of OSC have reached a national strategic level, leading to the establishment of numerous demonstration cities and industrial bases. For example, cities such as Chongqing, Beijing, and Shenzhen have mandated the adoption of OSC for affordable housing [21,54]. In March 2016, the Chinese State Council issued the "Guidelines on the Development of Prefabricated Buildings," followed by the launch of China's Fourteenth Five-Year Plan (2021–2025) in November 2019. This plan seeks to foster a smarter, greener, and safer construction industry, aiming to modernise the industrial chain, promote green and low-carbon production practices, integrate advanced information technologies, and improve building quality [15]. By 2025, the plan mandates that 30% of all new construction nationwide be completed using prefabricated methods, with specific key city clusters designated as key areas for implementation. In 2020, at the 75th session of the United Nations General Assembly, China committed to the ambitious goals of achieving carbon peaking by 2030 and carbon neutrality by 2060 [48]. These policy developments have significantly increased attention to OSC practices in China.

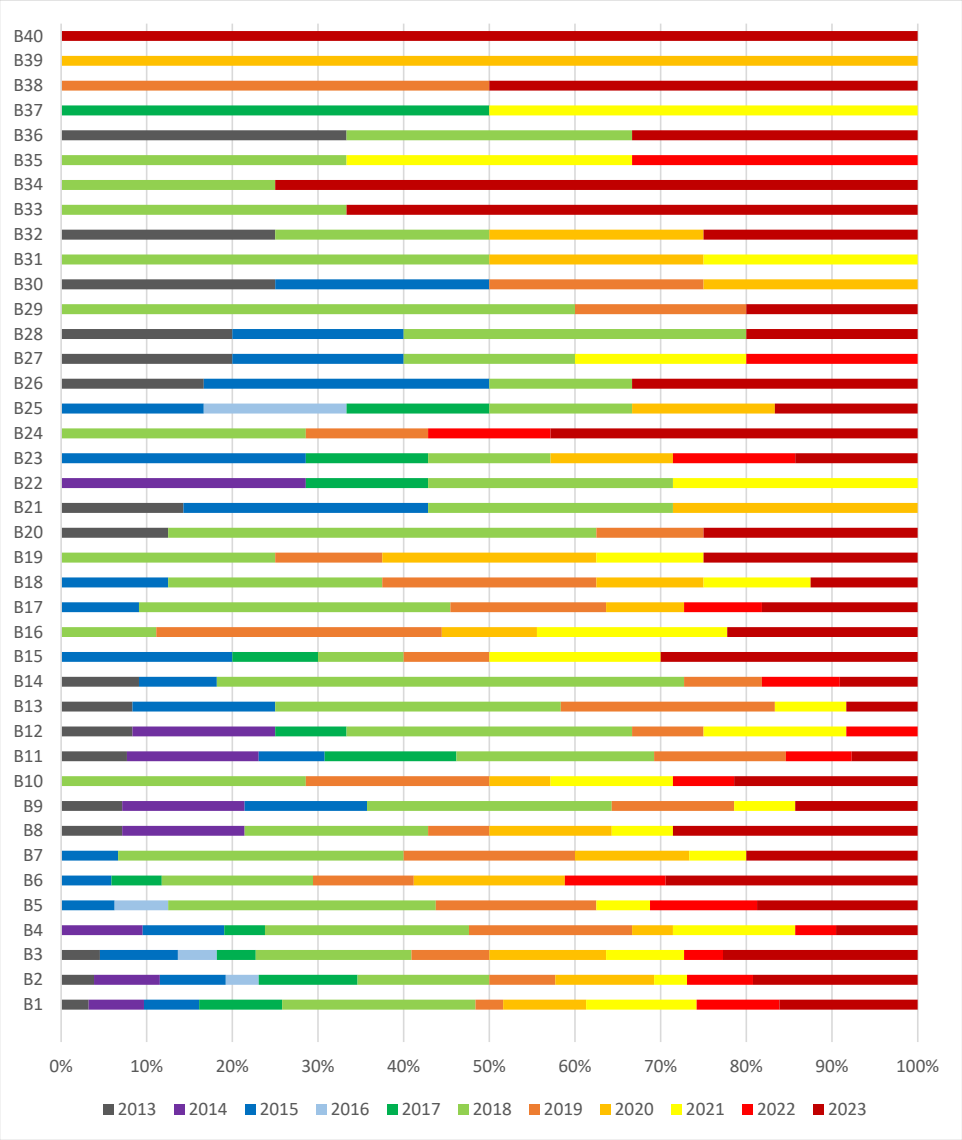

Figure 6. Distribution of barriers by year of article publication.

Based on these regulatory milestones, two main periods can arguably be identified, as indicated by the data in Figure 6. In the initial period from 2013 to 2017, limited focus was given to most barriers impacting OSC development, largely due to the foundational regulatory and policy developments that began in 2016. However, certain barriers, specifically B1, B2, B3, B9, and B11, received modest attention, reflecting the early-stage focus on essential areas that underpin broader OSC adoption. In the subsequent period, from 2018 to 2023, following the initial implementation of key policies, plans, and protocols, China's construction sector has gradually shifted from a traditional, extensive model to a scale-intensive approach. This transition resulted in an increased research focus on various OSC-related barriers, particularly B1, B2, B3, B4, B5, B6, B8, B10, B11, and B13. These barriers represent foundational elements essential for OSC implementation, including the need for relevant skills and knowledge, industry fragmentation, limited OSC infrastructure, lack of standardisation and supportive regulatory frameworks, and the need to raise public and investor awareness of OSC's benefits and significance. As such, these areas became priorities within the sector.

This foundational focus underscores the need to establish a robust base and capabilities that support the long-term success of OSC in China, given that the sector remains in

a developmental phase. Consequently, it is logical that the emphasis has largely been on building these core aspects of OSC. Nonetheless, it is also evident from the figure that recent years have demanded more advanced solutions to address specific challenges, such as enhancing the quality of prefabricated components, developing new business models, utilising advanced technologies for effective project delivery, and expanding the OSC market (B12, B15, B16, B17, B18, B22, B25, B27, and B29). Additionally, addressing the sector's limited investment in research and development (B18) will support both the refinement of existing practices and the broader success of OSC in China.

4. Conclusions

The OSC method is energy-efficient, environmentally friendly, labour-saving, and promotes improved construction quality and safety, alongside faster project completion times, aligning well with the sustainable development goals for the industry. Although the benefits of OSC are widely recognised by governments, adoption among construction stakeholders in China has remained limited. This paper provides a comprehensive understanding of the factors hindering the adoption of OSC among industry stakeholders. It highlights existing trends and gaps that, if addressed, could promote increased OSC adoption in China, which can contribute to improving the execution and delivery of construction projects, with a focus on the organisational, political, economic, environmental, and social dimensions of governance. A total of 48 articles published from 2013 to 2023 were selected for analysis. The annual publication trend indicates a growing interest in OSC, with a significant increase over the past five years, during which 81.25% of the reviewed articles were published. Notably, 23% of the articles were published in 2023 alone. The studies included in this review used rigorous and suitable methods to assess barriers to OSC adoption, resulting in reliable findings.

Most of the reviewed articles did not specify a particular project type, instead generally referring to "construction" or "buildings." Future research could benefit from a more focused approach on specific project types, as this could yield more specialised insights and enhance the relevance and applicability of findings for future studies. This review identified a total of 40 barriers, which were classified using PESTLE analysis (Political, Economic, Social, Technical, Legal, and Environmental). Over one-third of all references to barriers (39.0%) were technical barriers related to OSC design and products, and have the most significant effect on successful adoption. Logistical constraints, risks, and uncertainties associated with OSC design and processes can significantly influence project performance and outcomes. Social barriers were the second most frequently cited, accounting for 25.0% of all references. This underscores the critical role of construction stakeholders' behaviours and attitudes in the successful adoption of OSC within the sector.

Following closely are political/legal and economic barriers, which account for 18% and 17%, respectively. Notably, despite governmental efforts to promote OSC, political and legal barriers remain prominent in China, with three governance-related barriers appearing among the top five. Environmental barriers comprised only 1% (one barrier). This suggests a strong emphasis on technical and technological challenges, with limited attention to environmental issues—a result expected given that OSC inherently addresses many environmental concerns more effectively than traditional construction, resulting in fewer environmental obstacles to adoption. The most frequently cited barriers within each category were as follows:

1. Absence of a design code and national standards for prefabrications (political/legal).
2. Increased project costs (economic).
3. Limited OSC expertise and capabilities within the organisation (social).
4. Poor integration and cooperation between value chain stakeholders (technical).

5. Environmental constraints (environmental).

A limitation of this study is the restricted range of citation databases utilised in the systematic review. Expanding the database sources could uncover additional barriers and increase the number of relevant articles, allowing for a more comprehensive analysis. Future research could also build on this paper's findings by examining and clarifying the root causes behind the enduring barriers to OSC adoption. Further studies could extend our findings by exploring correlations, weighting mechanisms, or systematic patterns among the identified barriers.

5. Policy and Regulatory Recommendations

This paper analyses factors hindering OSC adoption, highlighting trends and gaps that could impede future uptake if left unaddressed. Enhancing the leading role of the government and professional bodies in promoting OSC is vital, as it is suggested that both mandatory and incentive regulation will encourage stakeholders and decision-makers to adopt OCS. Based on this research, the following policies and regulations are recommended:

- Professional training programmes should be made available for construction industry practitioners to strengthen their knowledge and expertise in prefabrication and OSC. Such programmes enable construction enterprises to build the capability needed to successfully transition to OSC. Designers can then deliver smarter and more integrated designs, while consultants gain the confidence to communicate its benefits to clients and recommend OSC, helping to reduce hesitation toward adoption. For contractors, training ensures they are better equipped to apply OSC and manage its logistics effectively. Ultimately, clients and developers can gain a full understanding of the value of OSC, increasing their confidence and making them more likely to demand OSC solutions. Additionally, since OSC technologies have not yet been prioritised in Chinese higher education, it is important to introduce new subjects and update existing curricula in construction-related programmes to incorporate necessary knowledge.
- The establishment of a standardisation system as a foundation element of OSC development. One of the key means of achieving standardisation is to establish comprehensive and mature procedural standards and robust legal frameworks that guide the decisions of construction stakeholders including developers, clients, consultants, designers, contractors, and regulatory bodies throughout the construction process. This supports higher quality, reduces engineering errors, modifications, and maintenance costs, and ultimately optimises material usage while minimising construction waste. Additionally, establishing a modulus-based standard system for OSC enables harmonised fittings and components, ensuring standardised production and interchangeability, efficient installation, economies of scale, and reduced costs.
- Providing financial incentives can largely encourage stakeholders to adopt OSC. Offering tax breaks such as reductions, exemptions, or lower provincial rates, would help ease developers' tax burden and make OSC more attractive. At the same time, governments can introduce mandatory measures to discourage heavy reliance on traditional construction, such as by imposing higher taxes on enterprises that continue using such methods. Gradually, tax instruments such as energy taxes and carbon taxes could be applied in the OSC market, with rates adjusted according to their environmental impact. Additionally, offering expedited permits and granting pre-sale permits in advance would further support construction enterprises by reducing approval delays, accelerating project timelines, and improving cash flow.
- The establishment of a cost management system and efficient business model for OSC is key to reduce production and project cost. Such a system can improve cost control, enhance efficiency, and ultimately increase the revenue of enterprises, improving the

maturity of the market. Additionally, by formulating and monitoring appropriate market prices for prefabricated components, demand can be aligned with the purchasing capacity of different stakeholders. This approach not only stimulates market demand but also fosters healthy competition, encouraging wider adoption of OSC.

- The establishment of an information exchange platform for OSC can greatly enhance communication and collaboration among different stakeholders. Such a platform would allow stakeholders to share experiences and best practices, reduce information asymmetry, and facilitate the development of standardised prefabricated designs. Additionally, it could support the dissemination of cutting-edge knowledge on OSC, helping to accelerate adoption and improve overall industry performance.

Author Contributions: Conceptualisation, M.A. and A.L.; methodology, M.A. and A.L.; validation, M.A. and A.L.; formal analysis, M.A.; investigation, M.A.; data curation, M.A.; writing—original draft preparation, M.A. and A.L.; writing—review and editing, M.A. and A.L.; visualisation, M.A.; supervision, M.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data sharing is not applicable to this article as no new data were created in this study.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Mixed Methods Appraisal Tool (MMAT) assessment of study quality.

First Athor, Year, Citation Number	All Studies		Qualitative Studies					Quantitative Non-Randomised					Quantitative Descriptive					Mixed Methods					Score
	S1	S2	1.1	1.2	1.3	1.4	1.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5	
Zhai, 2013 [38]	Y	Y											Y	Y	Y	C	Y						80%
Rahman, 2014 [20]	Y	Y											Y	Y	Y	Y	Y						100%
Zhang, 2014 [37]	Y	Y											Y	Y	Y	Y	Y						100%
Luo, 2015 [39]	Y	Y	Y	Y	C	Y	Y						Y	Y	Y	C	Y	Y	Y	Y	N	C	70%
Mao, 2015 [19]	Y	Y	Y	Y	C	Y	Y						Y	N	Y	C	Y	Y	Y	Y	C	Y	70%
Li, 2016 [42]	Y	Y	Y	Y	Y	Y	Y																100%
Li, 2017 [33]	Y	Y	Y	Y	Y	Y	Y	Y	C	Y	Y	Y						Y	Y	Y	Y	Y	90%
Gan, 2017 [49]	Y	Y	Y	Y	Y	Y	N						Y	Y	Y	Y	Y	Y	Y	Y	N	Y	85%
Xue, 2017 [50]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Hong, 2018 [24]	Y	Y	Y	Y	Y	Y	N	C	Y	Y	Y	Y						Y	Y	Y	Y	Y	85%
Ji, 2018 [59]	Y	Y	Y	Y	Y	Y	C	N	Y	Y	Y	Y						Y	Y	Y	Y	C	80%
Gan, 2018 [54]	Y	Y	Y	Y	Y	Y	Y																100%
Gan, 2018 [21]	Y	Y						N	Y	Y	Y	Y											80%
Zhang, 2018 [55]	Y	Y	Y	Y	Y	Y	N						Y	Y	Y	Y	Y	Y	Y	Y	N	Y	85%
Jiang, 2018 [56]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Han, 2018 [57]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Wu, 2019 [45]	Y	Y						Y	Y	Y	Y	Y											100%
Gan, 2019 [10]	Y	Y	Y	Y	N	Y	Y																80%
Dou, 2019 [46]	Y	Y						Y	Y	Y	Y	Y											100%
Dou, 2019 [70]	Y	Y	Y	Y	Y	Y	C	Y	Y	Y	Y	Y						Y	Y	Y	C	Y	85%
Li, 2019 [71]	Y	Y	Y	Y	N	Y	Y																80%
Gong, 2019 [32]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Li, 2020 [66]	Y	Y						Y	Y	Y	Y	Y											100%
Yuan, 2020 [34]	Y	Y	Y	Y	Y	Y	Y																100%
Jiang, 2020 [44]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Dang, 2020 [53]	Y	Y	Y	Y	Y	C	C	Y	Y	Y	C	Y						Y	Y	Y	Y	C	70%

Table A1. *Cont.*

First Athor, Year, Citation Number	.5 All Studies		Qualitative Studies					Quantitative Non-Randomised					Quantitative Descriptive					Mixed Methods					Score
	S1	S2	1.1	1.2	1.3	1.4	1.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5	
Wu, 2021 [40]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Ji, 2021 [31]	Y	Y	Y	Y	Y	Y	Y																100%
Zhang, 2021 [61]	Y	Y	Y	Y	Y	Y	Y																100%
Li, 2021 [22]	Y	Y											Y	Y	Y	NA	Y						80%
Wang, 2021 [72]	Y	Y						Y	Y	Y	Y	Y											100%
Li, 2022 [58]	Y	Y						N	Y	Y	Y	Y											80%
Zhang, 2022 [67]	Y	Y	Y	Y	Y	C	C						Y	N	Y	Y	Y	Y	Y	Y	N	C	65%
Luo, 2022 [60]	Y	Y											Y	Y	Y	Y	Y						100%
Shang, 2022 [47]	Y	Y						Y	Y	Y	NA	Y											80%
Yang, 2022 [62]	Y	Y						Y	Y	Y	NA	Y											80%
Lu, 2022 [75]	Y	Y	Y	Y	Y	Y	C	Y	Y	Y	C	Y						Y	Y	Y	N	C	70%
Pan, 2023 [43]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Cao, 2023 [69]	Y	Y						Y	Y	Y	Y	Y											100%
Sun, 2023 [68]	Y	Y						Y	Y	Y	Y	Y											100%
Wang, 2023 [48]	Y	Y	Y	Y	Y	Y	C	C	Y	Y	Y	Y						Y	Y	Y	Y	Y	85%
Zhai, 2023 [76]	Y	Y	Y	Y	Y	Y	Y																100%
Dou, 2023 [73]	Y	Y	Y	Y	N	Y	Y																80%
Liu, 2023 [74]	Y	Y						C	Y	Y	NA	Y											60%
Sing, 2023 [63]	Y	Y						N	Y	Y	Y	Y											80%
Zhang, 2023 [64]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	100%
Chen, 2023 [41]	Y	Y	Y	Y	Y	Y	Y																100%
Wuni, 2023 [65]	Y	Y											Y	Y	Y	C	Y						80%

Y: Yes, N: No, NA not applicable, C: Cannot determine. All studies—screening questions: S1: Are there clear research questions? S2: Do the collected data allow to address the research questions? Qualitative studies: 1.1: Is the qualitative approach appropriate to answer the research question? 1.2: Are the qualitative data collection methods adequate to address the research question? 1.3: Are the findings adequately derived from the data? 1.4: Is the interpretation of results sufficiently substantiated by data? 1.5: Is there coherence between qualitative data sources, collection, analysis and interpretation? Quantitative non-randomised studies: 3.1. Are the participants representative of the target population? 3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)? 3.3. Are there complete outcome data? 3.4. Are the confounders accounted for in design and analysis? 3.5. During the study period, is the intervention administered (or exposure occurred) as intended? Quantitative descriptive studies: 4.1. Is the sampling strategy relevant to address the research question? 4.2. Is the sample representative of the target population? 4.3. Are the measurements appropriate? 4.4. Is the risk of nonresponse bias low? 4.5. Is the statistical analysis appropriate to answer the research question? Mixed methods studies: 5.1. Is there an adequate rationale for using mixed methods design to address the research question? 5.2. Are the different components of the study effectively integrated to answer the research question? 5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted? 5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? 5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Appendix B

Table A2. Summary of the reviewed articles.

Paper Title	Citation Number	Journal	Year	Methodology	Project Type	OSC Term
Factors impeding the offsite production of housing construction in China: an investigation of current practice	[38]	Construction Management and Economics	2013	Questionnaire	Housing	Offsite production
Barriers of Implementing Modern Methods of Construction	[20]	Journal of management in engineering	2014	Questionnaire	General Buildings	MMC
Exploring the challenges to industrialised residential building in China	[37]	Habitat International	2014	Questionnaire	Housing	IBS
Risk factors affecting practitioners' attitudes toward the implementation of an industrialized building system A case study from China	[39]	Engineering, Construction & Architectural Management	2015	Mixed Method	Housing	IBS
Major Barriers to Off-Site Construction: The Developer's Perspective in China	[19]	Journal of Management in Engineering	2015	Mixed Method	General Buildings	OSC
Schedule risks in prefabrication housing production in Hong Kong: a social network analysis	[42]	Journal of cleaner production	2016	Interviews	Housing	Prefabrication
Modular and Offsite Construction of Piping: Current Barriers and Route	[33]	Applied Sciences	2017	Mixed Method	MEP construction	Prefabrication
Critical Factors Affecting the Quality of Industrialized Building System Projects in China	[49]	Sustainability	2017	Mixed Method	General Buildings	IBS
Factors Affecting the Capital Cost of Prefabrication—A Case Study of China	[50]	Sustainability	2017	Mixed Method	General Buildings	Prefabrication
Barriers to promoting prefabricated construction in China: A cost benefit analysis	[24]	Journal of Cleaner Production	2018	Mixed Method	General Buildings	PC
Assessing and Prioritising Delay Factors of Prefabricated Concrete Building Projects in China	[59]	Applied sciences	2018	Mixed Method	General Buildings	PC
Barriers to the transition towards off-site construction in China: An Interpretive structural modeling approach	[54]	Journal of Cleaner Production	2018	Interviews	General Buildings	OSC
Overcoming barriers to off-site construction through engaging stakeholders: A two-mode social network analysis	[21]	Journal of Cleaner Production	2018	Questionnaire	General Buildings	OSC
The hindrance to using prefabrication in Hong Kong's building industry	[55]	Journal of Cleaner Production	2018	Mixed Method	General Buildings	PC/PBs
Constraints on the Promotion of Prefabricated Construction in China	[56]	Sustainability	2018	Mixed Method	General Buildings	PC
Identifying barriers to off-site construction using grey DEMATEL approach: case of China	[57]	Journal of Civil Engineering & Management	2018	Mixed Method	General Buildings	OSC

Table A2. *Cont.*

Paper Title	Citation Number	Journal	Year	Methodology	Project Type	OSC Term
Factors influencing the application of prefabricated construction in China: From perspectives of technology promotion and cleaner production	[45]	Journal of Cleaner Production	2019	Questionnaire	General Buildings	PC/PBs
Exploring the interaction among factors impeding the diffusion of prefabricated building technologies: Fuzzy cognitive maps	[10]	Engineering Construction & Architectural Management	2019	Interviews	General Buildings	PC
Measuring the Factors that Influence the Diffusion of Prefabricated Construction Technology Innovation	[46]	KSCE Journal of Civil Engineering	2019	Questionnaire	General Buildings	PC
Factors Influence China's Off-Site Construction Technology Innovation Diffusion	[70]	Sustainability	2019	Mixed Method	General Buildings	OSC
ISM-based relationship among critical factors that affect the choice of prefabricated concrete buildings in China	[71]	International Journal of Construction Management	2019	Interviews	General Buildings	PBs
Modeling Constraints for the On-Site Assembly Process of Prefabrication Housing Production: A Social Network Analysis	[32]	Sustainability	2019	Mixed Method	Housing	PHP
Research on investment risk influence factors of prefabricated building projects	[66]	Journal of Civil Engineering & Management	2020	Questionnaire	General Buildings	PC
Research on the Barrier Analysis and Strength Measurement of a Prefabricated Building Design	[34]	Sustainability	2020	Observation	Housing	PBs
Factors affecting prefabricated construction promotion in China: A structural equation modeling approach	[44]	PLoS ONE	2020	Mixed Method	General Buildings	PC
Critical Factors Influencing the Sustainable Construction Capability in Prefabrication of Chinese Construction Enterprises	[53]	Sustainability	2020	Mixed Method	General Buildings	PC
Factors influencing transaction costs of prefabricated housing projects in China: developers' perspective	[40]	Engineering, Construction & Architectural Management	2021	Mixed Method	Housing	PHP
Factors Influencing Sleeve Grouting Quality for Prefabricated Building: An Interpretive Structural Modeling Approach	[31]	Advances in Civil Engineering	2021	Interviews	General Buildings	PBs
Identification of Critical Factors Influencing Prefabricated Construction Quality and Their Mutual Relationship	[61]	Sustainability	2021	Workshop	General Buildings	PC
Barriers to the development of prefabricated buildings in China: a news coverage analysis	[22]	Engineering, Construction & Architectural Management	2021	Other	General Buildings	PBs

Table A2. *Cont.*

Paper Title	Citation Number	Journal	Year	Methodology	Project Type	OSC Term
Analysing factors affecting developers' behaviour towards the adoption of prefabricated buildings in China	[72]	Environment, Development & Sustainability	2021	Questionnaire	General Buildings	PBs
Diffusion prediction of prefabricated construction technology under multi-factor coupling	[58]	Building Research & Information	2022	Questionnaire	General Buildings	PC
Critical Factors Influencing Interface Management of Prefabricated Building Projects: Evidence from China	[67]	Sustainability	2022	Mixed Method	General Buildings	PBs
Fuzzy Cognitive Map-Enabled Approach for Investigating the Relationship between Influencing Factors and Prefabricated Building Cost Considering Dynamic Interactions	[60]	Journal of Construction Engineering & Management	2022	Questionnaire	General Buildings	PBs
The Efficiency of the Chinese Prefabricated Building Industry and Its Influencing Factors: An Empirical Study	[47]	Sustainability	2022	Other	General Buildings	PBs
Network Model Analysis of Quality Control Factors of Prefabricated Buildings Based on the Complex Network Theory	[62]	Buildings	2022	Other	General Buildings	PBs
Influencing Factors Analysis of Supply Chain Resilience of Prefabricated Buildings Based on PF-DEMATEL-ISM	[75]	Buildings	2022	Mixed Method	General Buildings	PBs
Implementing modular integrated construction in high-rise high-density cities: perspectives in Hong Kong	[43]	Building Research & Information	2023	Mixed Method	General Buildings	MIC
Evaluating risk in prefabricated building construction under EPC contracting using structural equation modeling: a case study of Shaanxi Province, China	[69]	Buildings	2023	Questionnaire	General Buildings	PBs
Research on the Restrictive Factors of Vigorous Promotion of Prefabricated Buildings in Yancheng under the Background of "Double Carbon"	[68]	Sustainability	2023	Questionnaire	General Buildings	PBs
Research on the Barriers and Strategies to Promote Prefabricated Buildings in China	[48]	Buildings	2023	Mixed Method	General Buildings	PBs
Design for Assembly (DFA) Evaluation Method for Prefabricated Buildings	[76]	Buildings	2023	Interviews	General Buildings	PBs
Development strategy for prefabricated construction projects: a tripartite evolutionary game based on prospect theory	[73]	Engineering, Construction & Architectural Management	2023	Interviews	General Buildings	PC
Research on the tripartite evolution strategy of prefabricated building promotion based on the deepening of demand-side interests	[74]	PLoS ONE	2023	Other	General Buildings	PBs

Table A2. *Cont.*

Paper Title	Citation Number	Journal	Year	Methodology	Project Type	OSC Term
Developing an analytic hierarchy process-based decision model for modular construction in urban areas	[63]	Journal of Engineering, Design & Technology	2023	Questionnaire	General Buildings	MIC
Analysis of Factors Affecting Prefabricated Building Quality Based on ISM-BN	[64]	Sustainability	2023	Mixed Method	General Buildings	PBs
Factors influencing construction time performance of prefabricated house building: A multi-case study	[41]	Habitat International	2023	Interviews	Housing	PBs
Exploring the challenges of implementing design for excellence in industrialized construction projects in China	[65]	Building Research & Information	2023	Questionnaire	General Buildings	Industrialised construction

References

1. United Nations Environment Programme. *2022 Global Status Report for Buildings and Construction: Towards a Zero Emission, Efficient and Resilient Buildings and Construction Sector*; United Nations Environment Programme: Nairobi, Kenya, 2022.
2. Chang, R.D.; Zuo, J.; Zhao, Z.Y.; Soebarto, V.; Lu, Y.; Zillante, G.; Gan, X.L. Sustainability attitude and performance of construction enterprises: A China study. *J. Clean. Prod.* **2018**, *172*, 1440–1451. [CrossRef]
3. Jiang, Y.; Zhao, D.; Wang, D.; Xing, Y. Sustainable performance of buildings through modular prefabrication in the construction phase: A comparative study. *Sustainability* **2019**, *11*, 5658. [CrossRef]
4. Nadim, W. Modern Methods of Construction. In *Construction Innovation and Process Improvement*; Akintoye, A., Goulding, J.S., Zawdie, G., Eds.; Wiley-Blackwell: Hoboken, NJ, USA, 2012; pp. 209–233.
5. Goodier, C.; Gibb, A. Future opportunities for offsite in the UK. *Constr. Manag. Econ.* **2007**, *25*, 585–595. [CrossRef]
6. Zhou, J.; Li, Y.; Ren, D. Quantitative study on external benefits of prefabricated buildings: From perspectives of economy, environment, and society. *Sustain. Cities Soc.* **2022**, *86*, 104132. [CrossRef]
7. Tsz Wai, C.; Wai Yi, P.; Ibrahim Olanrewaju, O.; Abdelmageed, S.; Hussein, M.; Tariq, S.; Zayed, T. A critical analysis of benefits and challenges of implementing modular integrated construction. *Int. J. Constr. Manag.* **2023**, *23*, 656–668. [CrossRef]
8. Autodesk. Three Examples of Modular and Prefab Hospitals Constructed to Fight COVID-19. Autodesk. Available online: https://www.autodesk.com/design-make/articles/modular-hospitals (accessed on 15 October 2024).
9. Jiang, R.; Mao, C.; Hou, L.; Wu, C.; Tan, J. A SWOT analysis for promoting off-site construction under the backdrop of China's new urbanisation. *J. Clean. Prod.* **2018**, *173*, 225–234. [CrossRef]
10. Gan, X.L.; Chang, R.D.; Langston, C.; Wen, T. Exploring the interactions among factors impeding the diffusion of prefabricated building technologies: Fuzzy cognitive maps. *Eng. Constr. Archit. Manag.* **2019**, *26*, 535–553. [CrossRef]
11. Du, H.; Han, Q.; Sun, J.; Wang, C.C. Adoptions of prefabrication in residential sector in China: Agent-based policy option exploration. *Eng. Constr. Archit. Manag.* **2023**, *30*, 1697–1725. [CrossRef]
12. Su, Y.; Xue, H.; Han, R.; Zhang, S.; Sun, Z.; Song, Y. Policies of improving developers' willingness to implement prefabricated building: A case study from China. *J. Civ. Eng. Manag.* **2023**, *29*, 289–302. [CrossRef]
13. Shanghai Municipal Housing Administration, Municipal Development and Reform Commission, Municipal Administration of Planning, Land and Resources, and Municipal Finance Bureau. Opinions on the Implementation of the Prefabricated Building 2014901. 2014. Available online: http://www.shjx.org.cn/article-6597.aspx (accessed on 15 October 2024).
14. Han, Y.; Wang, L.; Kang, R. Influence of consumer preference and government subsidy on prefabricated building developer's decision-making: A three-stage game model. *J. Civ. Eng. Manag.* **2023**, *29*, 35–49. [CrossRef]
15. The People's Republic of China. *The 14th Five-Year Plan (2021–2025) for National Economic and Social Development and Vision 2035 of the People's Republic of China*; Xinhua News Agency: Beijing, China, 2021.
16. Han, Y.; Fang, X.; Zhao, X.; Wang, L. Exploring the impact of incentive policy on the development of prefabricated buildings: A scenario-based system dynamics model. *Eng. Constr. Archit. Manag.* **2023**, *31*, 4697–4725. [CrossRef]
17. Dou, Y.; Xue, X.; Wang, Y.; Luo, X.; Shang, S. New media data-driven measurement for the development level of prefabricated construction in China. *J. Clean. Prod.* **2019**, *241*, 118353. [CrossRef]
18. Alhawamdeh, M.; Lee, A. A systematic review and meta-synthesis of the barriers of offsite construction projects. *Int. J. Constr. Manag.* **2024**, *25*, 1087–1099. [CrossRef]
19. Mao, C.; Shen, Q.; Pan, W.; Ye, K. Major barriers to off-site construction: The developer's perspective in China. *J. Manag. Eng.* **2015**, *31*, 04014043. [CrossRef]
20. Rahman, M.M. Barriers of implementing modern methods of construction. *J. Manag. Eng.* **2014**, *30*, 69–77. [CrossRef]
21. Gan, X.; Chang, R.; Wen, T. Overcoming barriers to off-site construction through engaging stakeholders: A two-mode social network analysis. *J. Clean. Prod.* **2018**, *201*, 735–747. [CrossRef]
22. Li, Z.; Zhang, S.; Meng, Q.; Hu, X. Barriers to the development of prefabricated buildings in China: A news coverage analysis. *Eng. Constr. Archit. Manag.* **2021**, *28*, 2884–2903. [CrossRef]
23. U.S. Department of Housing and Urban Development. *Offsite Construction for Housing: Research Roadmap*; U.S. Department of Housing and Urban Development: Washington, DC, USA, 2023; p. 83.
24. Hong, J.; Shen, G.Q.; Li, Z.; Zhang, B.; Zhang, W. Barriers to promoting prefabricated construction in China: A cost–benefit analysis. *J. Clean. Prod.* **2018**, *172*, 649–660. [CrossRef]
25. Xie, F.; Fu, X.; Huang, R. Promoting the application of off-site construction in China's residential building industry from the angle of ecosystem. *Systems* **2023**, *11*, 140. [CrossRef]
26. Chang, W.; Hong-Jun, G.; Lyu-Shui, Z.; Hai-Lin, Y. China's urban minerals policies: Evolution, problems and countermeasures—A quantitative research. *J. Clean. Prod.* **2018**, *197*, 114–123. [CrossRef]
27. Chang, Y.; Li, X.; Masanet, E.; Zhang, L.; Huang, Z.; Ries, R. Unlocking the green opportunity for prefabricated buildings and construction in China. *Resour. Conserv. Recycl.* **2018**, *139*, 259–261. [CrossRef]

28. Levy, Y.; Ellis, T.J. A systems approach to conduct an effective literature review in support of information systems research. *Informing Sci.* **2006**, *9*, 181–212. [CrossRef] [PubMed]
29. Peters, M.D.J.; Godfrey, C.M.; Khalil, H.; McInerney, P.; Parker, D.; Soares, C.B. Guidance for conducting systematic scoping reviews. *JBI Evid. Implement.* **2015**, *13*, 141–146. [CrossRef] [PubMed]
30. Singh, V.K.; Singh, P.; Karmakar, M.; Leta, J.; Mayr, P. The journal coverage of Web of Science, Scopus and Dimensions: A comparative analysis. *Scientometrics* **2021**, *126*, 5113–5142. [CrossRef]
31. Ji, Y.; Zhao, Z.; Yao, F.; Li, H.X.; Li, Y.; Du, X. Factors influencing sleeve grouting quality for prefabricated building: An interpretive structural modeling approach. *Adv. Civ. Eng.* **2021**, *2021*, 5598424. [CrossRef]
32. Gong, P.; Teng, Y.; Li, X.; Luo, L. Modeling constraints for the on-site assembly process of prefabrication housing production: A social network analysis. *Sustainability* **2019**, *11*, 1387. [CrossRef]
33. Li, X.; Li, Z.; Wu, G. Modular and offsite construction of piping: Current barriers and route. *Appl. Sci.* **2017**, *7*, 547. [CrossRef]
34. Yuan, Z.; Ni, G.; Wang, L.; Qiao, Y.; Sun, C.; Xu, N.; Wang, W. Research on the barrier analysis and strength measurement of a prefabricated building design. *Sustainability* **2020**, *12*, 2994. [CrossRef]
35. Wuni, I.Y.; Shen, G.Q. Critical success factors for modular integrated construction projects: A review. *Build. Res. Inf.* **2020**, *48*, 763–784. [CrossRef]
36. Hansen, S. Characterizing interview-based studies in construction management research: Analysis of empirical literature evidences. In Proceedings of the International Conference on Innovations in Social Sciences Education and Engineering (ICOISSEE), Bandung, Indonesia, 7 August 2021; pp. 1–12.
37. Zhang, X.; Skitmore, M.; Peng, Y. Exploring the challenges to industrialized residential building in China. *Habitat Int.* **2014**, *41*, 176–184. [CrossRef]
38. Zhai, X.; Reed, R.; Mills, A. Factors impeding the offsite production of housing construction in China: An investigation of current practice. *Constr. Manag. Econ.* **2014**, *32*, 40–52. [CrossRef]
39. Luo, L.Z.; Mao, C.; Shen, L.Y.; Li, Z.D. Risk factors affecting practitioners' attitudes toward the implementation of an industrialized building system: A case study from China. *Eng. Constr. Archit. Manag.* **2015**, *22*, 622–643. [CrossRef]
40. Wu, H.; Qian, Q.K.; Straub, A.; Visscher, H.J. Factors influencing transaction costs of prefabricated housing projects in China: Developers' perspective. *Eng. Constr. Archit. Manag.* **2022**, *29*, 476–501. [CrossRef]
41. Chen, Y.; Zhu, D.; Tian, Z.; Guo, Q. Factors influencing construction time performance of prefabricated house building: A multi-case study. *Habitat Int.* **2023**, *131*, 102731. [CrossRef]
42. Li, C.Z.; Hong, J.; Xue, F.; Shen, G.Q.; Xu, X.; Mok, M.K. Schedule risks in prefabrication housing production in Hong Kong: A social network analysis. *J. Clean. Prod.* **2016**, *134*, 482–494. [CrossRef]
43. Pan, W.; Yang, Y.; Pan, M. Implementing modular integrated construction in high-rise high-density cities: Perspectives in Hong Kong. *Build. Res. Inf.* **2023**, *51*, 354–368. [CrossRef]
44. Jiang, W.; Huang, Z.; Peng, Y.; Fang, Y.; Cao, Y. Factors affecting prefabricated construction promotion in China: A structural equation modeling approach. *PLoS ONE* **2020**, *15*, e0227787. [CrossRef]
45. Wu, G.; Yang, R.; Li, L.; Bi, X.; Liu, B.; Li, S.; Zhou, S. Factors influencing the application of prefabricated construction in China: From perspectives of technology promotion and cleaner production. *J. Clean. Prod.* **2019**, *219*, 753–762. [CrossRef]
46. Dou, Y.; Xue, X.; Zhao, Z.; Jiang, Y. Measuring the factors that influence the diffusion of prefabricated construction technology innovation. *KSCE J. Civ. Eng.* **2019**, *23*, 3737–3752. [CrossRef]
47. Shang, Z.; Wang, F.; Yang, X. The efficiency of the Chinese prefabricated building industry and its influencing factors: An empirical study. *Sustainability* **2022**, *14*, 10695. [CrossRef]
48. Wang, Q.; Shen, C.; Guo, Z.; Zhu, K.; Zhang, J.; Huang, M. Research on the barriers and strategies to promote prefabricated buildings in China. *Buildings* **2023**, *13*, 1200. [CrossRef]
49. Gan, Y.; Shen, L.; Chen, J.; Tam, V.W.Y.; Tan, Y.; Illankoon, I.M.C.S. Critical factors affecting the quality of industrialized building system projects in China. *Sustainability* **2017**, *9*, 216. [CrossRef]
50. Xue, H.; Zhang, S.; Su, Y.; Wu, Z. Factors affecting the capital cost of prefabrication—A case study of China. *Sustainability* **2017**, *9*, 1512. [CrossRef]
51. Aguilar, F.J. Scanning the Business Environment. Available online: https://lccn.loc.gov/67011688 (accessed on 7 December 2024).
52. Alhawamdeh, M.; Lee, A. A behavioral framework for construction waste minimization: The case of Jordan. *Int. J. Environ. Sustain.* **2021**, *17*, 9. [CrossRef]
53. Dang, P.; Niu, Z.; Gao, S.; Hou, L.; Zhang, G. Critical factors influencing the sustainable construction capability in prefabrication of Chinese construction enterprises. *Sustainability* **2020**, *12*, 8996. [CrossRef]
54. Gan, X.; Chang, R.; Zuo, J.; Wen, T.; Zillante, G. Barriers to the transition towards off-site construction in China: An Interpretive structural modeling approach. *J. Clean. Prod.* **2018**, *197*, 8–18. [CrossRef]
55. Zhang, W.; Lee, M.W.; Jaillon, L.; Poon, C.S. The hindrance to using prefabrication in Hong Kong's building industry. *J. Clean. Prod.* **2018**, *204*, 70–81. [CrossRef]

56. Jiang, L.; Li, Z.; Li, L.; Gao, Y. Constraints on the promotion of prefabricated construction in China. *Sustainability* **2018**, *10*, 2516. [CrossRef]
57. Han, Y.; Wang, L. Identifying barriers to off-site construction using grey DEMATEL approach: Case of China. *J. Civ. Eng. Manag.* **2018**, *24*, 364–377. [CrossRef]
58. Li, T.; Li, Z.; Dou, Y. Diffusion prediction of prefabricated construction technology under multi-factor coupling. *Build. Res. Inf.* **2023**, *51*, 333–353. [CrossRef]
59. Ji, Y.; Qi, L.; Liu, Y.; Liu, X.; Li, H.X.; Li, Y. Assessing and prioritising delay factors of prefabricated concrete building projects in China. *Appl. Sci.* **2018**, *8*, 2324. [CrossRef]
60. Luo, L.; Wu, X.; Hong, J.; Wu, G. Fuzzy cognitive map-enabled approach for investigating the relationship between influencing factors and prefabricated building cost considering dynamic interactions. *J. Constr. Eng. Manag.* **2022**, *148*, 04022081. [CrossRef]
61. Zhang, K.; Tsai, J.S. Identification of critical factors influencing prefabricated construction quality and their mutual relationship. *Sustainability* **2021**, *13*, 11081. [CrossRef]
62. Yang, S.; Hou, Z.; Chen, H. Network model analysis of quality control factors of prefabricated buildings based on the complex network theory. *Buildings* **2022**, *12*, 1874. [CrossRef]
63. Sing, M.; Chan, J.; Liu, H.; Ngai, N.N. Developing an analytic hierarchy process-based decision model for modular construction in urban areas. *J. Eng. Des. Technol.* **2023**, *21*, 1212–1229. [CrossRef]
64. Zhang, J.; Wang, M.; Zhao, L.; Chen, M. Analysis of factors affecting prefabricated building quality based on ISM-BN. *Sustainability* **2023**, *15*, 9682. [CrossRef]
65. Wuni, I.Y.; Wu, Z.; Shen, G.Q. Exploring the challenges of implementing design for excellence in industrialized construction projects in China. *Build. Res. Inf.* **2023**, *51*, 301–315. [CrossRef]
66. Li, X.J. Research on investment risk influence factors of prefabricated building projects. *J. Civ. Eng. Manag.* **2020**, *26*, 599–613. [CrossRef]
67. Zhang, S.; Li, Z.; Ma, S.; Li, L.; Yuan, M. Critical factors influencing interface management of prefabricated building projects: Evidence from China. *Sustainability* **2022**, *14*, 5418. [CrossRef]
68. Sun, H.; Fang, Y.; Yin, M.; Shi, F. Research on the restrictive factors of vigorous promotion of prefabricated buildings in Yancheng under the background of "Double Carbon". *Sustainability* **2023**, *15*, 1737. [CrossRef]
69. Cao, P.; Lei, X. Evaluating risk in prefabricated building construction under EPC contracting using structural equation modeling: A case study of Shaanxi Province, China. *Buildings* **2023**, *13*, 1465. [CrossRef]
70. Dou, Y.; Xue, X.; Zhao, Z.; Luo, X. Factors influence China's off-site construction technology innovation diffusion. *Sustainability* **2019**, *11*, 1849. [CrossRef]
71. Li, D.; Li, X.; Feng, H.; Wang, Y.; Fan, S. ISM-based relationship among critical factors that affect the choice of prefabricated concrete buildings in China. *Int. J. Constr. Manag.* **2022**, *22*, 977–992. [CrossRef]
72. Wang, Y.; Wang, F.; Sang, P.; Song, H. Analysing factors affecting developers' behaviour towards the adoption of prefabricated buildings in China. *Environ. Dev. Sustain.* **2021**, *23*, 14245–14263. [CrossRef]
73. Dou, Y.; Sun, X.; Ji, A.; Wang, Y.; Xue, X. Development strategy for prefabricated construction projects: A tripartite evolutionary game based on prospect theory. *Eng. Constr. Archit. Manag.* **2023**, *30*, 105–124. [CrossRef]
74. Liu, M.; Chen, Y. Research on the tripartite evolution strategy of prefabricated building promotion based on the deepening of demand-side interests. *PLoS ONE* **2023**, *18*, e0290299. [CrossRef] [PubMed]
75. Lu, J.; Wang, J.; Song, Y.; Yuan, C.; He, J.; Chen, Z. Influencing factors analysis of supply chain resilience of prefabricated buildings based on PF-DEMATEL-ISM. *Buildings* **2022**, *12*, 1595. [CrossRef]
76. Zhai, Y.; Sun, Y.; Li, Y.; Tang, S. Design for Assembly (DFA) Evaluation Method for Prefabricated Buildings. *Buildings* **2023**, *13*, 2692. [CrossRef]
77. Mao, C.; Xie, F.; Hou, L.; Wu, P.; Wang, J.; Wang, X. Cost analysis for sustainable off-site construction based on a multiple-case study in China. *Habitat Int.* **2016**, *57*, 215–222. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.