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Basic types and evolutionary characteristics of the socialist built heritage in China, 1949–1978: bibliometrics analysis of the *People's Daily*

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Abstract

The socialist built heritage (SBH) is a product of the great and typical socialist construction and is considered to be one of the unique contemporary legacies. However, due to political controversy and a shorter history, its conservation status is dire. In order to better understand and promote future conservation, this study explored the typology and evolution of SBH, using representative socialist China as an example. Based on the official *People's Daily*, the spatial term database of various socialist construction fields was generated by utilizing Python and Excel software. Through qualitative logical induction and quantitative word frequency statistics, the basic types and evolutionary characteristics of SBH were obtained. It was found that (1) the composite, multiscale, and extensive SBH were identified as twenty-six basic types. It was most widespread in the industry and agroforestry fields, while factories and facilities, collective organization buildings, government agencies, and assembly buildings were the most common basic types. (2) Related to social development, the fastest growth stage for SBH was from 1953 to 1960 and vice versa from 1966 to 1975. The evolution of SBH in technology field shifted from a non-significant increase to a sudden increase, while those in the finance and trade, and diplomacy fields fluctuated. The remaining fields were marked by large fluctuations to smoothness. The nature of SBH has become more modernized over time. These results further illustrated the distinctive value of the SBH, and can provide positive targeted support for their conservation.

Keywords Socialist built heritage, Basic type, Evolutionary characteristic, Bibliometrics analysis, Heritage conservation, Socialist China

Introduction

The concept of the socialist built heritage (SBH) emerged for the first time at the international conference “Socialist Realism and Socialist Modernism” in 2013. ICOMOS Germany united twelve Central and Eastern European countries, including Yugoslavia and Hungary, to designate their typical buildings, urban designs and green gardens built during the socialist period as SBH for nomination to the World Heritage List [1]. Later, the SBH is considered as the unique material product of the great and typical socialist construction and the second part of the twentieth century heritage in the (former) socialist countries [2]. This concept is gradually becoming the basic consensus of

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contemporary heritage conservation, especially in Russia and the Central and Eastern European countries.

SBH evolves with the socialist system. Since the founding of the Union of Soviet Socialist Republics in 1922, there have been upwards of fifty socialist countries in the world. These countries, under the leadership of socialist regimes, gathered their populations for communization and produced a wide variety of SBH. It can be seen that SBH witnessed the beginning and prosperity of the socialist system, carried the collective memory and identity of a particular system, and had the same historical and cultural value as common contemporary heritage [1]. However, with the subversion of the regime and the establishment of the capitalist system, the SBH was politicized as a symbol of the past socialist era and was in a crisis of destruction and abandonment [3]. In former socialist countries such as Ukraine, Bulgaria, and Armenia, the SBH is facing unprecedented protection dilemmas [4]. Therefore, the purpose of this paper is to provide the world with a deeper understanding of SBH in order to promote future conservation.

At present, international scholars have carried out rich theoretical research on SBH, focusing on four aspects, including heritage value, current situation investigation, historical evolution, and conservation and utilization. Specifically, first, by tracing the history of socialism back to its origins, the unique values of architectural art and historical craftsmanship possessed by SBH have been dialectically analyzed away from political controversies [5–8]. Second, in order to understand the conservation status and problems, a number of scholars have conducted detailed surveys of SBH and the residents through fieldwork, photographic documentation, and oral interviews [8–10], and published numerous books and photo albums [11, 12]. Third, based on multivariate spatial analysis, the evolution of the spatial pattern, geographic distribution, and other dimensions of SBH have been analyzed at multiple scales such as buildings, communities, regions, and countries [13–15]. Among them, the different types of SBH in China were found to be characterized by concentrated distribution and uneven evolution patterns at the national scale [16]. Fourth and foremost, numerous scholars have proposed diverse conservation and reuse measures through case studies of specific SBHs. These approaches include adaptation [17, 18], functional replacement [19], environmental remediation [20], linked tourism [21, 22], and so on. Typical examples include the iconic TV tower in the Czech Republic [23], the Zhengzhou No. 2 Grinding Wheel Factory in central China [24], and many others. It can be seen that scholars worldwide have begun to pay attention to SBH, providing an important foundation for this study.

In addition to the above research directions, several scholars and organizations have prescribed heritage types, which consist of three main forms. First, classify the heritage according to the age when it was first created, such as the Key Cultural Relics Protection Units in China [25]. Second, classify the heritage according to its components and structures, including the World Heritage List proposed by UNESCO [26] as well as China's National Industrial Heritage [27] and Revolutionary Cultural Relics [28]. Third and more widely applied, classify the heritage according to the function for which it was originally used, involving the 20th Century Cultural Heritage proposed by ICOMOS [29] and the 20th Century Architectural Heritage of China [30]. The current Chinese heritage list mentioned above already covers some of its socialist-era heritage, i.e., there is an official view that socialist-era remains can be heritagized. However, there is no consensus on the concept of SBH. Meanwhile, although these categorizations have been summarized based on large-scale and multi-heritage surveys, they are not fully applicable to SBH and hardly reflect the specifics of socialist construction and the socialist character of SBH. Consequently, it is important to develop an inquiry into the basic types of SBH in the context of China to understand its formation and value.

In summary, despite the fact that multidimensional theoretical studies on the value, status, evolution, and protection of SBH have been conducted globally, most of them focus on cases or a single type. Also, the focus on the basic types of SBH has been inadequate. In order to better understand and serve SBH conservation, this study integrated qualitative and quantitative methods to identify the basic types and evolutionary characteristics of SBH, based on the official *People's Daily*, in the case of socialist China. The findings can provide positive guidance for future SBH-specific theoretical research and conservation.

The objectives of this study are as follows. (1) To objectively and accurately summarize the basic types of Chinese SBH through the bibliometrics analysis of the official literature. (2) To comprehensively characterize the evolution of SBH in the Socialist Revolution and Construction Period (SRCP) of China by counting the word frequencies and their percentages in different fields and basic types.

The paper is organized as follows. This “**Introduction**” section reviewed the concept of SBH and related research. In the “**Materials and Methods**” section, data resources, database establishment and data analysis were described in detail. In the “**Results**” section, the results of induction and word frequency statistics of SBH basic types were analyzed. In the “**Discussion**” section, the above two results were discussed in relation to the

historical information. In the “Conclusions” section, the main findings were summarized.

Materials and methods

Study design

Figure 1 shows the framework, including database establishment and data analysis. Specifically, (1) based on

the *People’s Daily*, valid reports were selected using the names of major socialist constructions as keywords. (2) These reports were preprocessed to create a database of fields by searching with the keyword field of socialist construction. Python was used to segment them. Then the top 3,000 words in terms of word frequency were extracted using Excel to further select valid spatial

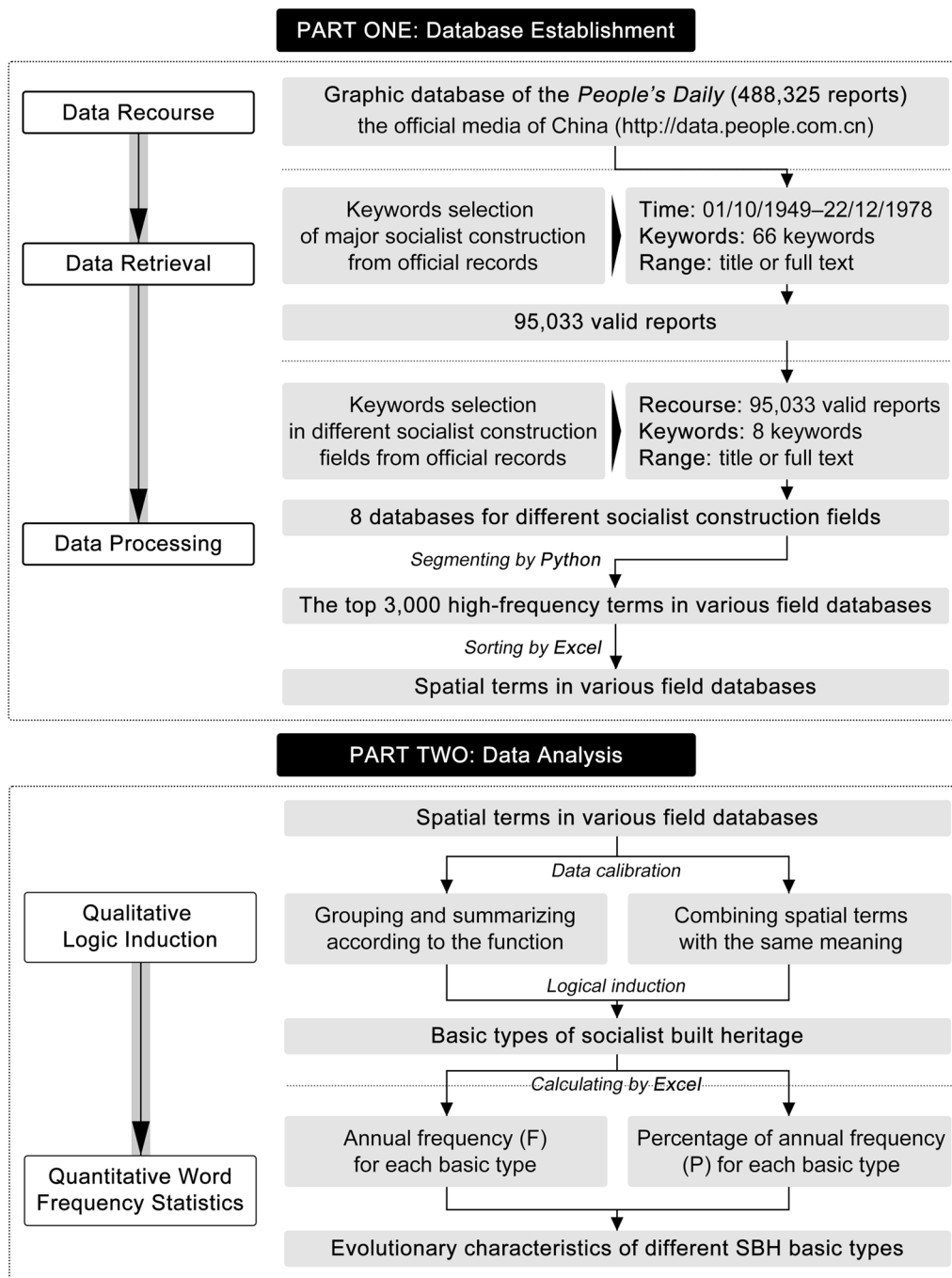


Fig. 1 Research Framework

terms in each field. (3) The basic types of SBH were summarized by manual correction and logical induction of spatial terms. (4) The corresponding evolutionary characteristics were revealed through counting the annual frequency (F) and the percentage of annual frequency (P) for each basic type.

Database establishment

Data recourse

In this study, the *People's Daily* was chosen as the recourse of literature data [31]. Founded in 1948, it is the central organ newspaper and an important official document of China's ruling Communist Party. It not only publicizes the policies, routes and major decisions of the Communist Party, but also records information on important people, events, products and regions that have emerged from the socialist construction in various fields [32]. Many of the "first", "largest", "earliest" and other major construction projects in New China are included in it, which fall precisely into the category of the SBH.

This study was limited to the past socialist early SRCP, because its socialist construction activities were the most extensive and important in the history of socialist China,

covering a wide range of fields, such as industry, agriculture, infrastructure, military, etc. [33]. It is officially credited with laying the foundation for today's national prosperity [34]. Its SBH, characterized by the unique socialist and national forms of the time, has also been recognized by many Chinese scholars as an element of heritage that urgently needs to be preserved and is valuable [35–37]. Therefore, this study utilized the *People's Daily* as a data resource to explore the basic types and evolutionary characteristics of SBH in the SRCP.

Data retrieval

Since the theme of the literature published in the *People's Daily* is not exclusively about the socialist construction of China, it is necessary to filter the valid reports by searching first. By reading the official history books [34], sixty-six terms for policies, calls, and guidelines for important socialist construction activities were selected, as listed in Table 1. Then using these terms as keywords, the *People's Daily* was searched for the period from October 1, 1949 to December 22, 1978 (the official definition of SRCP). To avoid duplication of literature, the search was conducted in the order of the year in which each keyword appeared.

Table 1 Retrieved keywords and their number of valid reports, N = 95,033 (accessed on July 20, 2023)

Terms types	Retrieved keywords (number of valid reports)	Number
Policies	land reform (土地改革, 5,538), democratic reform (民主改革, 1,535), the Patriotic Health Campaign (爱国卫生运动, 985), anti-revisionism (反对修正主义, 879), the Five-Year Plan (五年计划, 4,921), socialist transformation (社会主义改造, 3,858), joint public private operation (公私合营, 2,030), increased production and savings (增产节约, 5,357), collectivization (合作化, 5,012), the Patriotic Movement for Plenty of Fruit (爱国丰产运动, 185), industrial construction (工业建设, 2,746), agricultural mechanization (农业机械化, 1,853), railroad transport production (铁路运输生产, 25), the People's Communalization Movement (人民公社化, 489), household responsibility system (包产到户, 69), agricultural reclamation construction (农垦建设, 3), industrial consolidation (工业整顿, 1), people's sports (人民体育, 280), water management (治水, 2,041), illiteracy (扫盲, 819), reforestation (造林, 2,567), developing science and technology (发展科学技术, 226), modernization of science and technology (科学技术现代化, 215), cultural revolution (文化革命, 1,483), technological innovation (技术革新, 4,343), technological revolution (技术革命, 702), culture to the countryside (文化下乡, 10), environmental protection (环境保护, 79), developing atomic energy (发展原子能, 73), the Third-Front Movement (三线建设, 0), advanced scientific research (尖端科学研究, 4)	48,328
Events	Korean war (抗美援朝, 7,162), rectification movement (整风运动, 4,592), counter-revolutionary repression (镇压反革命, 682), the three-anti campaign (三反运动, 875), the five-anti campaign (五反运动, 206), the Great Leap Forward ("大跃进"运动, 8,016), reform of the writing system (文字改革, 273), socialist educational movement (社会主义教育运动, 789)	22,595
Slogans and Guidelines	"work hard, strive for excellence" ("鼓足干劲, 力争上游", 1,229), "quicker and more economical" ("多快好省", 3,125), "take the class struggle as a program" ("以阶级斗争为纲", 1,904), "build up the country through thrift and hard work" ("勤俭建国", 779), "forced agricultural experience for city intellectuals" ("上山下乡", 1,059), "people of the world united" ("全世界人民团结起来", 885), "unite for a greater victory" ("团结起来, 争取更大的胜利", 512), "take steel as the key link" ("以钢为纲", 87), "take grain as the key link" ("以粮为纲", 1,153), "learn from Daqing in industry" ("工业学大庆", 1,174), "learn from Tachai in agriculture" ("农业学大寨", 2,788), "readjust, consolidate, fill out gaps and raise standards" ("调整, 巩固, 充实, 提高", 43), "grasp the revolution and promote production" ("抓革命, 促生产", 2,519), "open the door to the workers and peasants" ("向工农开门", 482), "march for science" ("向科学进军", 275), "learn from Lei Feng" ("向雷锋学习", 39), "learn from the People's Liberation Army" ("学人民解放军", 69), "the community comes and goes" ("社来社去", 52), "a hundred flowers bloom, a hundred schools of thought contend" ("百花齐放, 百家争鸣", 317), "Deng Xiaoping's four modernizations" ("四个现代化", 994), "science and technology are the first productive forces" ("科学技术是第一生产力", 0), "prepare for war, prepare for famine, prepare for the people" ("备战, 备荒, 为人民", 1,171)	20,656
Documents	Standard of Truth (真理标准, 21), 156 Soviet-sponsored construction projects (156项, 8), trust (托拉斯, 207), China-Soviet Friendship and Alliance (中苏友好同盟互助, 687), cooperation agreement (合作协定, 2,531)	3,454
Total		95,033

A total of 95,033 valid reports were obtained and downloaded into Excel format to create the base database.

Data processing

Since construction activities vary in intensity and scope from one field to another, refining the search scope can reduce errors in order to crawl the basic types of SBH as comprehensively as possible. Therefore, in this study, the basic database was divided according to the socialist construction field. As pointed out in the previous literature [38], the central government of the New China took over the coordination of socialist construction, and its subordinate ministries and commissions carried out specific work in the corresponding fields. Referring to the descriptions in the official history books [34, 39], eight major construction fields were summarized as follows.

- Field A: finance and trade;
- Field B: industry;
- Field C: agroforestry;
- Field D: transport;
- Field E: hydrology;
- Field F: technology;
- Field G: culture, education, sports and sanitation;
- Field H: diplomacy.

The base database was cleaned using each construction field as keywords, resulting in eight field databases. Using Python and referring to the Jieba Chinese library [40], the reported texts of each field database were subjected to lexical segmentation and lexical annotation, as shown

in Fig. 2. The top 3,000 words were counted according to their total frequency, and the results were exported to Excel. Only spatial terms such as place terms (ns), object terms (nw) and institutional terms (nt) were scoped for this study and were included in the subsequent data analysis.

Data analysis

Qualitative logic induction

Based on methods from previous literature [41, 42], qualitative logical induction was used to summarize the basic types of SBH in the following steps. Briefly, (1) with spatial terms as the information source and functional meaning as the principle, term categories were assigned layer by layer (including word-frequency superposition) to form hypotheses of preliminary types. (2) By repeatedly comparing the relationships among the categories, the categories need to be supplemented or developed were populated. (3) Basic types of SBH were identified by extracting the major categories.

It is important to note that many spatial terms have the same meaning but are not recognized by the program resulting in errors in the frequency statistics. “Grain store (粮店)” and “grain station (粮站); “power station (发电站)” and “power plant (电力厂)” are all typical examples. Thus, duplicate statistics were avoided through manual data calibration during the process [43].

Quantitative word frequency statistics

Quantitative means of word frequency statistics were used to reveal the evolutionary characteristics of SBH basic types. The reports in the *People’s Daily* represented the developments, changes and trends in the construction of New China at that time. Consequently, the word frequency of its spatial terms can also reflect the evolution of SBH. Referring to previous research methods on the discursive flow of contemporary architectural studies in China [43, 44], this study calculated the F and P values for each basic type in each field, as shown in Eq. 1. The evolutionary characteristics were then discussed in terms of both frequency and frequency percentage scales.

$$P_x = \frac{F_x}{F_1 + F_2 + F_3 + \dots + F_{x-1} + F_x} \times 100\% \tag{1}$$

P_x was the percentage of annual frequency for the x -th basic type, F_x was the annual frequency for the x -th basic type, and $F_1, F_2, F_3 \sim F_{x-1}$ were the annual frequencies for the 1st, 2nd, 3rd $\sim x-1$ basic types.

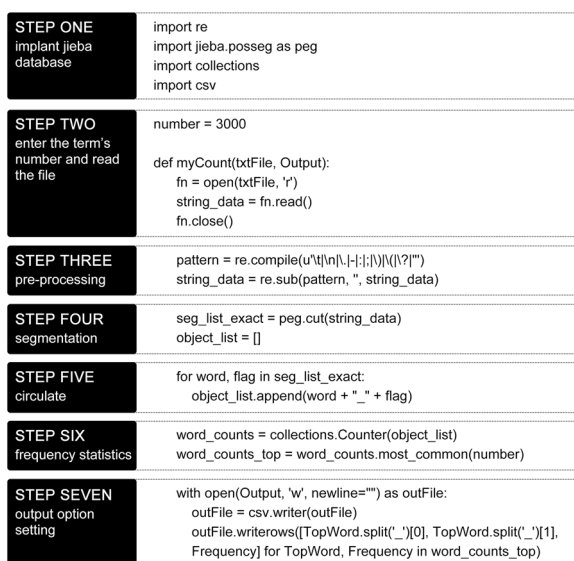


Fig. 2 Procedures for reported text segmentation and lexical annotation

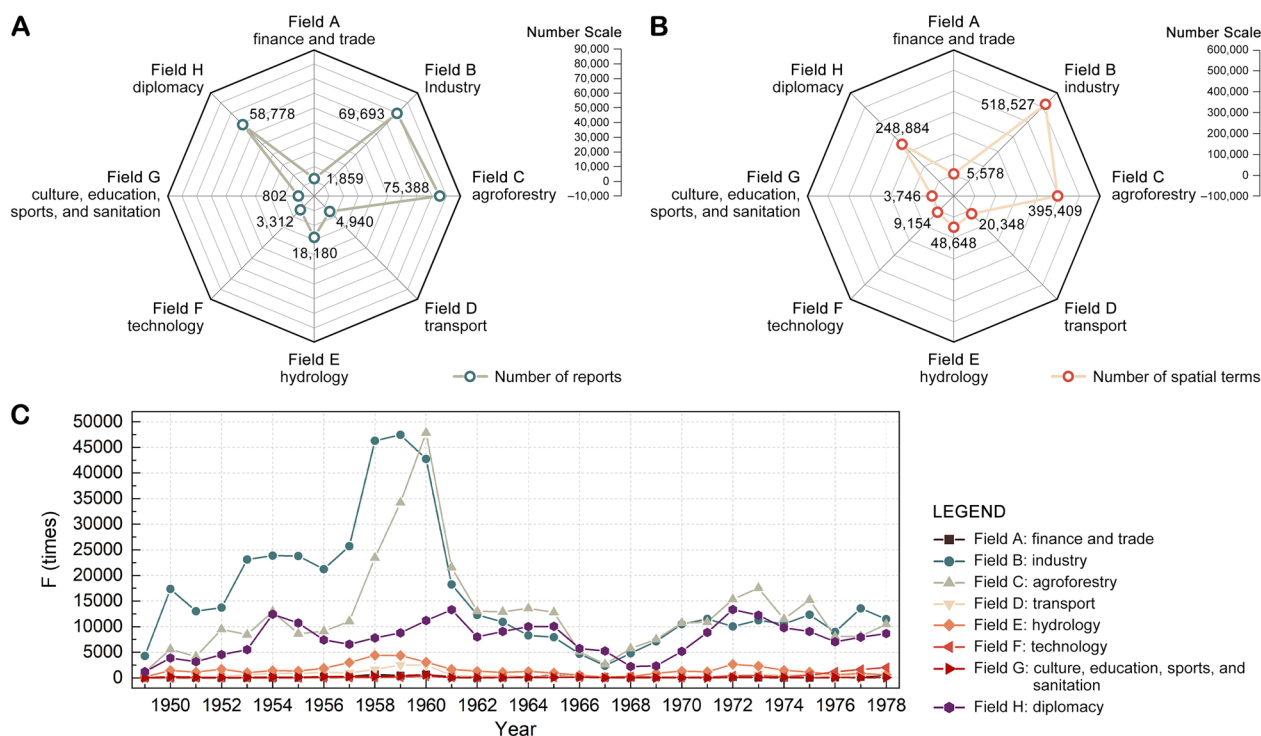


Fig. 3 Basic structural characteristics of the database for each field. **A** Number of valid reports; **B** Number of spatial terms; **C** Evolutionary trends in F-values in various fields

Results

Structural characteristics of the Database

The basic compositional structure of the database and spatial terms for the eight fields is presented in Fig. 3. In general, the discourse share of these fields in the *People’s Daily* was extremely uneven.

First, the quantitative structures of reports and spatial terms maintained a strong similarity (Fig. 3A, B). Concretely, fields B and C were the overwhelmingly dominant ones, both possessing approximately 70,000 reports and 400,000 terms. Field H followed closely behind with 25.23% of reports and 19.91% of terms. Aside from these three, the remaining five fields all exhibited very small shares, with the largest being field E, boasting a 7.80% share of reports and a 3.89% share of terms. These all indicated a huge disparity in the intensity of discussion in different construction fields.

Second, similar to the quantitative structure, the changes in F-values in various fields showed some differences (Fig. 3C). In terms of fields, the trends were more evident in fields B, C, and H due to having higher total F-values, while the remaining five fields were not significant. In terms of years, the period prior to 1960 was roughly one of increasing F-values in all fields, with an all-time peak around 1960. After that, however, the F-value for each field began to decrease and tended to

fluctuate in small increments. 1966 to 1969 was the most pronounced low period. It can be seen that there was temporal consistency in the trend of F-value changes across fields, despite the differences in the total F-values.

Logic induction of the SBH basic types

Figure 4 presents the distribution of Chinese raw spatial terms and their frequencies for the eight fields. After completing manual data calibration, logical induction was used to summarize the spatial terms in each field according to their function, with the specific process listed in Tables 2, 3, 4, 5, 6, 7, 8, 9. Then, as shown in Fig. 5, the specific compositional characteristics of the different types were visualized through pie charts.

First, field A contained sixteen spatial terms, which were grouped into three basic types according to their functions, i.e., organization buildings, commercial buildings, and government agencies (Table 2 and Fig. 5A). The frequency shares of the three were not very different. Organization buildings supporting collective trade had the largest share. “Supply and marketing cooperative” was the most common term. Commercial buildings with trade activities had the second largest share, with fairs and small department stores being the most dominant types. Government agencies regulating finance and trade, had the lowest frequency and number of terms.



Fig. 4 Word cloud maps of Chinese raw spatial terms in different fields generated by Python. **A** Field A: finance and trade; **B** Field B: industry; **C** Field C: agroforestry; **D** Field D: transport; **E** Field E: hydrology; **F** Field F: technology; **G** Field G: culture, education, sports and sanitation; **H** Field H: diplomacy

Table 2 Spatial terms in field A with the logic induction results, $N=5,578$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Supply and marketing cooperative (供销社, 购销社)	1,045	a	9	Retail department (门市部)	182	b
2	Ministry of Commerce (商业部)	987	c	10	Commission shop (代销店, 代销站)	164	a
3	Fair (集市, 市集, 市场)	823	b	11	Restaurant (饭店)	161	b
4	Small department store (商店, 百货商店, 百货公司, 百货商场)	430	b	12	Department of commerce (商业局)	110	c
5	Artel. cooperative (合作社)	376	a	13	Credit cooperative (信用社)	109	a
6	Bank (银行)	357	a	14	Confederation (联合会)	98	c
7	Grain supply shop (粮店, 粮站)	301	b	15	Hotel (旅社)	78	b
8	Agricultural cooperative (农业社)	287	a	16	Food market (菜场)	70	b

“a” for organization building, “b” for commercial building, and “c” for government agency

Table 3 Spatial terms in field B with the logic induction results, $N = 518,527$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Iron and steel factory (钢铁厂, 炼钢厂, 钢厂, 钢铁公司, 轧钢厂, 炼铁厂)	57,561	a	22	Film factory (电影厂)	4,863	a
2	Coalmine (煤矿, 原煤矿, 煤炭矿)	43,586	b	23	Management bureau (管理局)	4,793	d
3	Armament factory (军备厂, 武备厂, 武装厂, 装备厂)	39,815	c	24	Technical high school (工业中学)	4,416	e
4	Mine shaft (矿山, 矿井, 矿区, 工矿企业, 厂矿企业)	37,463	b	25	Manufacturing factory (制造厂)	4,107	a
5	Machine factory (机械厂, 农业机械厂, 机器厂)	32,596	a	26	Repair workshop (检修厂)	4,047	a
6	Plant (发电厂, 电力厂, 电站)	32,482	a	27	Repository (仓库)	3,753	a
7	Oil field (油田, 石油田)	25,429	b	28	Mining affairs bureau (矿务局)	3,294	d
8	Smelting furnace (冶炼炉, 锅炉, 高炉, 冶金炉)	22,535	a	29	Iron mine (铁矿)	3,269	b
9	Labor union (工会)	19,219	d	30	Rail station (车站)	3,224	a
10	MINISTRY of Industry (工业部)	18,546	d	31	Rubber factory (橡胶厂)	3,180	a
11	Chemical factory (化工厂, 化学工业厂)	17,995	a	32	Worker-peasant alliance (工农联盟)	3,176	d
12	Machine tool factory (机床厂, 机车厂, 车床厂)	17,101	a	33	Accessory factory (配件厂)	2,987	a
13	Cotton factory (棉厂, 棉花厂)	17,007	a	34	Building material factory (建筑材料厂)	2,908	a
14	Textile factory (纺织厂, 纺织工厂)	13,665	a	35	Vehicle factory (车辆厂)	2,683	a
15	Fertilizer factory (化肥厂, 肥料厂)	11,693	a	36	Glazing factory (玻璃厂)	2,481	a
16	Timber factory (木材厂)	10,175	a	37	Processing plant (加工厂)	2,476	a
17	Tractor factory (拖拉机厂)	9,522	a	38	Industry bureau (工业局)	2,434	d
18	Atomic energy site (原子能基地, 原子武器厂)	7,898	c	39	Plastic factory (塑料厂)	2,266	a
19	Engineering college (工业大学)	7,677	e	40	Paper mill (造纸厂)	2,234	a
20	Cement factory (水泥厂)	6,729	a	41	Fibre factory (纤维厂)	2,233	a
21	Instrument factory (仪器厂, 电子仪器厂)	5,009	c				

“a” for factory and facility, “b” for mining site, “c” for military industrial base, “d” for government agency, and “e” for technical or industrial school

Table 4 Spatial terms in field C with the logic induction results, $N = 395,409$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Production unit (生产队, 生产大队, 大队, 社队)	109,124	a	14	Grazing land (牧场, 牧区)	5,863	b
2	People's commune (人民公社, 公社)	101,104	a	15	Paddy field (水田)	5,651	b
3	Cropland (农田, 田地)	26,334	b	16	Wheat field (麦田)	5,412	b
4	Cultivation (农场, 国营农场)	25,223	b	17	Experimental field (试验田)	5,390	b
5	Mutual aid team (互助组)	15,369	a	18	Rice field (稻田)	4,724	b
6	Collective farm (集体农庄, 农庄)	11,513	a	19	Ministry of Agriculture (农业部)	4,471	d
7	Arable land (耕地)	10,690	b	20	Tractor station (拖拉机站)	3,897	b
8	Forest management area (林场)	9,141	b	21	Terracing (梯田)	3,494	b
9	Labor union (工会)	8,589	d	22	Waterwheel (水车)	3,339	b
10	Collective canteen (集体食堂)	7,725	a	23	College (学院)	3,129	c
11	Agricultural college (农业大学)	7,092	c	24	Cooperative of the advanced type (高级社)	2,730	a
12	Middle school (中学)	6,534	c	25	Agricultural high school (农业中学)	2,534	c
13	Cotton field (棉田)	6,337	b				

“a” for collective organization building, “b” for production site and facility, “c” for agricultural school, and “d” for government agency

Table 5 Spatial terms in field D with the logic induction results, $N=20,348$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Railway line (铁路运输线, 铁路)	4,684	a	11	Ministry of Transport (交通部, 交通部门)	536	b
2	Motorway (公路, 道路)	3,642	a	12	Marina (码头)	512	c
3	Rail station (车站)	2,049	d	13	Inland waterway (内河, 河道)	389	c
4	Ministry of Industry (工业部, 工业部门)	1,351	b	14	Ministry of Posts and Telecommunications (邮电部)	381	b
5	Bridge (桥梁, 大桥, 桥)	1,089	a	15	Airport (机场)	338	d
6	Port (港口, 港)	1,081	c	16	Management bureau (管理局)	326	b
7	Labor union (工会)	1,017	b	17	Waterborne transport (水运)	290	c
8	Channel line (航道线, 航线, 航运线)	969	c	18	Ministry of Railways (铁道部)	238	b
9	Command (指挥部)	710	b	19	Canal (运河)	206	c
10	Rails (铁道, 轨道)	540	a				

"a" for road and bridge, "b" for government agency, "c" for canal and port, and "d" for passenger terminal

Table 6 Spatial terms in field E with the logic induction results, $N=48,648$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial term (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Reservoir (水库)	10,691	a	10	Water pumping station (抽水站)	1,453	c
2	Drainage (水渠, 渠道, 干渠)	7,579	b	11	Electricity generating station (发电站)	1,402	a
3	Embankment (塘坝, 水坝, 大坝)	5,239	c	12	Industrial sector (工业部门)	1,266	d
4	Farmland conservancy project (农田水利工程)	4,939	b	13	Irrigation project (灌溉工程)	1,047	b
5	Hydroelectric power plant (水电站)	3,706	a	14	Ministry of Water Resources (水利部)	978	d
6	Dyke (大堤, 堤坝, 堤)	2,591	c	15	Command (指挥部)	942	d
7	Waterlock (水闸, 闸)	1,741	a	16	Ministry of agriculture (农业部)	941	d
8	River way (河道)	1,698	c	17	Water pump (水泵)	805	b
9	Borehole (水井, 井)	1,630	b				

"a" for hydroelectric power facility, "b" for agricultural irrigation and drainage facility, "c" for flood prevention facility, and "d" for government agency

Table 7 Spatial terms in field F with the logic induction results, $N=9,154$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Research institute (研究所)	1,750	a	12	Library (图书馆)	202	a
2	Test site (试验地)	1,666	b	13	Test field (试验田)	158	b
3	Academy of science (科学院, 中国科学院)	1,350	a	14	Academy (研究院)	144	a
4	Scientific and technical association (科技协会, 科协)	810	c	15	Ministry of Health (卫生部)	144	c
5	Oil field (油田, 大庆油田)	489	b	16	Ministry of Agriculture and Forestry (农林部)	135	c
6	Research unit (科研单位)	337	a	17	Ministry of Industry (工业部)	134	c
7	Laboratory (实验室)	310	a	18	Ministry of Education (教育部)	133	c
8	Meteorological office (气象台)	277	a	19	State Science and Technology Commission (国家科委)	128	c
9	Research center (研究室)	233	a	20	agricultural institute (农科所)	114	a
10	Cultivation (农场)	216	b	21	Ministry of Metallurgy (冶金部)	111	c
11	Labor union (工会)	212	c	22	Ministry of Machine Industry (机械工业部)	101	c

"a" for research building, "b" for experimental site, and "c" for government agency

Table 8 Spatial terms in field G with the logic induction results, $N = 3,746$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	Health office (卫生院, 医院)	897	b	16	Post office (邮电局)	62	d
2	School (学校)	661	a	17	Temple (寺庙)	58	f
3	Primary school (小学)	298	a	18	Public security bureau (公安局)	56	d
4	Middle school (中学)	171	a	19	Memorial hall (纪念馆)	55	f
5	College (大学, 学院)	138	a	20	Service station (服务站)	52	d
6	Cinema (电影院, 影院)	137	c	21	Clinic (卫生所)	50	b
7	Medical center (医疗中心)	129	b	22	Municipal government (市府)	50	e
8	Kindergarten (托儿所)	115	a	23	Library (图书馆)	45	c
9	Viva museum (万岁馆)	91	f	24	Labor union (工会)	43	e
10	Electricity office (电力局)	89	d	25	National Bureau of Statistics (国家统计局)	42	e
11	Institution of higher education (高等学校)	80	a	26	Ministry of Industry (工业部)	39	e
12	Exhibition hall (展览馆)	75	c	27	Theater (剧院)	38	c
13	Gymnasium (体育场)	69	c	28	Prefectural party committee (地委)	38	e
14	Nursery school (幼儿园)	67	a	29	Ministry of Commerce (商业部)	37	e
15	Gallery (美术馆)	64	c				

“a” for education building, “b” for medical and healthcare building, “c” for recreation building and facility, “d” for municipal services building, “e” for government agency, and “f” for religious and memorial building

Table 9 Spatial terms in field H with the logic induction results, $N = 248,884$

No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction	No	Spatial terms (Chinese raw spatial terms)	Total F-value	Basic type induction
1	General assembly (大会, 代表大会, 头脑会议, 会议)	91,479	a	11	Evening party (晚会)	2,006	c
2	Ministry of Foreign Affairs (外交部)	39,431	b	12	Piazza (广场)	1,919	a
3	Reception (招待会)	32,663	a	13	Military command (司令部)	1,679	b
4	Embassy (大使馆, 使馆, 中国大使馆)	29,382	b	14	Meeting place (会场)	1,657	a
5	Banquet (宴会, 盛大宴会)	24,988	c	15	Meeting (会晤)	1,653	a
6	Exhibition (展览会)	5,267	d	16	Celebration (典礼)	1,378	a
7	Wine reception (酒会)	3,468	c	17	Department of External Economic Research (外经部)	1,294	b
8	Protocol division (礼宾司)	3,146	b	18	Exposition (博览会)	1,282	d
9	Ministry of National Defence (国防部)	2,628	b	19	Residence (居住)	1,213	c
10	Ministry of Culture (文化部)	2,351	b				

“a” for assembly building, “b” for government agency, “c” for hotel building, and “d” for exhibition building

The Ministry of Commerce was its most representative heritage.

Second, field B, which had the highest total F-value, also covered the most spatial terms with forty-one, categorized into five basic types, namely factories and facilities, mining sites, military industrial bases, government agencies, and technical or industrial schools (Table 3 and Fig. 5B). Factories and facilities, which were utilized to carry out various industrial manufacturing, had an absolute dominance in word frequency. Iron and

steel factories, machine factories, and plants appeared most frequently. Mining sites for the extraction of mineral resources accounted for the next largest share, only half of the factories and facilities, with “coalmine” being the most dominant term. Military industrial bases for national defense construction and the government agencies in charge of industrial construction, on the other hand, occupied a similar share, both about 10.00%. The armament factory was the main military industrial base, while the labor unions and the Ministry of Industry were

the main governmental agencies. Technical or industrial schools had the smallest share. Among them, the engineering college was the major type, but its share in the total was very low.

Third, field C with the second highest total F-value covered twenty-five spatial terms, which were grouped into collective organization buildings, production sites and facilities, agricultural schools, and government agencies (Table 4 and Fig. 5C). Collective organization buildings accounted for the largest share, containing all organizational units serving agricultural production.

The production unit and the people's commune were the most common types. The second basic type was production sites and facilities, which involved a variety of farmland and related labor facilities. The most numerous and representative of these were croplands, cultivation, and some fields of a collective nature with different management approaches. Agricultural schools teaching agroforestry techniques and government agencies in charge of agroforestry construction occupied similar and smaller shares. Correspondingly, the

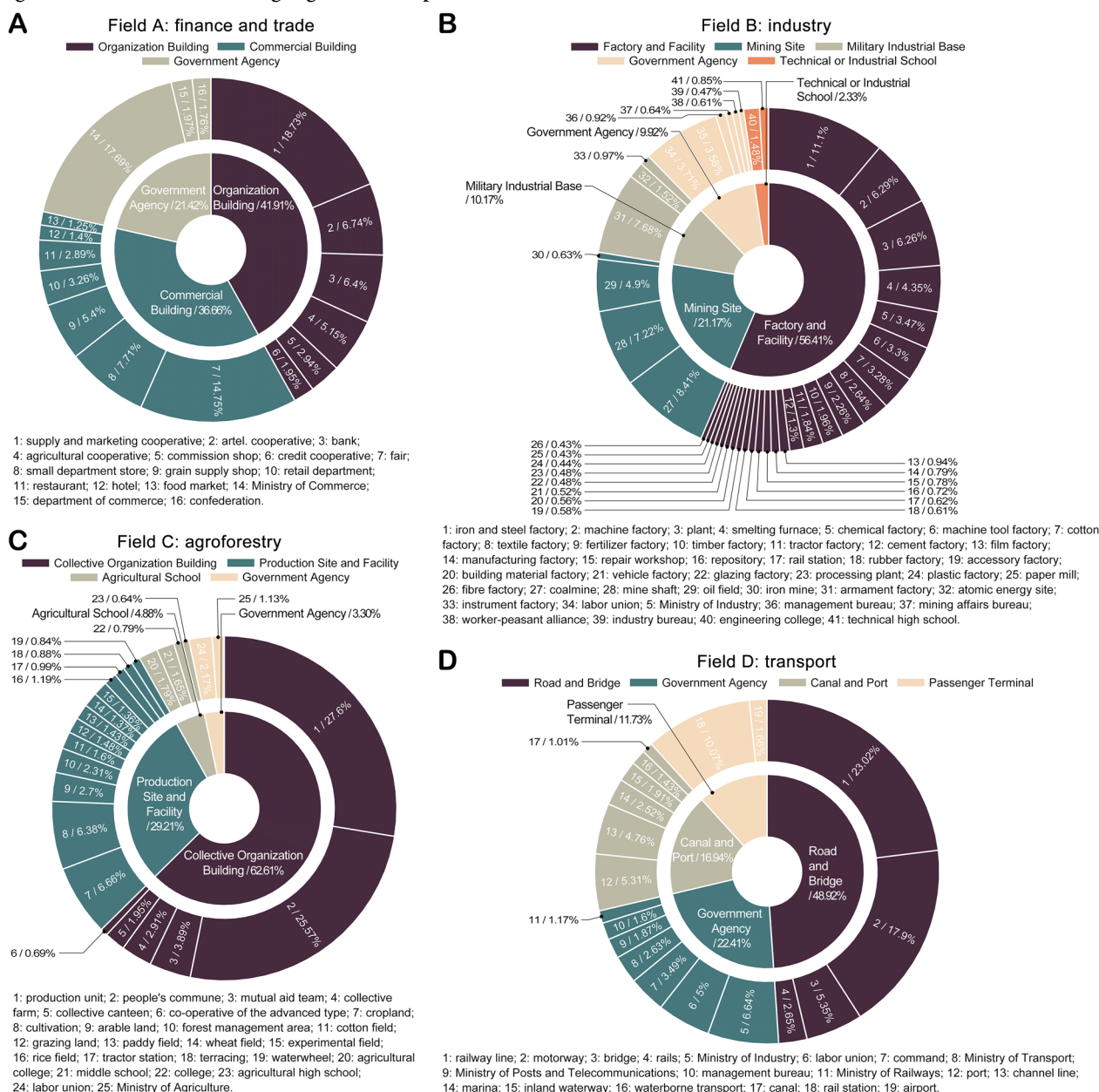
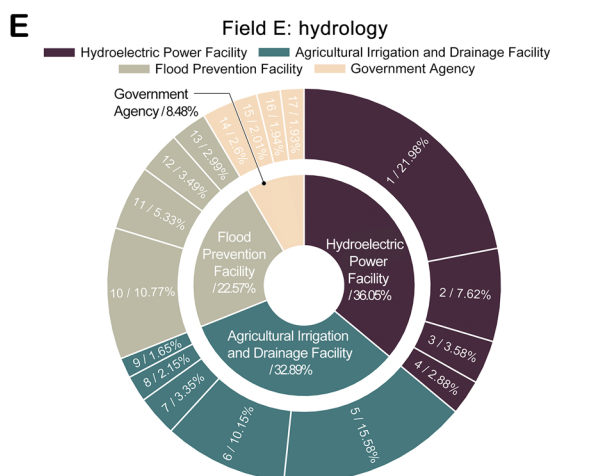
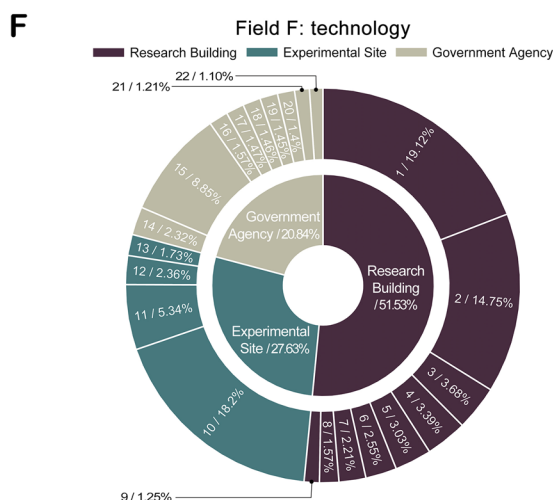


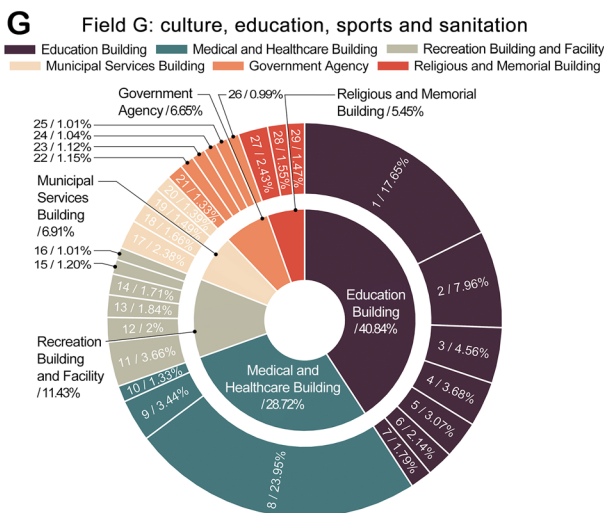
Fig. 5 Compositional characteristics of basic types with its attributed spatial terms for each construction field. **A** Field A: finance and trade; **B** Field B: industry; **C** Field C: agroforestry; **D** Field D: transport; **E** Field E: hydrology; **F** Field F: technology; **G** Field G: culture, education, sports and sanitation; **H** Field H: diplomacy



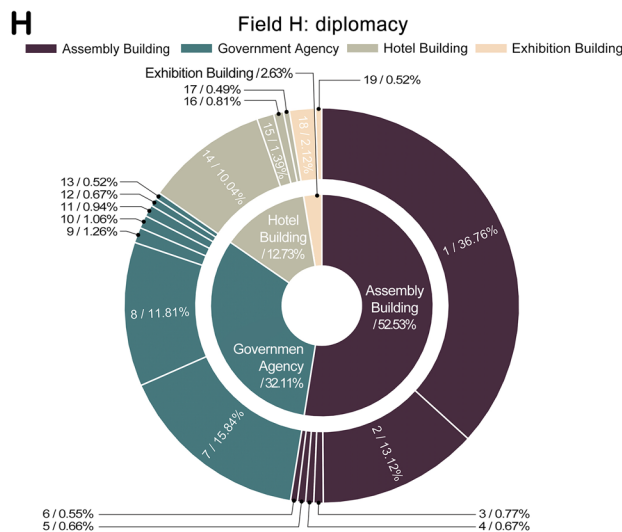
1: reservoir; 2: hydroelectric power plant; 3: waterlock; 4: electricity generating station; 5: drainage; 6: farmland conservancy project; 7: borehole; 8: irrigation project; 9: water pump; 10: embankment; 11: dyke; 12: river way; 13: water pumping station; 14: industrial sector; 15: Ministry of Water Resources; 16: command; 17: Ministry of Agriculture.



1: research institute; 2: academy of science; 3: research unit; 4: laboratory; 5: meteorological office; 6: research center; 7: library; 8: academy; 9: agricultural institute; 10: test site; 11: oil field; 12: cultivation; 13: test field; 14: labor union; 15: scientific and technical association; 16: Ministry of Health; 17: Ministry of Agriculture and Forestry; 18: Ministry of Industry; 19: Ministry of Education; 20: State Science and Technology Commission; 21: Ministry of Metallurgy; 22: Ministry of Machine Industry.



1: school; 2: primary school; 3: middle school; 4: college; 5: kindergarten; 6: institution of higher education; 7: nursery school; 8: health office; 9: medical center; 10: clinic; 11: cinema; 12: exhibition hall; 13: gymnasium; 14: gallery; 15: library; 16: theater; 17: electricity office; 18: post office; 19: public security bureau; 20: service station; 21: municipal government; 22: labor union; 23: National Bureau of Statistics; 24: Ministry of Industry; 25: prefectural party committee; 26: Ministry of Commerce; 27: viva museum; 28: temples; 29: memorial hall.



1: general assembly; 2: reception; 3: piazza; 4: meeting place; 5: meeting; 6: celebration; 7: Ministry of Foreign Affairs; 8: embassy; 9: protocol division; 10: Ministry of National Defence; 11: Ministry of Culture; 12: military command; 13: Department of External Economic Research; 14: banquet; 15: wine reception; 16: evening party; 17: residence; 18: exhibition; 19: exposition.

Fig. 5 continued

representative heritage terms for these two were “agricultural college” and “labor union”.

Fourth, for field D with nineteen spatial terms, four basic types were obtained according to the characteristics of transportation functions, namely roads and bridges, government agencies, canals and ports, and passenger terminals (Table 5 and Fig. 5D). Roads and bridges had the largest share of word frequency, almost half of the total, and mainly referred to the facilities that supported land transportation. Among them, “railway line” and “motorway” were the most frequently mentioned terms,

i.e., railroad and highway heritage. Government agencies for transportation ranked second, followed by canals and ports supporting water transportation, while passenger terminals serving turnaround had the lowest word frequency. Accordingly, the most representative heritages for these three were the Ministry of Industry, ports and rail stations.

Fifth, based on the principle of use and purpose, the seventeen spatial terms included in field E were categorized as hydroelectric power facilities, agricultural irrigation and drainage facilities, flood prevention facilities,

and government agencies (Table 6 and Fig. 5E). Hydroelectric power facilities and agricultural irrigation and drainage facilities had a similar number of word frequencies and accounted for the vast majority in the field. “Reservoir” was a high-frequency term for the former, while “drainage” was for the latter. In addition, the latter included typical facilities such as boreholes and water pumps. Flood prevention facilities were the third type of heritage, and “embankment” was the most dominant spatial term. Government agencies in charge of water resources had the least frequency, with the industrial sectors and the Ministry of Water Resources appearing most frequently.

Sixth, the twenty-two terms in field F were grouped into research buildings, experimental sites, and government agencies (Table 7 and Fig. 5F). Research buildings were the indoor spaces for scientific and technological work, accounting for more than half of the total. “Research institute” and “academy of science” were the most frequent heritage terms, while others included “meteorological office” and “library”. Experimental sites underpinned the outdoor technological activities, and government agencies oversaw the implementation of technological programs. Both had similar frequency shares, ranging from 20.00 to 30.00%, but the former was slightly higher. The representative high-frequency terms for the former were “test site” and “oil field”, while that for the latter was “scientific and technical association”.

Seventh, field G had the lowest total F-value, but was generalized to the largest number of basic types, based on the specific service function. It consisted of education buildings, medical and healthcare buildings, recreation buildings and facilities, municipal services buildings, government agencies, and religious and memorial buildings (Table 8 and Fig. 5G). The specific functions of these types were indicated by their very names. Of these, both education buildings and medical and healthcare buildings owned relatively large shares. High frequency terms for the former included mainly “school”, as well as the more

specific “primary school”, “middle school”, and “college”. As for the “health office” it was the main high-frequency term for the latter and the highest in the field. Recreation buildings and facilities came in third, with “cinema” as the most dominant spatial term. The shares of municipal service buildings and governmental agencies were comparable, ranging from 6.50% to 7.00%. “Electricity office” and “municipal government” were the corresponding most frequent terms. Then the one with the lowest word frequency was religious and memorial buildings, while having the least number of terms. The viva museum was the most distinctive and most frequent heritage.

Eighth, for the nineteen spatial terms in field F, four basic types of assembly buildings, government agencies, hotel buildings, and exhibition buildings were summarized (Table 9 and Fig. 5H). Similar to the composition of field F, the assembly buildings for holding meetings almost half of the total. Conference-related terms such as “general assembly” and “reception” were the most common, and the former was also the most frequent term in the field. Government agencies in charge of foreign affairs ranked second, with “Ministry of Foreign Affairs” as its representative term. Hotel buildings and exhibition buildings had relatively low frequencies, both below 15.00%, but the latter had the lowest. For the former, terms related to hotel services, such as “banquet” and “wine reception” had higher word frequencies. For the latter, “exhibition” was the most frequent term.

Evolution progresses of various SBH basic types

Field A: finance and trade

Figure 6 illustrates the fluctuation trends of the three basic types in field A. Specifically, the organization building was the first basic type to appear in November 1955. Its terms were “artel. cooperative” and “agricultural cooperative”, which were created as the products of the socialist transformation of agriculture. Collective economic organizations such as supply and marketing cooperatives

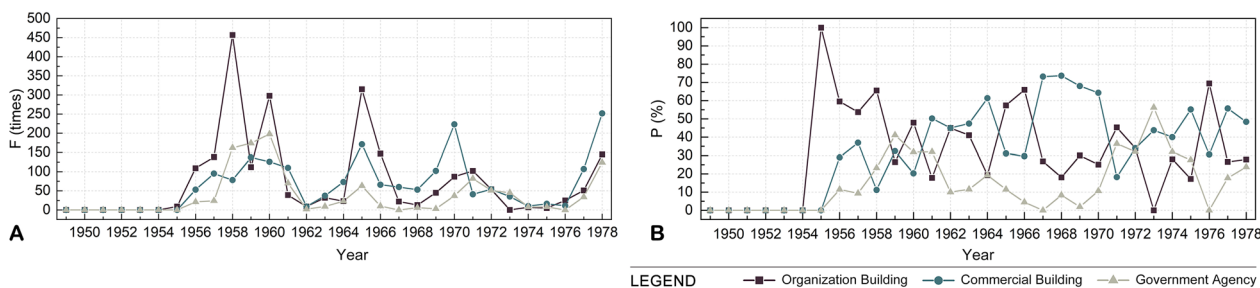


Fig. 6 Word frequency statistics for field A, $N=5,578$. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

and commission shops also appeared in the same year. Reports on these two types of organization buildings continued to increase, peaking in 1958 with F-values of 210 and 188, respectively. Meanwhile, commercial buildings such as small department stores and retail departments, and government agencies such as the Department of Commerce and departments of commerce all appeared in 1956 and have continued to grow.

“Fair”, “small department store”, “bank”, and “Ministry of Commerce” became hot spots for continuous coverage after 1958. The highest F-values for the first two were achieved in 1959 with 81 and 40 each, while the latter two peaked a little later in 1960 with corresponding F-values of 193 and 182, respectively. The relevant reports peaked again in 1965 after a short period of low peaks since 1961, with supply and marketing cooperatives, credit cooperatives and small department stores becoming the main types. They were mostly state-run or public-private partnership forms, with corresponding P-values of 39.16%, 12.93% and 10.75%.

Between 1966 and 1976, the relevant discussion entered a fluctuating downturn, with only minor peaks in 1970 and 1971, and was mostly associated with grain supply shops (P=35.45%, only values noted later), the Department of Commerce (34.67%), and commission

shops (31.11%). It was not until 1975 that the coverage increased and became more diverse. Terms such as “confederation”, “department store”, “food market”, and “shopping mall” began to appear.

Field B: industry

As indicated in Fig. 7, the evolution of the five basic types of field B presented a trend from undulation to stabilization, all of which maintained high F-values. In detail, at the beginning of the national construction in 1949, “coalmine”, “machine factory”, “plant”, “cotton factory”, and “iron and steel factory” became the hotspots at that time and showed an increasing trend, with the corresponding F-values in 1950 being 1,307, 1,497, 947, 650, and 625. In the same year, the worker and peasant accelerated secondary school (F=329, only values noted later) burst onto the scene with the F-value increasing dramatically. From 1952 onwards, terms such as “timber factory”, “smelting furnace”, “machine tool factory”, “tractor factory”, “manufacturing factory”, “building material factory”, “oil field”, “armament factory”, “atomic energy site”, “mining affairs bureau”, and “industrial management bureau” appeared one after another. Moreover, they all formed a brief peak from 1953 to 1957, indicating that the category of heavy industry in China was expanding during this period.

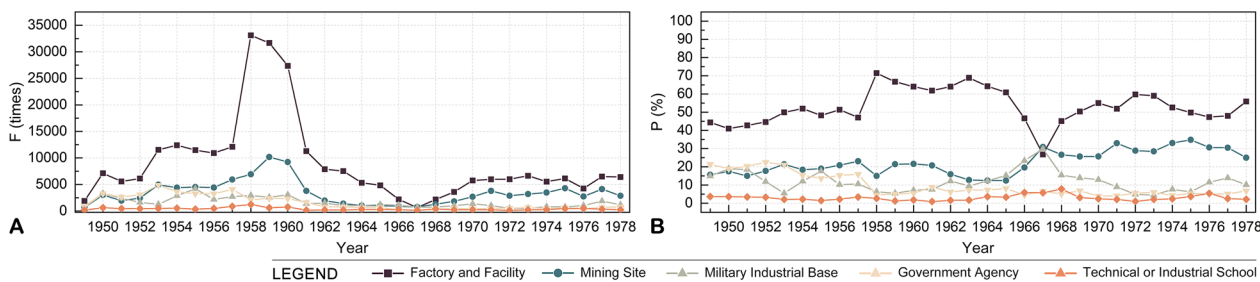


Fig. 7 Word frequency statistics for field B, N=518,527. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

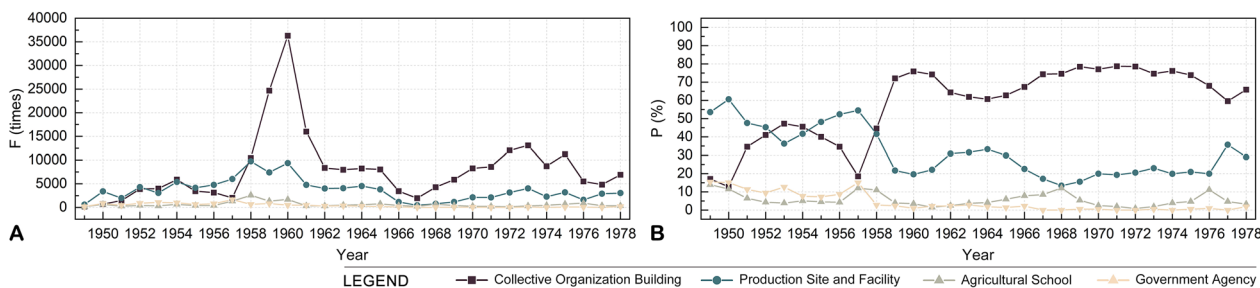


Fig. 8 Word frequency statistics for field C, N=395,409. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

From 1958 to 1959, there was a sudden increase in the total F-value of this field. The F-values of terms related to steel production such as “iron and steel factory”, “smelting furnace”, “machine factory”, “coalmine”, etc. have even reached their highest peaks in three decades, which were 11,499, 4,138, 3,187, and 2,691. It is interesting to note that industrial schools and colleges in the half-work form were also produced during the period, with a total F-value of 1,231. But in 1961, the reports entered a longer cooling-off period. Beginning in 1964, reports began to decline, but at a somewhat more moderate rate, reaching a low point in 1966.

After 1969, the terms “machine factory”, “plant”, “chemical factory”, “fertilizer factory”, “cement factory”, and “armament factory” appeared frequently again and began to grow slightly. Their F-values in 1971 were 936, 846, 450, 183, 182, and 865. Thereafter, the relevant reports generally stabilized until 1978, and the share of each basic type was balanced.

Field C: agroforestry

Figure 8 displays the high-frequency and fluctuating evolutionary characteristics of the four basic types within field C. In particular, in 1949, the sole collective organization that emerged was the collective farm (17.05%), with cultivation as the main production site (31.44%). In the subsequent year, mutual aid teams spontaneously formed by peasants became visible and grew (438). Various field terms such as “cropland”, “arable land”, “cotton field”, and “wheat field” also came into being. Moreover, amateur schools for workers and peasants were established with a total F-value of 647. Then in 1954, the term “mutual aid team” (3,546) reached its all-time peak. However, it declined significantly after 1955. Meanwhile, the cooperatives of the primary type appeared in transition with a lower F-value. The cooperatives of the advanced type (10.70%) emerged in 1956, which gradually replaced the first two as the main collective organization. In 1954, the term “tractor station” reached its highest F-value at 948. Gradually, the waterwheels, which were once more

prevalent, disappeared throughout 1964. Furthermore, following 1955, there was a noticeable increase in reports concerning cultivation, forest management areas, and grazing land that was associated with military reclamation. Government agencies such as the Ministry of Agriculture and Reclamation and the Ministry of Forestry and Reclamation were established.

In 1958, the terms “production unit”, “people’s commune” and “collective canteen” gained popularity as basic labor units. They continued to grow for 3 years, peaking in 1960. The F-values for the production sites, including cropland, cultivation, arable land, and forest management areas, were also inflated. Agricultural high schools, similar to industrial amateur schools, were established in 1958 (515). The reports in this field experienced a steep decline after 1961 and maintained a relatively stable trend from 1962 to 1965.

Beginning in 1968, reporting gradually returned to normal. Among them, the F-values of production units, people’s communes and various types of farmland increased throughout the period and reached a small peak in 1973. Between 1975 and 1978, after a brief period of decline, the discussion began to grow again.

Field D: transport

As shown in Fig. 9, similar to field B, the evolution of the basic types of field D was characterized by fluctuating and then stabilizing. More specifically, between 1949 and 1952, national agencies such as the Ministry of Transport, the Ministry of Railways, and the Ministry of Posts and Telecommunications were the first to appear, accompanied by railway lines, motorways, channel lines, inland waterways, and other transportation facilities, suggesting that construction was mostly focused on land and water transportation. As project implementation units, commands and management bureaus have also begun to emerge. However, since construction was not yet fully underway, the F-values for all of the above terms were low and had a weak growth trend.

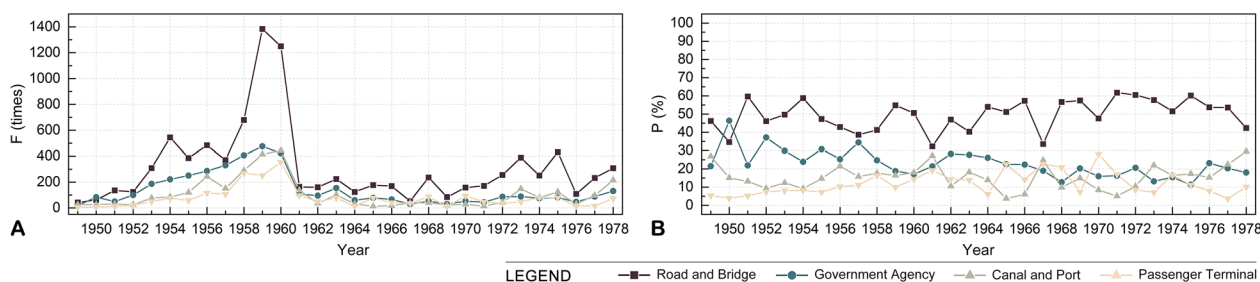


Fig. 9 Word frequency statistics for field D, N=20,348. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

Beginning in 1953, the P-values for the terms “railway line”, “motorway”, and “rail station” continued to jump, and those for terms such as “channel line” and “canal” also increased slightly. This trend was reinforced in 1958, when the F-values for all terms reached an all-time high in 1959, including “railway line” (672), “motorway” (477), “rail station” (252), “bridge” (143), “port” (128), and “command” (101).

In 1961, there was a sharp decline in the number of such reports, which then remained at a steady level. During the next 5 years, the material of the motorway changed mainly from stone and cement to asphalt, and the bridges changed from stone arches to reinforced concrete. In 1961, there was also the first discourse on the construction of airports, indicating that air transport had begun to develop.

After 1966, the F-values for all the basic types shrank again. But in 1968 there was a second surge in the development of land transport, with railway lines (156), motorways (66), rail stations (67) and other transportation facilities still continuing to grow in size. The materials used for bridges moved towards more modern concrete. Meanwhile, the F-values for the terms “port”, “marina”, and “channel line” also increased somewhat, reaching 79, 33, and 22 in 1973. Air transport, on the other hand, has been relatively slow to develop, and terms

such as “airport” have continued to languish, reaching a small peak of 16.57% only in 1970. After a brief decline in 1975, the number of related stories began to increase in 1977, covering all types.

Field E: hydrology

Consistent with the evolutionary trend of field C, the four basic types of field E have undergone several major fluctuations, as evidenced by Fig. 10. Government agencies such as the Ministry of Water Resources (175) appeared in 1950, initiating the hydraulic construction of the New China. As a result, the terms “waterlock”, “reservoir”, dykes, and “embankment” had high F-values and continued to grow, reaching a small peak around 1952 at 321, 242, 146, and 121, respectively. At the same time, facilities such as drainage and boreholes for agricultural irrigation sprang up together, with phase extremes of F-value occurring in 1952 at 216 and 152. From 1953 to 1957, the total F-values for hydroelectric power generation, agricultural irrigation and drainage, and flood prevention facilities all increased steadily, suggesting further development in the scale and quantity of hydraulic construction.

Between 1958 and 1960, reports covering the terms “drainage”, “farmland conservancy project”, “embankment”, and “water pumping station” continued to

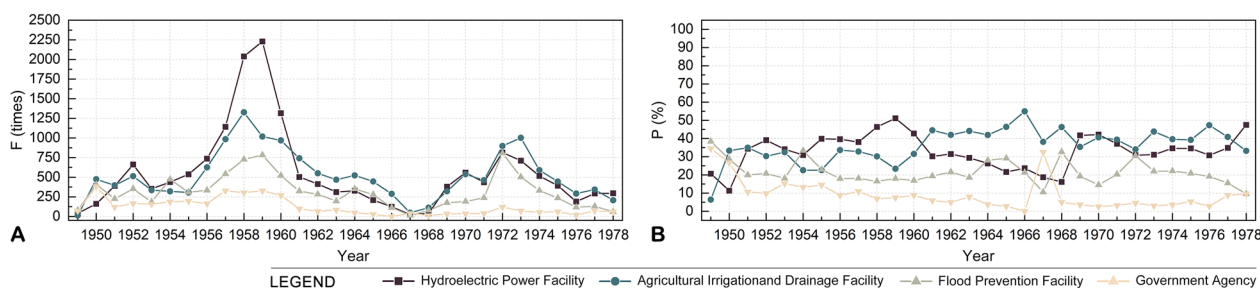


Fig. 10 Word frequency statistics for field E, $N=48,648$. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

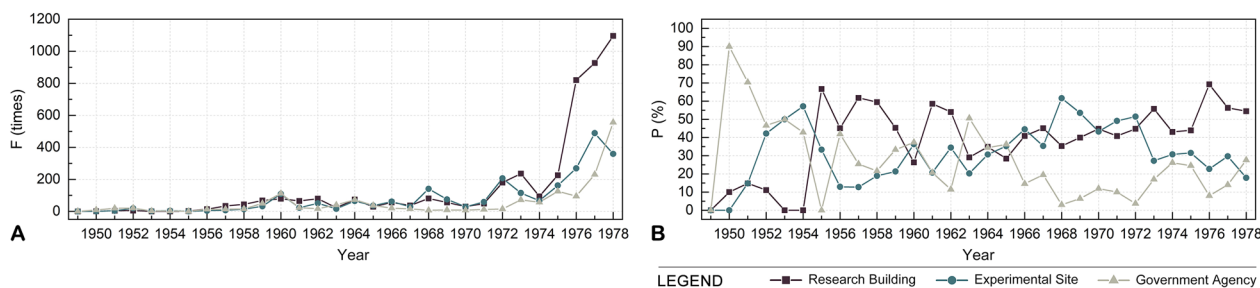


Fig. 11 Word frequency statistics for field F, $N=9,154$. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

increase, corresponding to F-values of 620, 397, 457, and 195 in 1958, accordingly. Moreover, hydroelectric power facilities, represented by reservoirs (37.13%), hydroelectric power plants (6.88%), and electricity generating stations (4.91%), became the most dominant heritage type, reaching the peak of the F-value in 1959. Since 1961, the reports have been somewhat weaker, and the term “drainage” dominated with a P-value of about 25%.

Field reporting reached a low point in 1967. Nevertheless, the F-value of each basic type increased again in 1969 and reached a third peak in 1972, such as reservoirs (520), dykes (444) and drainage (370).

Field F: technology

Distinguishing from other fields, the evolution of the three basic types of field F was characterized by a slow growth from zero and then a rapid leap, as illustrated in Fig. 11. The Chinese Academy of Sciences, an important research institution, was established in November 1949, which led to the development of science and technology in the country. Thus, around 1952, terms such as “scientific and technical association,” “academy of science,” “meteorological office,” and “research institute” began to appear with a slight increase in F-value (all less than 5 times), indicating a slight upturn in the construction of New China. Until 1956, the F-values for the terms “test site,” “research institute,” “cultivation,” and “academy of science” continued to increase slightly, reaching extreme values of 86, 35, 18, and 15 in 1960, respectively. Judging by the prefixes, these terms covered a wide range of sectors, including agriculture, engineering, metallurgy, meteorology, and defense, signifying the breadth of the study.

The above smooth development trend was maintained until 1966. Since then, reports on science and technology have reached a low point, with government agencies such as scientific and technical associations and the State Science and Technology Commission receiving F values close to zero. However, from 1968 onwards, “test

site” (59.83%) became the most prominent term and was mostly related to military and defense. In the early 1970s, the number of reports began to increase, and the F-values of various research institutes, oil fields, and test sites continued to rise. In addition, it entered a new phase of rapid and comprehensive development after 1975. The total F-value for this field in 1978 was 2,011, which was 6.7 times higher than that in 1960.

Field G: culture, education, sports and sanitation

The evolution of field G, which had the most basic types, was roughly characterized by fluctuations from strong to weak, and the P-values of each category were not balanced, as indicated in Fig. 12. In the early period of the New China, “school” (22.78%), “middle school” (10.97%), and “health office” (20.25%) quickly became high-frequency terms in 1950, indicating that education and health systems for workers and peasants had been established. With regard to cultural construction, “cinema” (6), “gymnasium” (4), and “library” (3) were mentioned very rarely. The establishment of the people’s government also contributed to the short-term growth of municipal facilities such as public security bureaus and municipal governments. Beginning in 1952, the F-values for the terms “college” and “institution of higher education” entered a period of rapid growth. These were mostly specialized colleges for industry, agriculture, forestry, and the military.

In 1958, the field began a period of rapid expansion and dramatic increases in F-value. In particular, the facilities such as health offices, kindergartens, nursery schools, and service stations, which accompanied the people’s communes in field C, occurred frequently, as did half-work schools. The terms corresponding to these facilities all reached their all-time peaks in 1960, with F-values of 164, 68, 42, 43, and 78, respectively. As for the cultural and sports construction, gymnasiums, libraries, and exhibition halls dominated the types of recreation buildings and facilities at that time. In addition, the religious

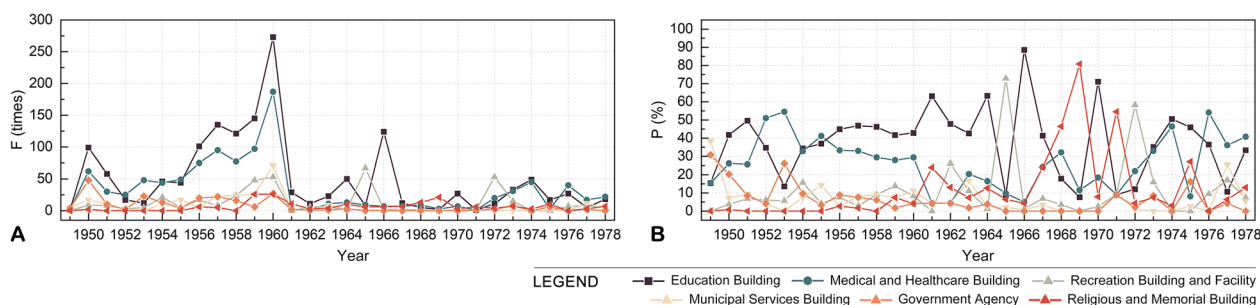


Fig. 12 Word frequency statistics for field G, N=3,746. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

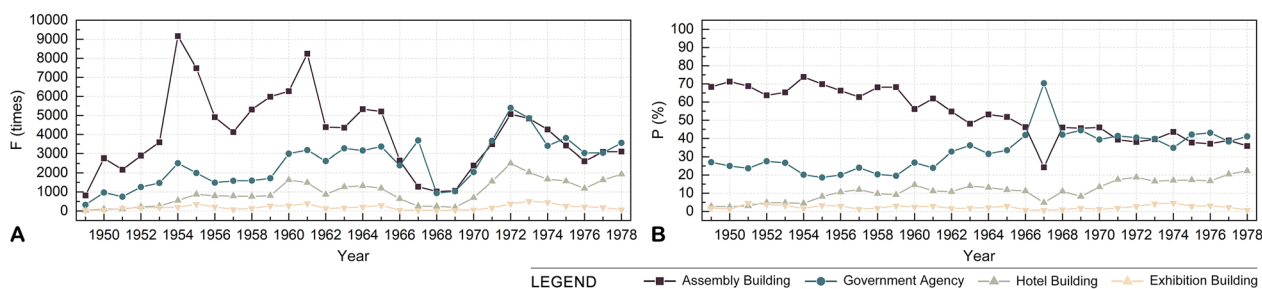


Fig. 13 Word frequency statistics for field H, $N=248,884$. **A** Evolutionary trend of the F for each basic type; **B** Evolutionary trend of the P for each basic type

building type of temple (21) was also emphasized in 1960. The sudden increase in F-values described above was tempered in 1961, with a slight increase after a sudden decrease.

Around 1966, all types of coverage in the field began to fluctuate at low F-values. In the same year, however, the special term “viva museum” (80.78%) entered the public consciousness and triggered a construction boom in 1969. Galleries (49.45%) as platforms for art and culture also proliferated in 1972. Thereafter, until 1978, the relevant reports stabilized, but mostly focused on health and education construction, with P-values of 40.74% and 33.33%, respectively.

Field H: diplomacy

Figure 13 presents an evolutionary process with several large fluctuations in the four basic types of field H, which has always been dominated by assembly buildings. In the early years of the country’s establishment, especially in 1950, government agencies such as the Ministry of Foreign Affairs (17.19%) and embassies (6.76%) became the

main types as a result of the frequent meetings on diplomatic relations. Therefore, related terms such as “general assembly” (2,563) also had high P-values and increases. The F-values for the terms “general assembly”, “reception”, and “celebration” peaked from 1954 to 1956, with the data of 8,051, 775, and 163 for 1954. Most of these terms were related to the establishment of diplomatic relations with New China, and some were from reports of 156 Soviet-sponsored construction projects. Along with diplomatic exchanges in the same period, both the hotel industry and exhibition industries in China took off, with F-values for “banquet” and “exhibition” rising steadily.

After 1957, there was a renewed upsurge in assembly buildings for organizing congresses, receptions, and meetings, and government agencies such as protocol divisions emerged. These terms culminated in 1961 with corresponding F-values of 6,408, 1,448, 157, and 192, respectively. Exhibition-related reports also grew slightly in the same year. In addition, the F-values for “banquet” and “reception” remained elevated during this period, with an average P-value of approximately 10.00%. This

Eight fields	Twenty-six SBH basic types					
Field A: finance and trade	government agency	organization building	commercial building			
Field B: industry	government agency	factory and facility	mining site	military industrial base	technical or industrial school	
Field C: agroforestry	government agency	collective organization building	production site and facility	agricultural school		
Field D: transport	government agency	road and bridge	canal and port	passenger terminal		
Field E: hydrology	government agency	hydroelectric power facility	agricultural irrigation and drainage facility	flood prevention facility		
Field F: technology	government agency	research building	experimental site			
Field G: culture, education, sports, and sanitation	government agency	education building	medical and healthcare building	recreation building and facility	municipal services building	religious and memorial building
Field H: diplomacy	government agency	assembly building	hotel building	exhibition building		
	Same Basic Type					

Fig. 14 The composition of the SBH basic types

evolutionary trend of high F-values was maintained until 1966.

After 2 years of stagnation in 1968 and 1969, the three terms “Ministry of Foreign Affairs”, “reception” and “banquet” increased dramatically in tandem, reaching the phase peak in 1972, with the F-values of 2,902, 2,576, and 2,237, respectively.

Nevertheless, the F-values for “exhibition” and “exposition” increased but the P-values were relatively low (about 4.00%). It indicates that the exhibition industry as a means of complementing foreign policy did not develop rapidly during that period. Beginning in 1975, there was a downward revision in the number of reports in this field, but the growth trend resumed immediately after 2 years, excluding exhibition buildings.

Discussion

Basic types of SBH

Through in-depth processing of 95,033 related reports from the *People's Daily* graphic database, twenty-six basic types of SBH were identified and obtained (government agencies were collectively named), as displayed in Fig. 14.

In response to these basic types and their composition, there are three interesting observations to be discussed in this study.

First, SBH is not an unconventional singularity heritage, but is composite, multi-scale, and broad. From the scale of these types, SBH includes not only buildings in the conventional perception, but also many planning heritages (e.g., people’s communes, factories and facilities), landscape heritages, and facility heritages (e.g., large-scale hydroelectric power facilities), among others. As Tan G.Y. [12] and Liu H. [37] pointed out, the construction of New China in the SRCP was extensive and pioneering, with the state and its people undertaking large-scale construction and generating construction achievements of various scales. Examples of planning heritage related to fieldwork include Yueyang Petrochemical and Qinyong Village in Ningbo, Zhejiang [9], and facility heritage includes the Three Gorges Dam [45] and the Miyun Reservoir in Beijing [46], as displayed in Fig. 15. It is these diverse achievements that have shaped the present-day SBH, giving it a distinctly multi-scale and broad character. Meanwhile, these identified basic types



Fig. 15 Typical planning heritages and facility heritages in SBH. **A** Yueyang Petrochemical Plant is a large-scale joint venture designed, equipped and installed by New China itself, which was founded at the end of 1969. It is not only a plant, but also a small city with more than 15,000 employees. With industrial production at the center, many buildings and facilities, such as housing and living services, have been extended to form a large city-like pattern [37]. **B** Qinyong Village in Ningbo City, Zhejiang Province, is a model village for the Maoist era’s “learn from Tachai in agriculture” movement. Between 1974 and 1976, the villagers collectively built this brand-new village at the foot of a mountain. Its collective production and construction became a model for Zhejiang province and the whole country. **C** Three Gorges Water Hub Project, built in 1994, is a large-scale water conservancy project integrating flood control, power generation, navigation and water resource utilization. It consists of a dam, power generation buildings, and navigation building, and is one of the largest water conservancy hub structures in the world. It took twelve years to build and solved the problems of flooding and energy shortage in the Yangtze River [45]. **D** Miyun Reservoir was built in 1958 and is the largest reservoir in northern China. It took two years to complete the construction by gathering the efforts of more than 200,000 people and solved the water problem of the capital city of Beijing [46].

are consistent with the categorization of the 20th Century Architectural Heritage and National Industrial Heritage of China [26, 29], such as assembly building, hotel building, industrial facility, and military industrial base. Due to the socialist system, there are also many types that are exclusive to SBH, such as people's communes for collective organization buildings, viva museums for religious memorial buildings, and industrial and agricultural schools. They are all forms of production and life oriented towards the communal nature of the working and peasant classes, or the commemoration of the national leaders. These typologies are only proof of the communist and collectivist character of the SBH, which distinguishes it from the usual contemporary heritage or modern architecture, and which makes it so uniquely valuable.

Second, SBH varied widely across fields, with fields B and C being the most prominent. Within the SRCP, in order to reverse its backward economic situation, New China has made industry and agroforestry important development tasks, especially heavy industry related to the military [47]. It led to the highest percentage of valid reports and spatial terms in both fields during the period. SBHs associated with industry and agroforestry accounted for the vast majority of the overall volume, with a total word frequency share of 73.10%. Fields D and E were also mentioned several times, with a combined share of 5.52%. Transportation construction guaranteed the stability of industrial processes such as the raw material supply, production and use, sales and export, while water construction promoted the development of agricultural irrigation, energy use, etc. [15, 16, 39]. As a result, SBH in these two fields also occupied a certain discourse as a supporting condition for the modernization of industry and agroforestry. Nonetheless, the word frequency share of SBHs in fields A, F, and G were all below 1.00%. This is because the three belonged to a relatively marginal part of the socialist construction in the early national establishment, and the relevant reports had not yet begun in full [48, 49].

Third, different basic types also showed large differences in discourse frequency. Factories and facilities, collective organization buildings, government agencies, and assembly buildings were the most frequently occurring heritage types (word frequency share > 10.00%), consistent with the field characteristics. It is important to note that government agencies were the most unique component of SBH. With the establishment of the new Chinese socialist regime, a large number of hierarchical governments and organizations were constructed to fully embrace the party leadership and orderly social construction [38]. Thus, in almost every field there were corresponding government agencies that took on the role of

planning, managing, and supervising socialist construction. Assembly buildings were the places where all the important domestic and foreign talks were held. During this period, China established diplomatic relations with about one hundred countries around the world, and held numerous meetings and received positive publicity [50], which led to a high number of occurrences of this type. Other basic types had smaller word frequency shares, such as the five types in field G, all of which were less frequently mentioned due to the marginal nature of the construction, for reasons similar to the differences in the fields described above.

Evolutionary characteristics of SBH

The twenty-six basic types of SBH in the eight fields did not exist independently, but intertwined with each other in the process of socialist construction in New China. Combined with the change pattern of word frequency, this study dissected the evolutionary characteristics of each type of SBH, including the chronological stage, pattern and nature.

Evolutionary chronological stages

Ignoring the differences in type, the word frequency changes demonstrated that SBH had six distinct evolution stages in the SRCP. It included periods of recovery (1949–1952), expansion (1953–1957), dramatic inflation (1958–1960), cooling (1961–1965), depression (1966–1975), and stabilization (1976–1978).

More specifically, first, 1949 to 1952 was a period of recovery. In this period, the country focused on the rehabilitation and development of mining, power, iron and steel, cotton textile, machinery manufacturing, etc., which largely contributed to the growth of SBH in fields B and D [13, 18]. Simultaneously, the establishment of the organizational system of supply and marketing cooperatives, the socialist transformation of agriculture, and land reform were carried out one after another [51], which led to the emergence of supply and marketing cooperatives, mutual aid teams, and other types of heritage. In addition, a large number of water management projects were planned to solve the problem of frequent floods (Huaihe River, Yellow River, etc.) [52]. It can be seen that the restoration and construction of the national economy resulted in an increase in the number of all SBH types, but it was still very limited.

Second, 1953 to 1957 was a period of expansion. In 1953, the ruling party of the New China put forward the important task of socialist industrialization and the socialist transformation of agriculture, handicrafts, and capitalist industry and commerce [34, 53]. The first 5-Year Plan, which focused on 156 Soviet-sponsored projects, was implemented, and a more independent

industrial system was initially formed [54, 55]. The country also restructured the layout of the old systems of education, culture, and sports, and established diplomatic relations with several countries around the world [47, 56]. During this period, the implementation of the first 5-Year Plan contributed significantly to the expansion of SBH and the diversification of its basic types, especially in fields B, C and H. Most of the machine tool and tractor factories associated with the instrument manufacturing, as well as the socialist agricultural cooperatives of the advanced type, assembly buildings, and exhibition buildings first appeared during this stage.

Third, 1958 to 1960 was a period of dramatic inflation. The Great Leap Forward and the People's Communalization Movement were launched in 1958 on the basis of the second 5-Year Plan for industrialization [39, 57]. The whole country was rapidly engaged in ostentatious construction with lofty goals such as the popularization of people's communes, industrial production competitions, and hydrological and transportation construction. Nearly 8,000 km of railway lines were built and more than 290 hydrological projects were launched. This extensive construction movement was blindly pursued in the rapid rise of the economic level, causing a short-term surge in the number of all SBH basic types. It contributed to a historic peak in the type and number of SBHs within the SRCP (Fig. 3C), especially in the government-society people's communes and steel-related factories and facilities.

Fourth, 1961 to 1965 was a period of cooling. From 1961 onwards, in order to reverse the erroneous situation of the above-mentioned leap forward, the ruling party implemented the construction policy of "readjust, consolidate, fill out gaps and raise standards" for the national economy [58]. It not only adjusted the policy of rural cooperativization, but also reformulated the national economic plans for industry, finance and trade. At that time, all construction activities were abruptly curtailed with a reduction in project targets. Accordingly, reports of SBH were rapidly reduced and have returned to their former normal levels in terms of numbers. In addition, essentially no new basic types have emerged.

Fifth, 1966 to 1975 was a period of depression. In May 1966, the political campaign of the Great Proletarian Cultural Revolution broke out, causing great damage to the socialist construction of the New China [59]. The movement concentrated on fields F, G, and H, resulting in a sharp decrease in the word frequency of their SBH [60], especially from 1966 to 1969. As in field F, its government agencies were barely mentioned (F-value approaching zero). However, in 1970, the Third-Front Movement and local industries began to be laid out, and a large number

of modernization projects for industry, military, transportation and hydrology were constructed [12, 61]. New basic types such as machine factories, armament factories, railway lines, and electricity generating stations have thus proliferated. Despite the overall decrease in word frequency across basic types in all fields during this stage, the number remained relatively high compared to the previous stage.

Sixth, 1976 to 1978 was a period of stabilization. At the end of 1975, the New China initiated a comprehensive reorganization. Similar to the fourth stage, many construction projects were adapted and altered, resulting in the word frequency of the basic types of most fields remaining slow-growing or unchanged. It is worth mentioning that with the introduction of advanced technology and equipment from developed countries such as Germany, SBH in fields A and F began to enter a phase of large-scale, multi-type development [62]. As can be seen, in addition to the socialist functional characteristics, the fluctuating evolutionary development process of the SBH also witnessed the rise and growth of early socialist China.

Evolutionary patterns

Considering the basic types, the evolutionary characteristics of the twenty-six basic types can be subdivided into three patterns. First, the evolutionary process displayed a trend of significant growth → significant reduction → smooth transition. Most of the types in fields B, C, D, E, and G fall into this pattern. Since these fields have always been an important part of construction concerning people's livelihoods, they were highly susceptible to political changes [10]. The turning points in the evolution of SBH in these fields were associated with national events, as illustrated in the chronological stages above. Or rather, these fields were themselves the point of departure and the object of political campaigns. For example, fields B and C were directly affected by the Great Leap Forward and the the People's Communalization Movement in 1958 [9, 51], which led to a dramatic increase in the size of iron and steel factories and people's communes. Field G was also the direct target of the Great Proletarian Cultural Revolution of 1966 [34, 60], for which the special memorial building of the viva museum was built, creating a construction boom.

Second, it is summarized as consistently fluctuating evolutionary characteristics, including fields A and H. Uncertainty exists not only because political events have had little impact on them, but also because the major events that have affected them have not been able to spill over into other fields. For instance, the frequency peaks of the three basic types in field H

coincided with the emergence of New China's three diplomatic relations, which were in 1954 (attendance at the Geneva Conference, etc.), 1961 (three visits to Asian, African, and Latin American countries), and 1972 (the legal seat in the United Nations, etc.) [56], which failed to significantly influence the other fields.

Third, only the evolutionary characteristics of field F were identified as no significant growth → sudden increase. The development of science and technology in the New China started from scratch. The SBH in this field failed to grow significantly until 1971 due to the multiple impacts from political campaigns. It was only after 1971, when New China started the Third-Front Movement and introduced equipment, that there was a sudden increase in the frequency of the corresponding terms [12, 16], especially for research buildings. The fact that it was closely related to state secrets and could not be published publicly may also be one of the reasons for the lower frequency. In general, the different evolutionary patterns of the SBH represent the development models of socialist construction in different fields.

Evolution of the heritage nature

Specific to the terms, SBH was found to have progressed in its basic type with time. It is mainly in terms of function, structure and size, which can be explained by following examples. First, in terms of function, the collective organization buildings in field C have gone through the mutual aid teams (in 1950) → cooperatives of the primary type (in 1955) → cooperatives of the advanced type (in 1956) → people's communes (in 1958), with the function tending to be more collectivized and diversified [34, 39]. Major factories and facilities in field B also exhibited changes of machine factories (in 1950) → iron and steel factories (in 1958) → armament factories (in 1971), reflecting the times and reforms that responded to the national needs, i.e., from meeting industrial production to emergency preparedness [13, 14]. Also, waterwheels were the most common means of agricultural production until 1964, after which they were replaced by more mechanized means such as tractors.

Second, for the structure, after 1961, the material of the motorway has changed from stone and cement to asphalt, and the bridge structure has progressed from arch to reinforced concrete [63]. It indicates that more technologically advanced materials and structures were gradually utilized in the construction [64].

Third, in terms of scale, the most prominent ones were the appearance and development of large-scale hydroelectric power facilities, research buildings, and exhibition buildings, whose starting points for steady growth were 1953, 1975, and 1973, respectively. Their word

frequencies have begun to dominate the field on a large scale since their appearance [52]. The nature of these SBHs has evolved to further demonstrate the course of socialist construction in New China and to truly record the traces of development. At the same time, this is precisely where the value of the SBH lies.

Limitations

First, there are limitations in the data resources for this study. Although the official *People's Daily* recorded the development of socialist construction in various fields, it could not fully cover all the events. Using it as a data resource, it can roughly reveal the basic types and evolutionary characteristics of SBH, but more historical information is needed to complete and improve it in the future [34, 64].

Second, only sixty-six construction keywords and eight field keywords were included in the search requirements when the database was created, and relevant reports may have been omitted. In other words, this search has covered the vast majority of important fields of socialist construction, but it is still incomplete. Therefore, in order to explore the basic types of SBH in China more comprehensively, the scope of screening can also be narrowed or refined, especially in the construction of other niches such as news communication and marine fishing [65].

Third, there are improvements that could be made to the term screening process. In this study, only the first 3,000 terms were counted, discarding terms with lower word frequencies. For instance, mass housing, a type widely built in the SCRP [66], was not identified. This was due to the fact that the *People's Daily* focused on national-level planning and political development, with little coverage of mass housing in the livelihood field [32]. Moreover, even if there were some relevant reports, the terms that appeared tended to be figurative place names, such as Sanlihe, Dingzigu etc., which were mostly associated with factories and communes to serve production [31, 67]. As a result, this type was overlooked due to its low frequency in term retrieval and processing. However, because the statistical scope has covered the vast majority of high-frequency terms, this study still constructed a relatively complete database using this method and was able to outline the SBH basic types in a more comprehensive manner. Furthermore, the analysis results of the evolution of the basic type were made more convincing by calculating and comparing the F and P values of each term. In future studies, Python can be developed for more accurate word segmentation to avoid errors in manual correction. There is also a need for more extensive fieldwork to support the refinement of the basic typology system.

Conclusions

As a result of socialist construction, SBH is one of the young but precious types of world cultural heritage. At present, despite the extensive theoretical research on SBH by international scholars, there is still insufficient attention to its typology. In order to promote the understanding of SBH and its future conservation, a preliminary study on the basic types of SBH was conducted using China, the largest and most powerful socialist country at present, as an example. With the official *People's Daily* as a base resource, the most generalized SBH types in the SRCP, as well as their evolutionary process and characteristics, were revealed from a bibliometric perspective using Python and Excel.

The main research findings are as follows.

- (1) SBH is an integrated heritage with multi-scale and broad characteristics. It is not limited to architecture, but also includes many planning heritages, landscape heritages and facility heritages. Meanwhile, there is some variation in SBH across construction fields. SBHs in fields B and C were the most widespread (73.10% of the total), while those in fields A, E, and G were less frequently mentioned (all less than 1.00%). In addition, the share of SBH specific to the basic type was uneven. Overall, the most frequently occurring basic types were factories and facilities, collective organization buildings, government agencies, and assembly buildings (all greater than 10.00%), while medical and healthcare buildings, recreation buildings and facilities, municipal services buildings, and religious and memorial buildings were less common (all less than 0.10%).
- (2) The evolutionary characteristics of SBH were closely related to the development of society and contained six chronological stages and three patterns. Among them, in terms of stages, 1953 to 1960 was the fastest growing stage for both the number and size of SBHs, influenced by the first 5-Year Plan, the Great Leap Forward and the People's Communalization Movement. The period from 1966 to 1975 was the trough stage, especially from 1966 to 1969, due to the emergence of the Great Proletarian Cultural Revolution. In terms of fields, field F showed an evolutionary characteristic of no significant growth → sudden increase, while fields A and H fluctuated. The remaining fields of SBH were all featured by significant growth → significant reduction → smooth transition, as they were mostly directly related to major political events. In addition, SBH has evolved with time, demonstrating progressiveness in its function, structure, and size.

The immediate implication of this study is the initial establishment of a typology system for SBH, further emphasizing that it is an integral part of the contemporary cultural heritage system and calling for attention and protection. Then, the results refer to the sorting out of SBH types for China, Russia, and Central and Eastern European countries, which in turn can suggest item management and categorized assessment for future conservation work. For the remaining socialist countries today, this study can call on them to begin to pay forward-looking attention to this contemporary heritage type and to undertake preventive or salvage conservation in the future. Furthermore, the study will also be an important document for theoretical research in the field of SBH, and will have a positive value in explaining the process of socialist construction in New China and contemporary attitudes toward heritage conservation.

Nevertheless, it is important to note that this study is only part of the theoretical research, and there are still more areas that have not yet been covered. In the future, more comprehensive literature testimony, refined selection, and in-depth measurement principles are needed to more clearly dissect the typological composition of SBH. Ultimately, this type of contemporary heritage, which has been underemphasized in the present, still requires greater attention and action from all sectors of society. For example, the governments concerned must take a dialectical view of this controversial heritage and protect it as soon as possible. Academic organizations and scholars can awaken the public power and raise the mass awareness of heritage values by organizing open workshops, investigation tours, and other activities. In short, it will take a collaborative effort from many parts of the community to enable the future conservation of SBH.

Abbreviations

SBH	Socialist built heritage
SRCP	The Socialist Revolution and Construction Period

Nomenclature

F	Annual frequency
P	Percentage of annual frequency

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